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THE INSTITUTIONS ON THE NATIONAL SYSTEM INNOVATION: THE ROLE OF THE BRAZILIAN REGULATORY TELECOMMUNICATION AGENCY

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THE INSTITUTIONS ON THE NATIONAL SYSTEM INNOVATION: THE ROLE OF THE BRAZILIAN REGULATORY TELECOMMUNICATION AGENCY[1]

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1) Introduction

The process in which innovation is set has been widely studied as well as the role of the main agents that promote and encourage it. In Brazil, Telecommunications innovation system faced deep changes since the restructuring process occurred in the 1990's. There was a significant change in the role of key elements that constitute the telecommunication innovation system. The denationalization of the equipment manufacturers, the shift in focus of CPqD[2], the limitation of the actions of Ministry of Communications and the creation of regulatory are factors that have brought new challenges for the sector. (Szapiro 2005).

The focus on the relationship between regulations and innovation emerged in the economy in the past yearsand has given the national regulatory authorities relevant functions that go beyond the limits drawn by the traditional theory of regulation. In the case of Brazilian telecommunications sector, the restructuring occurred resulted in a new institutional arrangement that allowed the Brazilian Regulatory Telecommunication Agency – ANATEL to play a significant role in telecommunications innovation system.

Therefore, this research shall contribute to the knowledge on how the regulatory framework can improve and encourage innovation in telecommunication sector in Brazil as well as contribute to the development of more effective regulatory policy initiatives based on the experience of selected national regulatory authorities.

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[2] Telecommunications Development and Research Center.

2) The institutions in the context of the system of innovation approach

The innovation process is not isolated or occasional;it occurs continuously and is influenced by several factors. Firms, the initial core of the innovative process, do not innovate alone, they interact with other actors to develop and exchange knowledge, information and resources. These actors may be other firms, universities, research institutes, investment banks and government. Nevertheless, the behavior of the firm is shaped by institutions that restrict or encourage innovation as laws, cultural norms, social rules and technical standards (Edquist 1997). Therefore, the concept of Innovation System emerges from a dynamic process in which involves the interactions of many players and their relationships.

There are two views of the National Innovation System, the first one attributed to Nelson (1993) who identifies only those institutions that directly affect innovative strategies, the second view is attributed to Freeman (1987) and Lundvall (1988; 1992), that includes, besides the institutions related to the development of technology and innovation, other institutions such as the financial system and public policies that directly or indirectly affect the innovative capability. (Szapiro 2005).

In the initial approaches Freemam (1987) defines NIS as "network of institutions in public and private sectors whose activities interactions initiate, modify, import and diffuse new technologies". Lundvall (1992) states however," that innovation is a ubiquitous phenomenon observed in the modern economy. In practically all parts of the economy, and at all the time, we expect to ongoing processes of learning, searching and exploring, which result in new products, new techniques, new forms of organizations and new markets".

According to Lundvall's propositions, the learning process, research and exploration is influenced by all sectors of the economy and the existing **institutional arrangement** such as the production system, financial, marketing that are subsystems in which learning occurs. Therefore, the institutions are inherent and central to the National Innovations System approach.

The Role of the Institution

One of the most notable characteristics in the SNI approach is the emphasis on the role of institutions. This requirement arises from the perspective that the agent does not innovate alone and that innovation occurs in an environment where there is interaction between several agents and is influenced by the existing standards and norms. It is the institutions that ***regulate*** relationship between groups of people, among these and organizations and each other. So, if innovation is the result of the interactive process of learning and that depends on the relations of the agents, it is fair to say that institutions affect innovation. (Edquist 1997)

However despite the assumption of its importance in the NSI approach, the concept of institution is not unique.

