

Innovative Dynamics in the Brazilian Telecommunication Sectors

Dimária Silva e Meirelles

PhD, Professor of Mackenzie University

E-mail: d.meirelles@ig.com.br

Luiz Antonio Adamo

Master's Degree in Administration - Mackenzie University. Consultant of France Telecom

E-mail: luiz.adamo@orange-ftgroup.com

ABSTRACT:

This paper attempts to study the elements that compose and make conditions to the innovative dynamics in the Brazilian telecommunications sector. In the last decades, the telecommunications sector has provoked deep social and economic changes, which propitiated benefits and facilities to many different areas, such as leisure, education, health and entertainment. The purpose is to study the innovative capacity of this area, which is always facing changes of technological and institutional patterns. The work tries to study the strategy of change adopted by companies, as well as verifies if the enterprises are conscious of having a proper strategy to innovation and how they construct an organizational support to this purpose. The idea is to identify the organizational structure, the way as the management innovation is done and the inter-relations between the networking agents who compose the sectorial system innovation. Therefore, the essay analyses the predominant innovations, the agents that promote the innovation and the relationship between them. The theoretical base of this study has the works from Gallouj and Weinstein (1997), Bilderbeek and Hertog (1999), Sundbo and Gallouj (1998), the Manual of Oslo (2005) for innovation in service, the studies of Bessant et al. (2001) and Mintzberg (2003) for innovation management and, finally, Malerba (2002) for sectorial system of innovation. The research is composed by twelve interviews with managers, responsible or directly linked to the development areas of products and services. The most relevant companies, in Brazilian context, were selected, since operator companies, equipment manufacturers, services providers and research institutes. The half-structured questionnaires have been used to collect data in order to support the analysis process of the innovation management of these companies. The paper is composed by five items. The first presents the introduction, the second one the literature on innovation, primary innovation in services. The third shows the innovative dynamics. The fourth item shows the results of the interviews, like the principal type of innovation and the main networking agents who actually innovate in the sector. And finally, the fifth describe the study conclusions.

Keywords:

Innovation strategy, innovation management, innovation in services, sectorial innovation system, telecommunication sector.

1 – Introduction

In the last years the Brazilian telecommunication sector was one of the most responsible for the production and performance increase in the companies – process that results in the country growing. By telecommunication means a long way that start with the telegraphy than telephony for voice between people and now a days infinite forms of transmission information and technologies of transmission (microwave, optical fiber, satellites). This process brings

more agility to transmit the data circulation in the global extent and guarantee the diversification of the services provided. The area, with these facts, was promoted as a strategic issue for the productive sectors in the economy and for other dimensions of the social life, as leisure, education, health and entertainment.

However, the sector has showed different phases since the initial stage of the telecommunications deployment in Brazil to the recent privatization changes and the sector liberalization. Each of these stages is marked by different market structures configurations. In the initial stage of this sector, until the 1960 decade, there were many companies without clear rules for the system operation, and different technological standards being used. As consequence, the service quality was very bad. In the end of 60th, were created public companies from the Telebras system, which led to a monopoly in the industry, following the American model - the Bell System. The monopoly control was done by the state subordinate to the Communications Ministry. However, the lack of systematic investments for years and the technological changes have caused big problems in the system, which have culminated in the system privatization and, consequently, the competition introduction in the Brazilian telecommunications industry. A new telecommunications industry was structured with the presence of new players and markets convergence. The public regulation was guided by competition principles, and through this, attempts to promote the consumers interests. The changes that have occurred in the industry promoted a new innovation dynamic.

Considering the importance of the sector and the exhibited arguments, this study proposes investigate the elements that that compose and make conditions to the innovative dynamic in the Brazilian telecommunications industry. Therefore, the study searches examining predominates innovations, the innovation networking agents and how they inter-relate. Specifically, the study intend investigate the strategy innovation used by companies, as well as identify the organizational structure, the way that is done the innovation management and the interrelations between the players that make up the sectorial system innovation.

To elaborate this work was used an exploratory study as research methodology, based on a qualitative approach, which makes use of personal interviews semi-structured (GODOY, 1995). Companies were selected to highlight the Brazilian telephony industry, covering operators, equipment manufacturers, service providers and research institutes. The chapter two of this study presents the theoretical benchmarks, the third the dynamics that compose the telecommunications sector in Brazil, the fourth the results analysis, and in the fifth the conclusions of the study.

