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RedeSist's conceptual framework and
analytical methodology**

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Local Innovation and Production Systems: RedeSist's conceptual framework and analytical methodology¹

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Abstract

Throughout its twenty years of existence, a Brazilian research network, RedeSist, has developed and improved the conceptual and methodological framework of Local Innovation and Production Systems (LIPS). This paper has two articulated aims. The first is to present the main results of RedeSist's efforts, drawing attention to the relevance of the central elements in the LIPS' framework: knowledge, innovation and development and the territorial approach. Also the most significant convergences and differences with other concepts are discussed. The second objective is to explain the main methodological tools devised to capture collective and systemic processes of learning, capacity building, production and innovation, taking into account that every LIPS is inserted in specific, local, regional, national and global systems. The concluding remarks attempt at recuperating the most important arguments of the above discussion and at highlighting the advantages of creating and using contextualized and systemic theories, concepts, indicators and policy models.

Keywords: Local Innovation and Production Systems, LIPS, development, concept and methodology

1. Introduction

There are at least three characteristics of the current context of transformations in the global society and economy that justify RedeSist's² research agenda. On the one hand, the consensus notion that the processes of innovation have always characterized humankind evolution and are increasingly strategic to development. Second, at the same time that production activities are globalized, especially through the strategies of large transnational corporations (TNCs), the processes of generating and diffusing knowledge, far from becoming 'global', are increasingly localized. Third, these processes are established in different dimensions of the world territory in an asymmetrical and unequal way, in a way that significantly increases the disparities in wealth, income and skills among individuals, communities, and nations.

The research agenda of RedeSist, now celebrating 20 years, has set out to investigate: (i) the local dimension of the processes of generation and use of knowledge; (ii) identifying the most appropriate spaces and forms for promoting productive and innovative development at local, state, regional, national and supranational levels; (iii) proposing contextualized and systemic production and innovation policies aimed at increasing cooperation among individuals, firms, communities, countries and regions.

The use of the concept of Local Innovation and Production Systems (LIPS), developed by RedeSist in the late 1990s, required the elaboration of a research methodology capable of capturing the specificities of economic and social processes of complex nature, given its systemic character

¹ A preliminary version of this paper was presented at the 16th Globelics Conference in Accra, October 2018.

² RedeSist is the Brazilian Research Network on Local Innovation and Production Systems. See www.redesist.ie.ufrj.br.

This paper complements previous efforts (Matos, 2018; Cassiolato et al., 2017) which reviewed some of the most important achievements in analytical and normative terms revealed by the set of studies undergone by RedeSist scholars in the last 20 years. Its main objective is to present a synthesis of the conceptual and methodological effort undertaken by RedeSist, highlighting the main results accumulated throughout the different rounds of review in these two last decades. Although of great importance, this knowledge had never been organized and published comprehensively, although several technical notes related to different research projects explore these methodological elements. The available space does not allow the necessary detailing of each of the elements and instruments (questionnaires, interview scripts, tabulations, etc.). However, several references throughout the text point to where they can be accessed.

The paper is organized as follows. Section 2 presents the conceptual basis of the LIPS framework, as a focusing device resulting from the combination of the system of innovation approach with the contributions of the Latin American Structuralist School. It discusses the relevance of the central elements in the LIPS' framework for development: knowledge, innovation and the systemic and territorial approach. Some of the main similarities and differences with other conceptual frameworks, used to analyze productive and innovative local and regional activities, are also briefly examined. Section 3 discusses RedeSist's methodology for the analysis of LIPS, stressing its main building blocks in two levels: the LIPS external context and the structures and processes intrinsic to the local environment. In the sequence it presents the criteria used for the selection of cases studied by RedeSist, the characterization or design of the LIPS, the definition of actors to be interviewed and the sampling plan, the field research instruments and the analysis of the information obtained. In both sections it is exemplified how the successive rounds of empirical studies have oriented necessary adaptations and improvement of the conceptual and methodological frameworks as well as the very research agenda of RedeSist. In fact, a broader understanding of innovation was required in order to tackle with the scope of (i) small-scale and informal activities and also (ii) areas as culture and those of highly innovative services, such as health. The final item presents the conclusions.