According to Carlsson e Stankiewcz (1995),

"*Institutions are the normative structures which promote stable patterns of social interactions/ transactions necessary for the performance of vital societal functions (...) By the* ***institutional infrastructure of a technological system*** *we mean a set of institutional arrangements which, directly or indirectly,* ***support, stimulate and regulate the process of innovation and diffusion technology****. The range of institution involved is very wide. The political system, education system (including universities), patent legislation and institutions regulating labor relations are among many arrangements which can influence the generation, development, transfer and utilization of technologies*"

Lundvall (1992:10) states that institutions provide patter behavior and:

"*may be routines, guiding everyday actions in production, distribution and consumption, but hey may also be* ***guide-posts of change****. In this context, we may regard technological trajectories and paradigms, which focus the innovative activities of scientists, engineers, and technicians, as one special kind of institution*"

North (1990:3) underlines:

"*Institutions are the* ***rules of the game in society*** *or, more formally, are the humanly devised constraints that shape human interaction. "*

Adding:

"*Institutions are the humanly devised constraints that structure political, economic and social interaction. They consist of both informal constraints (sanctions, taboos, customs, traditions, and codes of conduct), and formal rules (constitutions, laws, property rights).*" (North 1991 : 97)

It should be noted however that these concepts involve the notion of rules, norms and standards that ***affect the behavior*** of agents on one hand, through incentives or restrictions, and on the other hand, through the political and educational system, the structure of national science and technology and R & D and funding policies. All these features are defined as institutional arrangements considered in the approach of the innovation process.

To better demonstrate the connection between institutions and innovation, Edquist (1997) illustrates three basic functions by which institutions influence the innovation process: **the reduction of uncertainty, managing conflict/cooperation and encourage innovation.** The correlation between the three institutions' basic functions described by Edquist and the Brazilian Regulatory Telecommunication Agency's assignments will be better exposed forward.

One of the inherent elements of the innovation process is the **uncertainty**, so institutions are important tools to reduce the uncertainty providing information to agents or reducing the amount of information required for the innovation process. In fact, institutions act as "flags" ensuring more "stability" to the process. This occurs, for example, by providing a set of information about the technologically feasible through the financial institutions (the longer the innovation process, the greater uncertainties, so that the support financial institutions directed to the innovative activities to ensure continuity of certain innovative experiences) and the creation of patent laws and property rights, because they reduce the uncertainty regarding the possibility of appropriation of rents from innovation.

Moreover, the institutions have an important role in conflict management and **promotion of cooperation**. Edquist (1997) emphasizes the stabilizing role of institutions in resolving conflicting interests. Within firms, for example, there is constant conflict between the areas of R & D, production and sales. Generally, R & D tend to be longer and less focused on cost reduction or productivity than the production area. The sales area on the other hand tends to be driven by user demand than the characteristics of a production product. These conflicts are resolved through

intersectoral cooperation practices and *work place democracy*. Other conflicts may be caused by innovation. The emergence of new products and other products can become obsolete and cause restructuring of firms or firms break even. Since the advent of a new technology, a new industry may arise while another may stagnate. What can lead to, for example, lost jobs, declining incomes of a given sector. Thus, education programs and re-training and social security can mitigate the resistance to technological change.

The third function of institutions is to establish **incentives for innovation** activity. Such incentives are characterized in several ways: subsidies and / or allocation of resources related to innovation activities such as universities, research institutes and other organizations involved in the process of learning and knowledge dissemination.

Finally, public policies are a powerful mechanism for targeting incentives for innovation, while creating standards and general rules for, both in private and to public agencies, focusing on actions to promote innovation (e.g. demands, expansion and quality target of a particular service).

3) Brazilian TelecommunicationInnovation System - BTIS

According to the concepts discussed above, the institutions in the BTIScan be analyzed as well asemphasizesthe later development of the regulatory agency – National Telecommunication Regulatory Agency - ANATEL – and its legal functions and competences which sets it as an important playeron promoting innovation in telecommunication sector.