2 – Innovation in Services: features and typology

According Miles (2001), the prevailing view until the 60th was that services were technologically delayed. The European Community efforts to study the service sector only begin in the 80's, when are highlighted the works of Jay Gershuny (1978) and Richard Barras (1986). Gershuny (1978) argues that most services were not innovative and that there was a consumer's tendency to produce their own services. Despite this narrow view, he showed the possibility of technology information enables a cost reduction and improve the services quality (Miles, 2001).

Currently, services innovation has been very exploited, mainly by the European Union countries. As reference, it is possible to cite the Services in the European Innovation System (SIS4) studies of the STEP Group (Study in technology, innovation and economic policy)

sponsored by the European Community OECD (Organization for Economic Co-operation and Development, OECD, 2005). The research in services innovation in Brazil are not many, but is possible to highlight the pioneering study of PAEP (Research of Economic Activity from Sao Paulo), conducted by the Seade Foundation (State System of Data Analysis Foundation) of the Sao Paulo state. As pointed out by Kubota (2006), the survey not captures fundamental dimensions of the service innovations as process innovation, organizational innovation and market innovation. The following will be presented the key features of service innovation according to the most recent literature, such as the works of Richard Barras (1986), Gallouj and Weinstein (1997), and Bilderbeek Hertog (1999) and Soete and Miozzo (2001).

2.1 – Features of services innovations

Most of the literature for innovation analysis is the result of studies conducted in the industrial sector and is dedicated to products. Innovation in services is much less studied, among other reasons by the difficulty of define which is a service (OSLO MANUAL, 2005). Innovation in service should be analyzed from the process innovation characteristics, from the point of view of the service provider as the customer, because service is an interactive activity. The importances of employees, customers, suppliers and government have a great resonance among several researchers (GALLOUJ; WEINSTEIN, 1997; SUNDBO; GALLOUJ, 1998b, BILDERBEEK; HERTOG, 1999).

Because the relatively recent approaches of services innovation, there is a range of interpretations about the features of the innovative dynamic and the innovation pattern of these activities. According Kubota (2006), one of the approaches of service innovation commonly known is the vision of the reverse product cycle - PRC, prepared by Barras (1986) from the financial services study in Britain. As a result of this study, the author proposes a model of innovation in services called reverse product cycle, which consists of three phases: the first phase, the applications of new technologies are designed to increase the efficiency of existing services. The focus is reducing the labors cost in saturated markets, in the second phase; the technology is applied to improve the quality of services. This improvement in the quality provides the markets expansion. In the last step, technology helps in the creation of new services.

In the Gallouj and Weinstein (1997) proposal, the services innovation process is essentially interactive, as the services provider maintains internal and external links that lead to innovation. In this sense, is a complex process, which covers large amount of phenomena and actors. Using the Lancaster product definition (1966, apud GALLOUJ; WEINSTEIN, 1997), to services, the authors propose an approach that integrates various characteristics of services, especially regard to the interactive nature of these activities and the intangible content. The interaction forms between the provider and the client, the expertise, skills and knowledge characterize the nature of the process. The nature of the processes associated with its technical characteristics (tangible and intangible) gives the final characteristics of the services. The authors propose six classifications of services innovation: radical, improvement, incremental, ad hoc, recombinative and formalization (GALLOUJ; WEINSTEIN, 1997).

Following also the goal of building a theoretical basis for addressing the services innovation Bilderbeek Hertog (1999) propose a model based on four dimensions: service concept, client interface, service delivery system / organization and technological options.

The dimension 1 (service concept) is a new idea or new concept on how to organize the solution of a problem. The method may be new to a particular market or be highly intangible, perhaps, being nothing more than an abstract image, a feeling, a typical approach for a certain type of problem or a new combination of service elements, which individually already may be well known in the market. The dimension 2 (client interface) is the way that the service is offered to customers and how is the communication with them. It may represent a complete innovation, as the offers of products are specific to the customer and delivered electronically, because, the customers, in some degree, is the product (service) production part, the way as the service provider interacts with the customer can be a source of innovation. The dimension 3 (service delivery system / organization) consist in the organization of the production process and the delivery of new products (services), referring to, primarily, the internal organizational arrangements, which must be done for allowing service workers the properly tasks implementation, in order to develop and deliver innovative services. Finally, the dimension 4 (technological options) is the application or influence in the appropriate technology development to the service provision, this dimension isn't always present, because the service innovation is possible without strictly technological innovation.