2. Conceptual basis of the LIPS framework

Among the few consensuses established in the intense debate on globalization and the diffusion - partial and skewed - of information technologies, two were fundamental in defining the intellectual framework and the research agenda of RedeSist. The first concerns the understanding that knowledge and innovation are the main factors that define the possibilities of development of nations, regions, sectors, companies and even individuals. The second refers to the changes in the geography of world production that reasserted the relevance of different territorial scales, in particular the local dimension. The next two items provide a quick overview of the contributions that helped to shape these consensuses.

2.1. Innovation, knowledge and development

The development of the conceptual and methodological framework of RedeSist benefits from contributions of the neo-schumpeterian approach and the Latin American structuralist tradition. In other works (Cassiolato et al., 2005; Cassiolato and Lastres, 2008) we argue that these traditions have strong points of connection, since, for both, development processes are characterized by structural changes, resulting from technological discontinuities that affect and are also affected by the social, cultural, political and institutional structures. Thus, development is a unique, specific systemic process, with theory and policy recommendations being highly dependent on each particular context (Furtado, 1964 and 1983, Freeman 1987 and 2003).

These propositions diverge from prevailing argument at the end of the 1990s - amid a political and economic debate still strongly influenced by the neoliberal agenda and the Washington consensus - that suggested that technological globalization would render national science, technology and innovation (ST&I) policies irrelevant. In clear contrast, the national innovation systems approach (Freeman, 1987) showed that the elements and relationships that make up the systems are shaped by the action of policy makers and other agents and institutions. Therefore, the importance of the public and private institutional arrangements for the creation and support of skills in national and regional economies was reaffirmed. In the Latin American tradition, we find a similar emphasis, which also (i) stressed the importance of accumulating resources and knowledge for sustainable development; and (ii) highlighted the negative results of the policies, adopted in the 1980s in the region, based on the so-called traditional comparative advantages, which Fajnzylber (1988) called as promoters of 'spurious competitiveness' (specialization in low-cost of labor and intensive use of natural resources without a long term vision).

The notions of knowledge, innovation and development used by RedeSist derive from the combination of Latin American structuralism and neo-Schumpeterian contributions.³ Innovation is understood as a systemic and contextualized process of an eminently social and cultural nature. It is the result of collective and interactive actions between individuals and companies, generated and sustained by a complex network of interpersonal, inter-agency and inter-institutional relations.

Another main point of connection between the two frameworks of thought resides in the relevance assigned to complex relationships between the micro, meso and macro levels. As pointed out by the Latin American structuralist literature the process of innovation is deeply influenced by the macroeconomic environment and policies (Herrera 1975, Coutinho, 2003). They significantly interfere with production and innovation strategies and capacities, eventually neutralizing explicit public and private innovation policies and restricting investment decisions, especially high-risk inversions, such as those aiming at innovation and technological development. By extension, it is paramount to take into account that the evolution of any national (or regional) economic system depends to a large extent on its place in the hierarchical and power structure of the world economy.

The understanding of the advance of financialization has also been an essential element for the understanding of global capitalism and its impacts on development and its policies. Emphasizing the main characteristics of the capitalist 'accumulation regime dominated by finance' (Chesnais and Sauviat, 2003), the 'global liberalization of the financial sector' and the 'progressive decoupling of finance' from the real side of the economy, Coutinho, Belluzzo, Chesnais and Freeman point them as capable of bringing the capitalist system into a succession of crises.

In fact, since the late 1970s, more than 100 financial crises in the global economy took place. Of these, at least seven have profoundly affected the world economy, and specially the countries of the South. Thus, globalization dominated by finance, its capacity to generate crisis and instability, and the understanding of its influence on production and innovation capacities, as well as of challenging industrial and ST&I policies constitute one of the basic tenets of the analytical framework of RedeSist⁴.