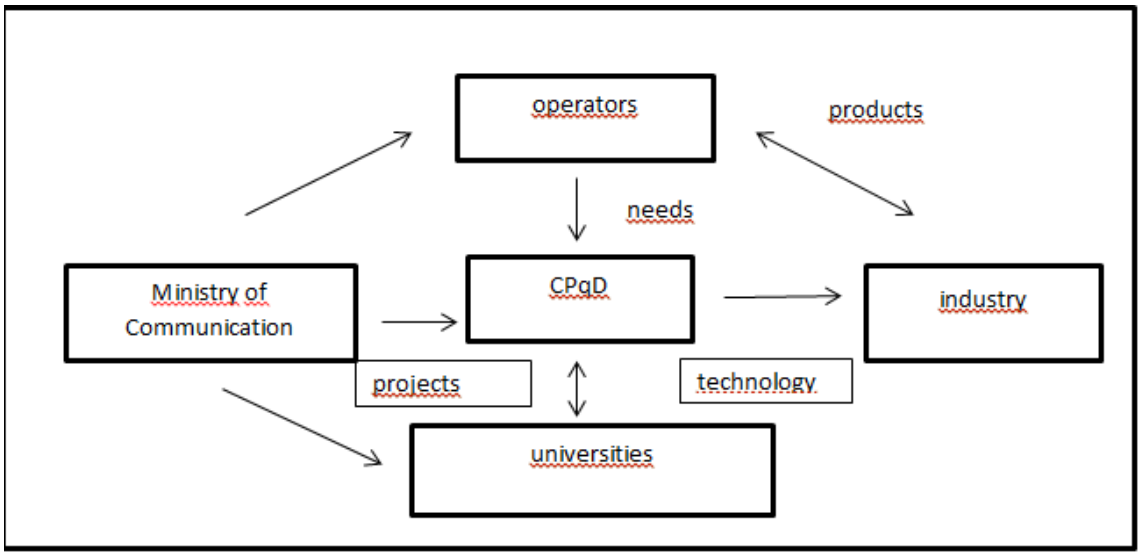
Telecommunications Sector from the 1960's

The telecommunications in Brazil has begunby the hands of private entrepreneurs. However, the approval of the Brazilian Telecommunications Code – BTC (Law n°. 4.117/62) was the first step towards the centralization and the orderly development of the sector in Brazil. It marked the beginning of the transformation of the telecommunications sector and was followed by the creation of the National Telecommunications Company (EMBRATEL) that would be responsible for operating the long distance service, implementing the integration of all regions of the country and also international connections. The strategy to implement a broad policy sector continuedwith the creation ofBrazilian Telecommunications S/A (TELEBRAS) which,

in the 1970's, provided more than 95% of telecommunications services in the country. Another important step was the creation of the Center for Research and Development (CPqD) in 1976. CPqD was responsible for key projects to expand the service capacity of the network operators and was responsible for developing equipment and network systems for industry.

According to Szapiro (2005: 144), "th*e set of acts adopted allowed the consolidation and unification of a national telecommunications network, the establishment of a domestic production base and development of local human resources and technologies to the Brazilian telecommunications industry. This effort, implemented by the government in the 1970's and 1980's resulted in the creation and development of the innovation system of the Brazilian telecommunications."*