An innovation may affect more intensely one of the dimensions, which may generate a number of changes in the others. Relations between the dimensions - activities of marketing, distribution and organization - are very importance for innovations. Bilderbeek and Hertog (1999) emphasized that the dimensions may be less interesting than the interconnections between them, as well as the way as the firm operating in a specific context.

The relationships between the dimensions have the following characteristics; the marketing deals with the development of service concepts and with the planning of interfaces with customers, the organizational development deals with the company preparation to operate and deliver the services and the distribution will be responsible for ensuring that services reach customers through various interfaces supported. The relationships between these dimensions are promoted by internal agents, also by the influence of external actors. Such interaction constitutes the forces that provide the innovation direction.

In a more systemic view, Sundbo and Gallouj (1998b) identify the influence of internal and external actors in the organization of the service innovation process. The formulation of these directional forces is the result of research studies on service innovation, which are part of the project SI4S (Services in Innovation, Innovation in Services) of the STEP Group (Study in technology, innovation and economic policy) sponsored by the European Community OECD (Organization for Economic Co-operation and Development).

According to Sundbo and Gallouj (1998a), the same as in manufacturing, the internal forces are the main determinants of services innovation. They highlighted three main forces: the managerial structures, which have a strategic decision, the workers, and the department of R&D or the area responsible for innovation. According Sundbo and Gallouj (1998b), all people of the companies are deeply involved in the innovation process of the service companies. Theirs skills have crucial importance to the innovation process success. The external forces of this model have two types: trajectories and agents. The concept of trajectory is established in the relationship between the concept of technological and institutional trajectory (SUNDBO; GALLOUJ, 1998a). The agents are defined as "persons, firms or organizations whose behaviors has importance for the possibilities of the firms sell their services and therefore to their innovation activities " (SUNDBO; GALLOUJ, 1998a). The services users or customers are the main players. In addition to being source information for

the process innovation, especially in areas where services are more focused on the consumer, the customers often participate actively in the innovation process through the "co-production". The competitors and suppliers may also be important players, as well as the public sector. On the whole, these agents are the external influence direct on the innovation process.

Finally, given the process nature and the interactive aspect of the service activities, its necessary analyze two dimensions of the service innovation process. The first refer to the management innovation. The second is the networking agent's identification involved in the innovation process, whether internal or external, and how they interact. This interaction between the various actors, which the knowledge flows around members of the production chain internal or external to the firm, contributes to the innovative capacity of a country, region, sector or locality and also affect them (CASSIOLATO; LASTRES, 2005).

2.2 – Management innovation

As argued by Lundvall (1992), the internal organization and inter-companies relations are important elements from system innovation. As a way to address these two elements, this study uses the management innovation literature. Bessant et al. (2001) show the mapping of the basic routines in the innovation management, which concern the success factors to acquire and accumulate technical resources and managerial capabilities all times.

Such routines are interaction patterns that are resident inside organization and the individuals (DOSI; TEECE, 1993). These routines presented can be grouped into four key themes (clusters), and the success of a management innovation involves: a) develop an appropriate strategy of innovation and its management; b) Developing and using effective mechanisms and structures to implement c) develop and disseminate a organizational support for the innovation context; d) Build and maintain an external effective connection.

These four routines clusters form the process innovation model proposed by Bessant et al. (2001). Therefore, the authors propose the analysis of four key components in the innovation process: strategy, effective implementation mechanisms, support for the organizational context and external effective connection. The point of view of these authors, an innovative organization involves much more than a structure: it's a setting of integrated components that work together to create an environment that enables the innovation.

Firstly, is necessary the establishment of an appropriate innovation strategy, in which the company should have as goals: innovation and business sustainability, strategy innovation knowledge and comparisons with the solutions adopted by competitors. The organization must have a clear sense of what must be done, what are the strategic objectives to be achieved and a total commitment between their leaders. Innovation requires energy to overcome the inertia and determination to change the same things (SUNDBO, 2001). Strategies should be shared by all organization members. Therefore, effective implement mechanisms are needed that involving four fundamental elements: rules and structures, centralization degree, formalization degree and competence and skill level.