2.2. *The relevance of different territorial scales*

In a clear contrast to arguments in vogue about the alleged and supposedly inexorable deterritorialization of productive and innovative activities in the contemporary economy, induced by the phenomenon of globalization and technoglobalism, RedeSist's perception was from the outset diametrically opposed, namely that the global and the local are dialectically complementary and nourish each other. Hence, the emphasis placed on the relationship between geographical proximity

³ For details see Cassiolato et al., 2005; Cassiolato and Lastres, 2008; Lastres and Cassiolato, 2017.

⁴ On this issue see RedeSist's books in honor of François Chesnais (Cassiolato, Lastres & Matos, 2014).

and redeeming of the diversity and specificities that characterize the different local productive systems and their economic, social, political and institutional contexts as central elements in the analysis of technological dynamism and competitiveness of entrepreneurs, companies, regions and countries.

The recognition of the importance of the territorial dimension of globalization ignited a renewal of academic interest about local processes of economic and social transformation⁵. But arguably it was the cluster literature that has attracted more attention, particularly in policy circles.

Elsewhere (Lastres and Cassiolato, 2005) we argued that some points of partial convergence among distinct approaches could be found. They are mostly related to the recognition that (i) the specificities of the environment are critical to the survival and development of the different LIPS; (ii) the focus on local activities can never ignore the global dimension; and that (iii) a variety of economic and non-economic agents are important elements of any local system. But we also highlighted the notable differentiations that exist between these approaches and the LIPS perspective. Among these differences it is possible to single out the specific connotations of key central tenets of each theoretical approach, such as development and innovation.⁶

Most important is the use of the LIPS framework as a focusing device capable of encompassing all types of production and innovation structures, and not only on structured and specialized agglomerations that can be identified by traditional indicators and that are normally associated with the notions of clusters, industrial districts, etc.⁷ Of course this is one of the reasons that grants the concept of LIPS a wider applicability to broader range of production activities and to different territories and countries. As the notion of cluster and industrial districts automatically emphasize structured and specialized agglomerations, its use leaves aside others that may also require better understanding and also policy support. As a matter of fact, emerging and less structured systems are frequently very important everywhere, and industrial and technological policies cannot ignore them. Also these are precisely the cases that generally cannot count on other means of support, either of that from government policies.

2.3. Main characteristics and advantages of the LIPS framework

The development and consolidation of the conceptual and analytical approach of RedeSist's LIPS results from the application of the concepts described above to the Brazilian reality. The approach encompasses economic, political and social actors and their interactions, including: companies producing final goods and services and suppliers of raw materials, equipment and other inputs; distributors and marketers; workers and consumers; organizations focused on training of human resources, information provision, research, development and engineering; support, regulation and financing; cooperatives, associations, unions and other representative bodies. It includes actors and productive and innovative activities with different dynamics and trajectories, from the most knowledge intensive to those using endogenous or traditional knowledge; of different sizes and functions, originating in the primary, secondary and tertiary sectors, operating locally, nationally or internationally.

Then, in sharp contrast with the frameworks that focus on the most structured and economically visible cases, the concept of LIPS assumes that some kind of system always exists around every production activity, however fragmented and unstructured it may be. In this sense, the concept of LIPS

⁵ In terms of RedeSist's contributions and for a more detailed conceptual discussion see: Cassiolato, Lastres and Maciel, 2003, and Matos et al., 2017.

⁶ For the differences on the notion of development see Cassiolato and Lastres, 2008.

⁷ For a detailed critique of use of traditional secondary indicators to 'identify' local patterns of specialization and define what is (or is not) a cluster including the use and abuse of LQ (locational quotients) see Cassiolato and Stallivieri, 2012 and Lastres and Cassiolato, 2005. For a critique of the cluster approach, see Martin and Sunley 2003.

can be understood as a synonym of local production and innovation structure.