Figure 1: BTISbefore privatization

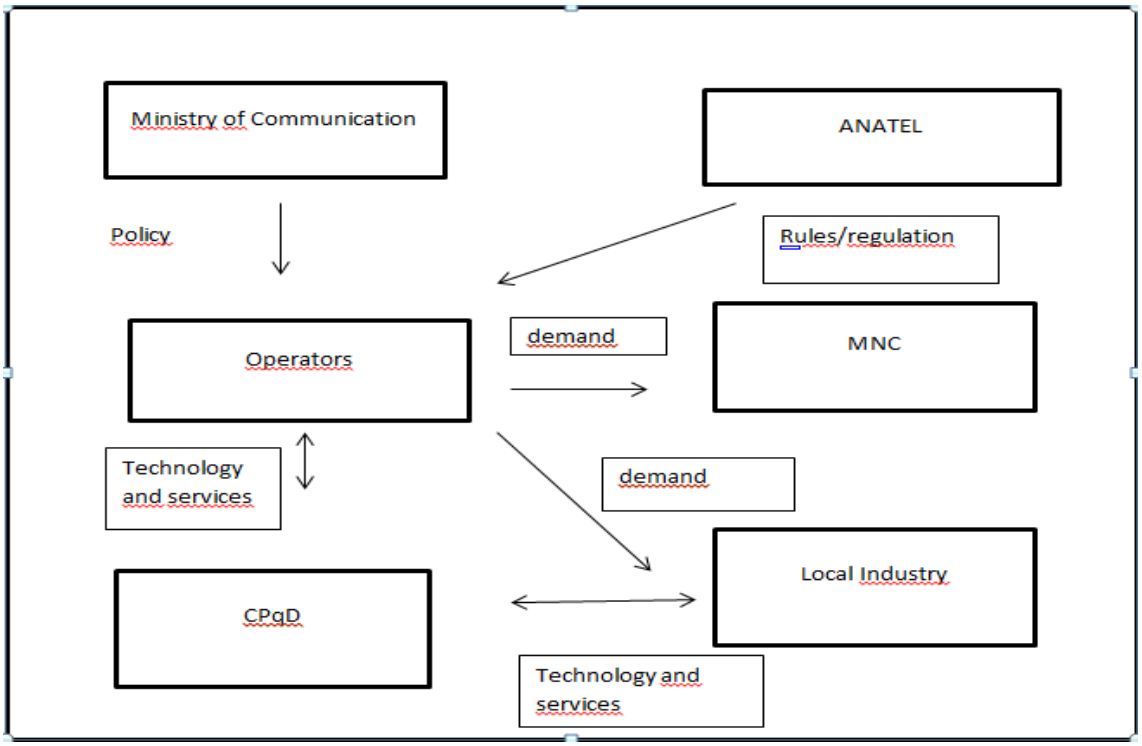


Source: Szapiro 2005

The figure emphasizes the relationship between the institutions of the innovation system of the Brazilian telecommunications. The Ministry of Communications designs the public policy for the sector that was performed by both TELEBRAS and by CPqD. It is right to point out, as states Szapiro (2005), that the CPqD played a central role in the BTIS since itimplemented the R & D activities alongside the research centers (e.g. universities) and with industry and operators as well.

The restructuring process in 1990's

Figure 2: BTIS after restructuring



Source: Szapiro (2005)

The restructuring of the sector has brought significant impacts on its innovation system with the inclusion of new actors and new forms of interaction between them. The main changes were the denationalization of industry,increasing the level of import of equipment, reducing the level of interaction with CPqD, reducing public demands driven by the Ministry of Communications as well as limiting the scope of performance of public policies and, finally, the creation of the National Telecommunications Agency - ANATEL.

4) The role of Anatel

The National Telecommunication Agency regulates the sector in Brazil and has as main objective to implement the state policy for the sector in order to develop thetelecommunications in Brazil. (Decree no. 2338/97). The regulatory function is

broad and multidisciplinary; however its role in the innovation system has not been performed since its inception.

The institutional arrangement of telecommunications regulation was designed to allow an intense interaction and intervention in the regulated sector. The basic competences discussed above as characteristics of the institutions of the innovation system such as a definition of standards and rules for the sector (both for equipment and services), implementation of public policies, knowledge exchange between institutions and interaction with society are all present in Brazilian regulatory framework.

Those can be identified among the main competences of ANATEL and can be related according to the three basic functions developed by Edquist (1997) by which institutions influence the innovation process:

Tabel 1: Summary of ANATEL's assignments

reduction of uncertainty	Finacing sector funds
managing conflict/cooperation	Guarantee the market competition / interaction with customers, institutions,other regulatory bodies and government
encourage innovation	Standardization and certification of telecommunications products / Grant of Telecommunications Services / Administration of Radio Frequency Spectrum / Encourage technology Development

Source: Telecommunication General Law nº 9742/97

Therefore, unlike the common perception of performance of regulatory agencies only in case of market failures (it will be better exposed below), it is necessary realizeand understand ANATEL as aplayer that belongs and influences the BTIS. However the main challenge is how to convert the competences and tasks of the regulatory agency on a mechanism to ensure and promote the innovation process.**This aim comes up against the traditional conception of regulation.**

5) The traditional Regulation theory and the IS approach

Regulation is one of the functions of the State. The regulatory activity involves restrictions imposed by the regulator to the decisions of economic agents regarding pricing, entry and exit conditions for firms in the market as well as the determination of specific parameters such as indicators of quality and performance.