These elements are the typology basis from the organizational structures proposed by Mintzberg (2003). It is necessary that the company has an organizational structure that enables the creativity, learning and interaction. The main issue is to find a balance between an organic or mechanistic structure for each case in particular.

The organizational archetypes proposed by Mintzberg (2003), the key features and implications for the innovation management are: simple structure, mechanized bureaucracy, divisional form, professional bureaucracy, adhocracy and mission oriented. In addition the two innovative process components, so far presented, appropriate innovation strategies and effective implementation mechanisms, Bessant et al. (2001) propose additional two components: organizational innovation support and external effective connections. For Bessant et al. (2001), there are several key elements to innovation inside organizations: key persons; training and development; innovation focus; teamwork; creative environment and internal communication.

The success characteristic from an innovative organization is how it is open to new stimuli from the external environment. It should be internal and external customers oriented, and have the culture of total quality in all customers activities. The external connections will be explored below, which uses the innovation system concept.

2.3 – System Innovation

According to the evolutionist theory, the innovation strategy adopted by the firm is influenced by institutions which are incentives and/or limits to innovation, such as laws, government policies, cultural behaviors, social rules and technical standards (MALERBA, 2002).

Based on analogy with the biology, the evolutionist theory on the economy, whose main authors Nelson and Winter (1982), Dosi and Teece (1993) and Saviotti (1997), try to explain the firm evolution through the species evolution axioms. Therefore, using concepts such as, genotype (technology), phenotype (firms), and selection mechanisms and adaptation (defined by the competitive dynamics). The gene understanding (technology) and its mutations, which is the technological progress dynamics, is central to the phenotype (firms) study and for the structural system change as a whole (NELSON; WINTER, 1982; SAVIOTTI, 1997).

According Dosi and Teece (1993), the competitive process is inherent in the selection. It causes changes in the competitor's capabilities through the selection (the best adapted organization survives) or the adjustment (organizations less adapted change). The search and selection processes from the new players affect the industrial dynamic and are differentiator's elements from the systems innovation sector. The creation process can be exemplified when occur paradigms changes in the industry. The changes result in new businesses emergence, so it creates new production techniques, products, and new organizing production ways, which affect the system sector boundaries. The selection process takes place from the moment at which the relationship between agents in the competitive environment, the competition process selects firms, products and services that they will continue in the market, reducing the heterogeneity that had installed (MALERBA, 2002).

The innovation system is highly regarded as a collection of various institutions that contribute to the innovation development and the learning of a country, region, sector or locality. This system consists of relationships that interact in the production, dissemination and use of knowledge (CASSIOLATO; LASTRES, 2005; NELSON, NELSON, 2002; PELAEZ; SBICCA, 2006). This system concept shows that the innovation capacity doesn't depend from the companies, education and research organizations performance, but also how they interact each other and also with the various agents and how it affects the system development. It involves two key aspects: the system idea and the innovation concept (PELAEZ; SBICCA, 2006).

The system innovation concept has been explored in two levels: national and sectorial. In the following are presented the main features of these systems.

Lundvall (1992) shows that the world has entered into a new phase of knowledge creation, which there is a stronger connection between science and technology where innovation will be the product of interaction between agents distributed by many institutions and even different places. These developments need to integrate more closely the knowledge basis of universities with the innovation process. For Lundvall (1992), which enables learning to innovation, emanating from the routine of the firms, therefore the innovation system is rooted in the production. The productive system analysis of the agglomeration is focused on two dimensions, the first related to the structures configuration that supports the productive activities. The second dimension try to capture the institutional and organizational features that affect the relations between the agents entered those structures.

The national system of innovation has a great involvement in the public policies, but they are not the unique determinants of the development process. Such policies are part of a entire production system and knowledge application, which includes the international environment, technological and organizational patterns and the competition existent in domestic and foreign firms, and also, the learning activities, basic and applied researches from the universities and research institutes (CASSIOLATO; LASTRES, 2005).

The concept of sectorial system of innovation includes concepts of the national system of innovation; this system has focused on firms, non-firms, organizations and national institutions (MALERBA, 2002). Malerba (2002) claims that every sectorial system of innovation is characterized by specific forms of interaction among agents, the knowledge basis, the process of learning, the technology and the demands, the institutions that regulate the innovative activities and the selection and creation processes.