This also highlights the limitations of techniques that used for identifying local production systems based on secondary data for the formal economy. Examples are indicators based on georeferenced data, such as the locational coefficient (LQ), the HHI concentration index, etc., as well as the use of spatial econometric techniques. First, they leave out informal activities, which in countries like Brazil account for more than half of occupied workforce. Second, they are limited to sectorial classifications that date back to the fordist era, which hardly take into consideration the complex systemic relation between diverse segments. Third, they use spatial cuts based on administrative units like municipalities, microrregions, states, regions, and countries, which can lead to the exclusion, fragmentation and disregard of important parts of these complex structures.

Of course the systemic and territorial notion of production and innovation is not restricted to a single sector. On the contrary, it is - by definition - associated with activities and capacities of others back and forth along the production networks. These vary from raw materials, equipments and other 'inputs' and production of final goods and services, to commercialization activities, as well as a series of activities related to the generation, acquisition, use and dissemination of knowledge.

Therefore, and as the LIPS approach goes beyond the focus on individual organizations, sectors or production chains, a distinctive feature is that a set of agents is taken as a unit of analysis. Particular attention is given to understanding that the capacity to generate innovations is potentialized by the articulations of producers and users of goods, services and technologies (Cassiolato, 1992).

The broad unit of analysis offered by the LIPS framework - besides encompassing, again by definition, all production activities - focuses on the space in which learning takes place, productive and innovative capacities are created and tacit knowledge flows (Lastres, Cassiolato and Maciel, 2003). In sum, as several working documents of RedeSist point out⁸, the LIPS framework:

- represents a practical unit of research that establishes a bridge between territory and economic activities, which are not restricted to classic spatial official cuts, such as the municipal and state/province levels;
- focuses on groups of different actors and related activities;
- encompasses the locus where productive and innovative capacities are created and tacit knowledge flows and represents the level at which training promotion policies can be more effective;
- implies on establishing a bridge between the micro, meso and macro spheres; and the social, economic and political spheres;
- provides companies, promotion agencies and other actors a comprehensive vision of the reality they face, helping to define appropriate strategies to support them.

From a conceptual and analytical point of view, RedeSist's research effort has succeeded in advancing the understanding of the different local and regional Brazilian production systems. Stress to the contribution that academia can play in terms of contributing to understand the potential that contextualized and proper development concepts and goals.

More than 200 cases competence building and innovation have been studied, providing a rich set of empirical evidence. Following the tradition, initially the focus was on manufacturing activities in the South and Southeast regions of Brazil. This perspective was gradually enriched with the incorporation of new activities and performed and all regions of the country. The new center of the research agenda became on LIPSs of agriculture and services, namely family agriculture, essential public services, tourism and cultural activities, including small-scale and informal ones. The parallel advancement of

⁸ See Lastres, Cassiolato and Maciel, 2003, and also other papers in www.redesist.ie.ufrj.br.

the research agenda required a continuous improvement of the framework in order to incorporate nuances related to different types of activities and structures.

From the normative point of view, it is important to highlight that the term LIPS was used as focus of policies by various governmental and non-governmental agencies at the federal, national and local levels. This has reinforced the extremely rich process of experimentation and learning. All agents involved learn a lot.⁹

3. RedeSist's methodology for the analysis of LIPS

There are diverse sources, variable systemic and non-linear forms through which knowledge is developed, acquired, used, and disseminated. These different sources and forms are complementary and often simultaneous. It is not surprising, therefore, that attempts to map and measure such collective processes and the sources and flows of knowledge and learning associated with them are still very incipient worldwide¹⁰. Thus, in an attempt to understand and evaluate the collective processes of generation and use of knowledge, creation and use of production and innovation capacities, a first challenge is to treat companies and other organizations and social actors in an aggregate way and to focus on their interactions.

For RedeSist, the use of the LIPS approach requires an investigation of the:

- articulations between companies and between them and other actors;
- knowledge flows (in particular, in their tacit dimension);
- basis of learning processes for productive, organizational and innovative capacities;
- ways in which geographical proximity and historical, institutional, social and cultural identity can constitute sources of diversity and sustained competitive advantages;
- the analysis of how the processes of articulation between the different territorial scales affect the development and possibilities of LIPS.