The central idea of the debate on regulation definesthat the existence of **market failures** (e.g. absence of perfect competition such as natural monopoly, presence of social costs and benefits and presence of public goods) would be the rationale for regulatory activity. (Fiani 1998)

Many regulatory have adopted the market failure approach to regulation. Thismeans the development of regulation can involve a process by which the **regulatory body identifies market failures and then develops instruments focused on 'correcting' them**. (BERR 2008b)

However, the traditional approach to regulation based on market failures has limitations and has been contested throughout the literature.

According to Alleman & Rappoport (2005)

"*Virtually, all policy makers have ignored dynamic considerations in their deliberations. While current policy practices do not account for dynamic efficiency, we feel it is more significant than static efficiency. Static efficiency is concerned with the allocation of resources at a moment in time when, inter alia, the productions technologies are the same, knowledge is the same and the products/services are identical*" (Alleman & Rappoport 2005: 8)

Also it should be considered that:

"(…) *resources are not stagnant; innovations will occur, technical progress will continue, substitute services will arise, and consumers' desires and needs will change. In these situations the policy maker does not have a "formula" to apply in developing policy. They are forced to make a much more reasoned approach to what will happen in the market – withtechnology, innovation, and market power*." (Ellig 2001; *apud* Alleman & Rappoport 2005: 8)

One of the main tasks of this research is to bring the role of the regulators from the "*market failure*" approach towards the NIS one. In fact, the regulators are **players** in the NIS, which is characterized by the existence of dynamics elements and mutual relationships, an opposite environment from what regulators have been analyzed under the traditional regulation theory.

Nevertheless, efforts to understand the relationship between regulation and innovation have been raised recently, as can be exposed below.

5.1) Introducing Innovation to Regulation

Regulation can affect innovation on both the supply side and demand side of the innovation system. For example, it can influence decisions on the inputs used (e.g. R&D investment, external knowledge), the nature of outputs (e.g. the characteristics of new differentiated products and services) and the direction of innovation (e.g. demand for particular technologies). Changes in the regulatory framework can have both a positive and negative impact on innovation behavior and outcomes. The direction of the impact depends on a number of factors relating to the way in which new proposals are designed, implemented and enforced. (BERR 2008b)

From this perspective we should consider the work of Martin Fransman (2010) who developed the concept of the "new ICT Ecosystem" by understanding the ICT sector as a " number of organisms that interact within an environment" where the innovation *lies at its very core.*

Fransman identifies four key group of player within the ICT ecosystem:

- Networked element providers who produce items such as PCs and their operating system, mobile phones and telecommunications switches and transmissions systems)
- network operators (who create and operate telecoms , cable TV and satellite networks)
- content and applications providers
- final consumers

These players interact within their environment which is shaped by the institutions that define the rules of the game and influence players' behavior, such as

financial institution, regulators, competition authorities, standardization bodies and universities. (Fransman 2010)

Consequently, regulators should analyzed the "new ICT ecosystem" understanding its interdependencies and complex interactions and view it as an **innovation system**; as a system which generates endogenously the innovations products, processes, form of organization and markets. These innovations largely emerge from the symbiotic relationships between the four key groups of players and their interactionwith environment.

However, adding dynamics elements to the sector, the conceptual framework within telecoms regulation, has involved does not address endogenous innovation as part of it. In other words,

"*it does not allow the process of innovation to be an endogenous part of the production and consumptions activities that are implicit in the theory. (…) In short, the process of innovation is inadequately treated. (…) it is innovation which is the main driver of the incessant change transforming the new ICT ecosystem, the conceptual framework underlying the Dominant Regulatory Paradigm in Telecom is found wanting*." (Fransman 2010: 17)

Therefore, regulators should abandon an exclusive 'competitive markets' approach to regulation, assuming that competition may be necessary, but it is not sufficient to the innovation processes and, what's essential, understand the strengths and weaknesses of the ICT ecosystem and what needs to be done to improve system performance.