For Malerba (2002), the agents that compose the sectorial system of innovation are organizations and individuals. Organizations can be firms (users, producers and inputs suppliers) and the non-firms (financial institutions, government agencies, and universities), institute of research and R & D and production departments. The companies are the main players in the sectorial system, they are concerned with innovation, production and sale of products and services and the creation and adoption of new technologies. The non-performing firms have the function of facilitating the diffusion of technology, innovation and production of the firms. Individual are consumers, entrepreneurs, scientists, etc.

Other element that characterizes the sectorial system of innovation are government institutions, which make the rules, routines, habits common, established practices, rules, laws, standards, and everything that shapes the actions of the agents and affects the relationship between them (NELSON; NELSON, 2002). The technologies involved in the innovation process and the demand pressure define the problems that firms have to solve in their innovative and productive activities.

An interesting way of working the technology in the sectorial system of innovation is given by the notion of technological regimes, operated by Nelson and Winter (1982), and by Malerba and Orsenigo (1993). According to these authors, the technological environment can be described in terms of conditions of opportunity, appropriability, cumulativeness and knowledge base and has a great effect on the sectorial system.

3. Innovative Dynamics in the Brazilian Telecommunication Sectors

The enterprises innovation process in the Brazilian telecommunications sector promoted radical changes because the privatization of 1998. The changes that are occurring in the telecommunications industry are significant and are permanently changing the market organization characteristics, which are reflected in the innovative dynamic. One of the best indicators of the former industry change and the sectorial system of innovation is the location of R & D. While in the former telecommunications industry the innovations engine was located in the researches centers from the operators network companies, dominated by monopolies, in the new telecommunications industry, the engine of R & D was directed to the suppliers specializing in technology or in the equipment industry.

With the introduction of technological innovations, marked by digital convergence, the former POTS (Plain Old Telecommunications Services) is broken. The new model, called PANS (Pretty Amazing New Services), also is reflected in the sectorial investment cycle with significant impact in the industry performance indicators.

In PANS model, there are a lot of technological innovations on a global scale, based in the standard - packet-circuit system such as the Internet. Another study that confirms this change of the R & D activities is the Workshop on Basic Research in Telecommunication report (NOLL, 2002). According Noll (2002), the result is a significant investment decrease in research and development.

In Brazil, the institutional market changes, together with the introduction of the new model PANS, caused significant changes in the innovative dynamics that reflect to a new sectorial system of innovation. The CPqD, which was the main source of innovation for the industry, is reducing the number of research projects and increased the number of consultancies and short term technological assistance because the need to capture financial resources. However, the entry of new technologies has occurred in the same manner by the imports of products and models of services (SZAPIRO; CASSIOLATO, 2003).

The simplified agents structure who work in the Brazilian telecommunications industry is composed by telecommunications equipment providers, service providers who act as networks infrastructure integrators, carriers of network telephony or services (Internet, paging, trunking, TV, cable TV etc.), government and regulatory sectors, customers that influence the dynamics of the industry, universities and research centers. There is a great interaction between these agents, which create a networking dynamics. The government regulatory areas, such as Anatel, introduce standards orders for network operating companies, but them affects directly the products manufactured by the industry of equipments. These agents are important components from the sectorial system of innovation and are the sample basis of this research (carriers, equipment manufacturers, service providers and research institutes).

The group of operators interviewed in this study includes the four incumbents companies' of fixed telephony, the two concessionaires of fixed telephony (mirrors companies) and the three most important cellular telephone provider (ANATEL, 2007). Among these companies, four agreed to participate in this study, three incumbents carriers and a mirror company - all from fixed telephony. In the equipment industry group, participated in the survey four manufacturers, three telecommunication equipment suppliers for data, voice, image and security, and a manufacturer of transmission products for telephony and high capacity data.

The third group of players was the service providers. Three companies participated in the survey, with two national were and one multinational. Finally, in the research centers and universities group are highlighted the eight major research references and was chosen the CPqD to participate in the study.