Drawing upon the last point, we underline the importance not to limit our view to the local specificities. This perspective has to be complemented by an in depth understanding of the LIPS's role within the productive systems at regional, national and international level.

Therefore, the analytical tool used by RedeSist starts with the observation that the transformation of a local system is influenced by elements on two interrelated levels. The first refers to the environment and context external to the LIPS, understanding it not as a closed structure but as an open system with diversified and complex interconnections with actors and dimensions that extrapolate the local sphere. This is a way to overcome the well-known criticism of 'localism' pointed out by several observers who warn about the risk of studies on local development that ignore the complex interrelations with the world system. This issue is further elaborated in the next item. The second level concerns the structures and processes largely intrinsic to the local environment and its specificities. The subsequent items explore the main aspects related to these analytical levels that are fundamental to the RedeSist methodology.

⁹ See Matos et al., 2017 and 2015; Cassiolato, Lastres and Maciel, 2003.

¹⁰ Cassiolato and Stallivieri (2010) discuss in detail the problems for the measurement of systemic innovation processes and those of innovation and analyze the few international attempts to tackle this problem.

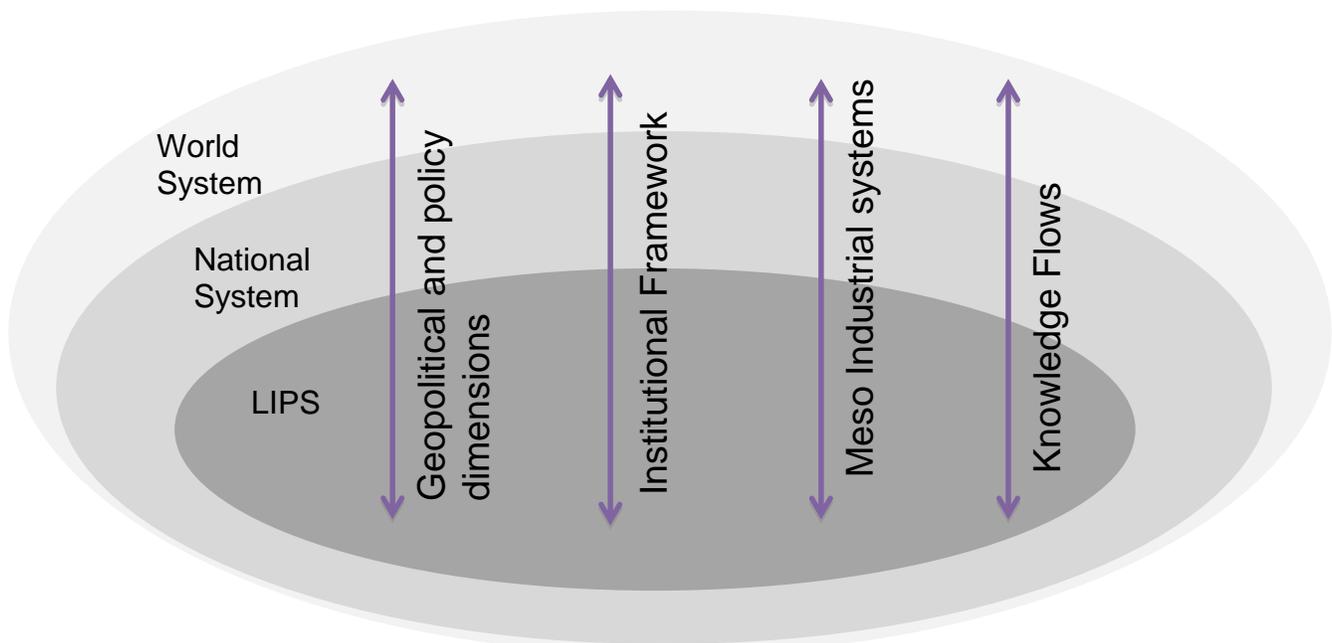
3.1. The international and national contexts in articulation with the LIPS' territory

Of course in globalized capitalism most, and almost all, local production is part of a world system. Moreover, 'the attempt to copy locally the structure of another territory is foolish', because the productive activity is the result of a historical trajectory involving capacity building and learning (Humbert 2003). The author explains how any social system of nation-state directs and regulates to a great extent a system of territorial production and how both are articulated with the world-system.