As Fransman argues "*an increasing number of academics are drawing attention to the limitations imposed by the implicit static assumptions made in the conventional approach. Technology, costs and demand are given in this approach. It rules out the real world in which all the players in the ICT ecosystem, including regulators, make their decisions.*" (Fransman 2010 : 158)

Fortunately, innovation issues were brought to the Regulators' agenda recently. A number of studies focusing on the role of the regulatory agencies towards a more effective interventionin order to increase, encourage and guarantee a proper environment to innovation have been developed.

Briefly, as part of this research, it will be analyzed three Telecommunication Regulatory Agencies and their perspectives towards innovation: ANATEL, the British regulatory agency - OFCOM and the French regulatory agency - ARCEP.

6) The overview of ANATEL, OFCOM and ARCEP

6.1) ANATEL

The privatization model adopted in Brazil resulted in an increasing technological dependence of the telecommunication industry. Faced with this situation, ANATEL has been concerned with the need to position itself ahead of a major role in the telecommunication sector in order to stimulate and enable innovation.

As an initial effort in 2008, the agency released the "General Plan for Regulation of Telecommunications", a set of guidelines which represents its strategic planning for the next 10 years. Among the actions planned, the agency focuses more clearly, though not as robust as necessary, on its role in promoting innovation in the industry.

Such effort will focus on developing specificrules to promotion the telecommunication R&D and the development of national technology by operators, manufacturers and national research institutions. The main guidelines are:

- Set a requirement of investment in R & D for operatorswith significant market power.
- Encourage the establishment of scientific and technological institutions authorized by ANATEL or association with national institutions.
- Development of programs and projects in science and technology sector telecommunications aimed at low-cost applications.
- Development of new processes for certification of products

Although none of these rules were yet developed, it is worth mentioning in addition that, the agency took in last bid of 4G mobile broadband some measures to stimulate the development of national technology, such as setting minimum percentage

for purchase of goods, products, equipment and telecommunication systems and data networks with national technology.

6.2) OFCOM

It should be mentioned that, despite of the recognition of the regulators' prominent role on innovation issues, the debate still remains "polluted" by traditional regulation theory approach, and this perspective could be noticed in the British OFCOM studies that will be exposed forward.

According to Cleevely (2006), there are three general guidelines by which the Agency can encourage innovation. First, and considered the most important, is to ensure competition by removing regulatory restrictions and allowing innovation to occur "naturally" by market forces. The second approach assumes that OFCOM can stimulate innovation through regulatory changes that will create a proper environment to innovation, and finally, through specific policies for research and development.

Thus, the appropriate mechanisms for its regulatory action are:

a) Promoting competition - Competition could lead firms to innovate so that they can sustain their profits.

b) Stability and reduction / exclusion of rules - Promoting competition and technological neutrality (not restricting or imposing any specific technology) allows the firms to innovate, however some control / rules should be kept in areas where there are not sufficient levels competition by ensuring sufficient levels of incentives and rewards for the risks incurred.

c) Providing information - provision of information on technological development (both domestic and international) which reduces the uncertainty of the innovation process.

In order to achieve such objectives, OFCOM has its own program of research and technological development to investigate the current and explore new technologies, which allows the agency to understand the technological advances and how they influence the regulatory activity. Moreover, the program also provides information to subsidize future policies and creating "*scripts*" that help technology firms and reduce the uncertainties.

OFCOM also realizes the need to act in the early stages of research, supporting firms in their product development (through the "Technology Roadmap"), faster

decisions to allow new technologies (which contributes to the diffusion of technological knowledge) and identify and share new technological opportunities (which reduces the costs of the firms monitor such opportunities), especially those occurring in other countries.

In addition, the British Department for Business, Enterprise and Regulatory Reform (BERR) and the Better Regulation Executive (BRE), as part of their work "*Innovation Nation White Paper*" (BERR 2008a), drew up a "check list" based on case study evidences in order to identify the circumstances under which regulation may help or hinder innovation. The five main tasks to regulators are:

- ✓ Consider how regulation may impact on beneficial innovation activity
- ✓ Consider how interaction with the stock of existing regulations may affect innovation
- ✓ Favor regulatory approaches that are outcome-focused and technology neutral
- ✓ Consider how implementation and enforcement can promote innovation
- ✓ Consider the effects of timing of regulation on innovation

6.3) ARCEP (Autorité de Régulation des Communications Électroniques ET des Postes)

The perspectives in the relationship between innovation and regulation were discussed in 2011 during the ACERP symposium on "Growth, innovation and regulation".