4. Results Analysis

This section present the main results obtained in the interviews that has used the content analysis methodology (BARDIN, 2000). Please note that the technical chosen for the research was directed interview with pre-established questions, based on the theoretical references. To provide subsidy for the directed interview technique was created a roadmap with questions whose objective was structure the research to achieve the necessary answers. To support the theoretical interview questions, was drawn up a mooring matrix. This is a connection resource between the specific objectives and the theoretical references that brings the main elements of this research. Because the large amount of information obtained in the field research, and also with the aim of structuring, organize and analyze, has been used a specific tool, the software XSight International from the QSR company (QSR, 2007), used in exploratory researches.

4.1 Innovation Strategies

The first specific objective of this study was to identify innovation strategies in the Brazilian telecommunications industry according the innovation pattern adopted (typology and service innovation model). In this specific purpose, there are two sub-categories groups, the first represented by the innovation strategies categorization, according to the schumpeterian pattern and the second one by the service innovation model, according the dimensions proposed by Bilderbeerk and Hertog (1999), which are presented below.

By the information content analysis obtained in the field, the first sub-category strategies innovation, the product innovation is the most important kind of innovation practiced in this sector. This is due that all firms perform this kind of innovation systematically. From the twelve companies surveyed, only the company Pa doesn't launch new products, but held constant improvement of the existing products.

Table 1: Units list of record found - Innovation pattern

Innovation pattern type	Registered Unit	Companies surveyed												Total
		O _a	O _b	O _c	O _d	F _a	F _b	F _c	F _d	P _a	P _b	P _c	I _a	
Product innovation	New products	X	X	X	X	X	X	X	X		X	X	X	11
	Products enhancements	X		X	X					X			X	5
Process innovation	New process		X	X	X	X		X	X	X	X	X	X	10
	New systems	X			X			X		X	X		X	6
Organizational innovation	Organizacional changes	X			X	X		X	X					5
	New structure		X	X			X			X	X	X		6
Market innovation	New design			X	X	X				X	X			5
	New market segment		X	X	X	X		X			X			6
	New midia					X								1
	New presentation way				X	X	X	X	X			X		6
	New payments models		X			X	X	X		X	X			6

Source: Developed by the authors based on the collected data.

Process Innovations and organizational innovation also have great importance in the industry and seems to walk the same product innovations pace demonstrating that service innovation also depends on these types of innovations, considered important by the companies surveyed.

But the market innovation not indicate have the same priority as the other three types. There is a greater concern about having a new market segment for carriers, a new presentation way for equipment manufacturers and new payment methods (price) for the equipment manufacturers and service providers. This last factor is possibly linked to the market environment and the strong competition in this sector.

4.2 Networking Agents and Innovation Management

The second specific objective was to investigate the agents participants in innovation in the Brazilian telecommunications sector (suppliers, telephony operators, service providers and research institute), evaluating the organizational structure and how is done the innovation management inside the companies.

As is showed in Table 2, in the second sub-category of services innovation model, the data analysis allowed infer that among the dimensions considered in the Bilderbeek and Hertog (1999) services innovation model, the dimensions most relevant are the dimension number 1 (new concepts and ideas) and dimension 4 (product and process technological investment).

From the total of twelve companies surveyed, the majorities says that use and have investments in these dimensions.

Table 2: Units list of record found – Service innovation model.

Innovation Model	Registered Unit	Companies surveyed												Total
		O _a	O _b	O _c	O _d	F _a	F _b	F _c	F _d	P _a	P _b	P _c	I _a	
Dimension 1 (New services concepts)	New concepts and ideas			X		X	X	X	X	X	X	X	X	9
	Business intelligence		X	X	X	X		X		X			X	7
Dimension 2 (New customers interface)	New ways of providing goods and services				X	X	X		X	X	X			6
Dimension 3 (New service delivery system)	New delivery and distribution forms for goods and services	X		X		X		X	X	X		X		7
Dimension 4 (Technological option)	Acquisition of new technology and external knowledge			X	X	X	X	X		X		X	X	8
	Technology acquisition – product			X	X	X	X	X	X	X			X	9
	Technology acquisition – process	X	X	X	X	X	X	X			X	X	X	10
	Technology acquisition – organizational			X					X	X				3
	Technology acquisition – New marketing methods													0

Source: Developed by the authors based on the collected data.

Regarding the innovation management within companies, as showed in Table 3, telecommunications companies indicate that they are very worried to have an appropriate innovation strategy, because all reported having innovation as a corporate strategy. From the twelve players interviewed, nine claim that are concerned about competitors comparison, as the reports provided.

A communication problem within companies was detected, because only five respondents said that exit knowledge about the innovation strategy inside the company. In the effective implementation mechanisms category, there is a strong presence of companies with rules and structures complex, with high formalization, characteristics very similar with the system before privatization.

However, in relation to the control, today he is more decentralized, which ensures greater autonomy to the units. In this case, is highlighted absolute predominance of decentralized control in the equipment manufacturer's enterprises. In relation to the competence level, there is once again the equipment manufacturers stand out among all the agents researched.

The organizational support for innovation analysis highlights that the majority of respondents believes that to have valuable resources (talent) is important inside the organization, as well as, the existence of a good organizational environment conducive to innovation. In this analysis, it's interesting to note that the level of training and innovation as a target are more significant for equipment manufacturers. Further to this item inference, is possible see that it's not usual to use tools for the knowledge management in the sector. Only four respondents said they use this tool - the majority of services providers.

The subcategory "external connection", it highlighted the businesses connection with others actors, especially with customers. The interaction with the government is an important connection for operators and research institute, and also for the manufacturer A, which has partnership with the government to spread the technology to the society, and the service provider A, which always interacted with governments since the Telebras system.

The study observed that the agents interaction with the research institute currently is small inside the telecommunications industry, especially regards the operators, unlike the previous model, which the research institute was the main responsible for the technological development and for the sector innovations.

Table 3: Units list of record found – Innovation management

Innovation management	Registered Unit	Companies surveyed												Total
		O _a	O _b	O _c	O _d	F _a	F _b	F _c	F _d	P _a	P _b	P _c	I _a	
Appropriate innovation strategy	Innovation as a company strategy		X	X	X	X	X	X	X	X	X	X	X	11
	Comparison with the competition		X	X	X	X	X		X	X	X	X		9
	Innovation strategy knowledge			X		X	X			X			X	5
Effective implementation mechanisms	Rules and structure – big	X	X	X	X		X	X	X			X	X	9
	Rules and structure – small					X				X	X			3
	Centralized control	X			X						X	X	X	5
	Decentralised control		X	X		X	X	X	X	X				7
	High formalization degree	X	X	X	X		X	X	X	X		X	X	10
	Competence and skill level			X		X	X	X	X	X			X	7
Innovation organizational support	Talents	X	X	X	X	X	X	X	X	X	X	X	X	12
	Training			X		X	X	X	X	X		X	X	8
	Innovation as a goal			X	X	X	X	X	X	X	X		X	9
	Organizational environment	X		X	X	X	X	X	X	X	X	X	X	11
	Knowledge management system					X				X		X	X	4
External connections	Interaction with equipment manufacturers	X	X	X	X					X	X	X	X	8
	Interaction with services providers	X	X	X	X	X	X	X	X	X				9
	Customer interaction	X	X	X	X	X	X	X	X	X	X	X	X	12
	Government interaction	X	X	X	X	X				X			X	7
	Research institutions interaction							X	X	X			X	4

Source: Developed by the authors based on the collected data.

Another category investigated in the second specific objective was the innovation responsibility. For the innovation process, the companies are considered responsible by themselves. However, regarding organizational and market innovations the responsibility is divided by the interacting with others companies. The product innovation indicates that the responsibility is from the equipment suppliers.

Table 4: Units list of record found – Innovation Responsibility.

Innovation Responsibility	Registered Unit	Companies surveyed												Total
		O _a	O _b	O _c	O _d	F _a	F _b	F _c	F _d	P _a	P _b	P _c	I _a	
Product innovation	The onw company				X	X	X	X	X		X	X	X	8
	Interaction with other firms									X				1
	Suppliers	X	X	X										3
Process innovation	The onw company	X	X	X	X	X	X	X		X	X	X	X	11
	Interaction with other firms													0
	Suppliers													0
Organizational Innovation	The onw company	X				X	X			X	X	X	X	7
	Interaction with other firms		X	X	X			X	X					5
	Suppliers													0
Market innovation	The onw company	X	X				X		X	X	X	X		7
	Interaction with other firms			X	X	X		X					X	5
	Suppliers													0

Source: Developed by the authors based on the collected data.