Unlike the British agency, ARCEP has not developed specific measures in favor of innovation; however these perspectives and the guidelines discussed during the symposium should be considered in the debate and will be listed briefly below.

Regulation and innovation seem to be on opposite sides, while the regulation requires/seeks a more stable and secure environment, innovation, in essence, however seeks unpredictable and non-programmed one.

Therefore the design of regulation can be viewed in a different light: the regulator can certainly not substitute the actors in the market where technologies changes occur, however, it can act as a catalyst, a pacemaker, an instigator, a trusted party that creates the conditions to creativity. The regulator can promote the process of

collective invention, without replacing innovators. In this sense, the regulator must agree to complement your logic of "problem solver" with a logic of "create agreed solutions" by hearing actors, simulation forums, organizing workshops, difuse good practices, etc. As the role of *hosting a reception*, the regulator needs to **ensure that their guests feel at ease and can interact with them successfully**.

One the other hand, regulators may also want to *regulate* innovation, not to encourage *ex ante*, but to prevent, reduce or correct *ex post* its possible negative external effects on the environment or society. Care should be taken, indeed; however, an excessive caution cannot kill innovation in the bud.

In other words, it is important not to confuse the risk that is inherent to any innovation, or indeed any human endeavor, with the danger, which in turn is a consequence of non-controlled risk. This is a tiny line that should be carefully distinguished by regulators.

Therefore, the regulation of electronic communications is not just a regulatory infrastructure network, which is the traditional goal of a sector regulator, is also dealing with the innovation engine of the third industrial revolution, a goal much less conventional and much more ambitious.

This dual purpose of the regulator also follows the duality of its duties. So sometimes, the **regulator should be problem-solver** in response to the first goal, and sometimes a ***catalyst* for creativity**, to answer to the second goal.

Therefore, the answer to the main question: are innovation and regulation compatible? It's a very obvious answer: yes, if the regulation is well made, and no, when regulation is poorly made.

Concluding remarks

It is assumed in this work that the key to design an innovation regulatory policy is by understanding innovation processes as a set of interactions and feedbacks. Innovation isno longerconsidered an isolated act, but a non-linear process of learningand institutionally shaped (Cassiolato and Lastres, 2005).

However, it is remarkable that the traditional (or dominant) regulation theory does not address the dynamic characteristics that are inherent to the technological change and the innovation process, neither understand the role of regulation within a

process of learning and searching capabilities.Therefore, the system of innovation approach provides a useful framework for the regulatory agencies.

That assessment can be evidenced by the evolution of the Telecommunications sector in which the innovation and technological change were the core of the sector in the last decades. Consequently, that evolution influenced the behavior of the regulatory agencies towards innovation issues.

As we don't have specific answers provided by the traditional regulation theory to face the innovation process in infrastructure sectors and assuming that regulation is related to innovation, some questions should be considered:

1) **Is it clearly understood or stated, according to the NSI approach, the means by which regulation interacts and influences the innovation process, and vice versa?**
2) **Can the lately discussion within the regulatory agencies evidence the limitation of the traditional regulatory means to intervene in the market in order to encourage innovation and can underline the understanding of its role in the NSI?**
3) **If so, can the efforts and discussion of the regulatory agencies be a reference to Anatel to develop its regulatory rules in order to encourage innovation?**

This paper attempted to demonstrate that although Brazilian Telecommunication Regulatory Agency has realized its role in innovation process, its intervention should be betterdefined. Therefore, this research shall contribute to improve the knowledge on how the regulatory framework can improve in order to encourage innovation in telecommunication sector as well as to contribute to the development of more effective regulatory policy initiatives.

However, it is clear that the relationship between regulation and innovation is and remains a challenge at the National Regulatory Authorities' arena.

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