4.3 Sectorial Innovation System

The third specific objective investigate what are the interaction mechanisms between agents and the incentives (or lack of them) from the institutional, technological and market environment in the innovation process.

Table 5: Units list of record found – Sectorial innovation system.

Sectorial innovation system	Registered Unit	Companies surveyed												Total
		O _a	O _b	O _c	O _d	F _a	F _b	F _c	F _d	P _a	P _b	P _c	I _a	
Mechanisms interaction	Government relationship			X	X	X			X				X	5
	Cooperation agreements			X		X	X	X	X	X			X	7
	Relationship with other agents - Networking	X	X	X	X	X	X	X	X	X	X	X	X	12
	Partnerships							X		X				2
Institucional environment	Favorable for innovation			X			X		X		X	X	X	6
	Use of government programs		X		X				X		X		X	5
Technological environment	Opportunity	X	X	X	X	X	X	X	X	X	X	X	X	12
	Appropriability				X	X	X	X	X	X		X	X	8
	Cumulativeness – systemic			X	X	X			X	X	X	X	X	8
	Knowledge base (education, training and external sources)	X		X	X	X	X	X	X	X	X	X	X	11
Market environment	Conducive to innovation	X	X	X	X	X	X	X	X	X			X	10
	Competition to promote innovation	X	X	X	X	X	X	X	X	X	X	X	X	12

Source: Developed by the authors based on the collected data.

The interaction mechanisms from the Brazilian sectorial telecommunications system investigated prove the strong relationship between the players, similar with the model

presented by Campanário et al. (2004). However, the government relationship is small, in contrast with the state control period. Again, is highlighted the equipment manufacturers involvement in the cooperation agreements with other companies results. However, the institutional environment doesn't seem conducive to innovation because the results presented in the research and also by the low use of government programs incentive.

Through the analyzed data the technological knowledge is extremely important to this sector, without exception, all actors demonstrate the commitment to search new technologies and ways of providing services. The agent equipment manufacturer again is present in one most important technology regime dimensions, the appropriability, which allows retain the innovations made by more time. This agent has a strong participation in others technological environment dimensions as the knowledge base, which is very important in this industry, that is highly technology dependent. The market environment in the telecommunications industry is currently favorable to innovation and is driven primarily by strong competition. In other words, the competition promotes and encourages innovation in the sector.

5 – Conclusion

Throughout this journey, sometimes historical, sometimes methodical, this study investigates the elements that compose the innovative dynamic in the Brazilian telecommunications industry. The departure point was examining the predominant innovations, the innovation networking agents and how they inter-relate. To study this general objective, set up three others specific objectives, which allowed the subject conclusions.

The first specific objective was to identify the innovation strategies in the Brazilian telecommunications sector according the innovation pattern adopted (typology and service innovation model). The main innovation identified is the product innovation, which also incorporates new services. Beyond the importance of this innovation type, the study identified the innovation in process, organizational and even market relevance, which didn't show the same level of importance from the others, but had significant results.

The second specific objective was to investigate the innovation participants actors in the Brazilian telecommunications industry (suppliers, telephony operators, services providers and research institute), evaluating the organizational structure and how is the enterprises innovation management done. The telecommunications companies in the industry are working to have an innovation strategy adhering to corporate strategies. Therefore, seek effective implementation mechanisms for the strategies through an organizational structure that can be generalized today, in the majority of companies, with rules and structures more complex and formal. However, the control is decentralized, which ensures greater autonomy and flexibility to organizations. Supporting the strategies and implementation mechanisms are the human resources that promote innovation, as well as a good organizational environment.

The third specific objective was to investigate what are the interaction mechanisms between the networking agents and the incentives (or lack of them) of the institutional, technological and market environments in the innovation process. Innovation is driven mainly by the interaction between the players, as noted above in the analysis performed, helped by the environments creation that encourage the sectorial system of innovation, mainly the technological environment with a solid knowledge base that allows the opportunities creation and the market environment, which is propelled by intense sector competition.

Observing the limitations as the generalization degree that the study has from the considered universe in the research, its possible verified that the Brazilian telecommunications industry is going through gradual changes, which was intensified in 1995. Until then, the government was responsible for the operation, planning and regulation in the industry. However, the services supply structure has been submitted to constant change. The technological innovations, the economic environment changes and the market in services were determining factors for the changes in the current institutional structures.

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