Figure 1 presents a schematic attempt to represent the various territorial levels - from the local to the global - and how a system of territorial production and innovation articulates with the social system of the nation-state to which it is subordinated and how both are articulated with the world-system.

In RedeSist's analytical framework it is absolutely crucial to understand how these articulations occur and affect the development of a LIPS.

Figure 1 – LIPS in the Context of the National System of Innovation and the Global System



Source: Matos et al. (2017) based on Humbert (2003)

The first arrow highlights that the global geopolitical and power dimension is particularly relevant for understanding local productive and innovative processes. At the highest level of complexity we have a global industrial system that is formed by the interaction of companies and industries, governments and various institutions. Transformations of territorial production structures that depend on these interactions can, for example, be limited by numerous constraints.

For example, several studies produced by RedeSist in the early 2000s pointed out that LIPS that attempted to enhance their innovation and learning capacities through insertion in global chains have been strangled by unequal power relations with large TNCs that dominate these chains or by protectionist policies from more advanced countries that hinder access to their higher value-added product markets. In the first case, we have the LIPSs for shoe production in the Sinos Valley in the

South of the country and for marble and granite production in Espírito Santo, in the Southeast. The shrimp production LIPS in Northeast Brazil is a good example for the second case.¹¹

A second analytical dimension that has a significant impact on the territorial dynamics relates to the institutional and legal framework, particularly the policies defined and implemented by organizations at other territorial scales (global, national, regional).

At the international level, provisions of international agreements such as Basel Agreement, Intellectual Property (TRIPS) and the World Trade Organization (WTO) signed in the last 20 years significantly affect the possibilities of access to, respectively, sources of finance, information and technology and markets, restricting and conditioning their possibilities of productive and innovative transformation.

At the national level, it is important to understand the impacts, problems and opportunities of the policy regime on the policies explicitly focusing on the promotion of production, innovation and territorial development. We take particularly into consideration the impact, on the territory and its capacities, of macroeconomic policy¹² and other ‘implicit policies’ such as trade, competition and foreign capital regulations, social and environmental macroeconomic policies. Important contributions of Latin American scholars (Herrera 1971, Katz 1996, Coutinho 2003) reveal how such policies have a much more significant impact on the possibilities of industrial and technological development than those specifically aimed at production and innovation.¹³

The third arrow illustrates the influence of the pattern of organization of production and competition on a global and national scale and the associated technological regime in conditioning strategies of local actors and the LIPS’s development. In the globalized world dominated by finance, large TNCs concentrate and command economic, political and technological power, controlling the flows of knowledge and information and the possibilities open to other companies. Therefore, it is paramount to understand the strategies of the big companies and the barriers to entry they erect, as well as which are the technological trends and the knowledge bases that condition the LIPS. This encompasses the nature of innovative processes, the main characteristics of innovations and their pattern of appropriation and dissemination.

The last arrow is closely connected to the third one and refers to the multiescalar knowledge flows. As said above, processes of production and generation, diffusion and use of knowledge are fundamentally social processes, of a collective nature. As such, they are localized in the territory. However, any social system has to deal with conditionings and other social systems that are not local, but rather regional, national and global. Local processes can capture opportunities arising from international flows of knowledge and technology, provided that the basic skills necessary to take advantage of them have been developed previously. However, many times these local processes are articulated, often in a subordinate way, to global, national and regional processes (Cassiolato, Lastres and Maciel, 2003; Szapiro et al., 2015). As described below the methodological framework of LIPS takes the multiescalar learning dimensions as a central element of analysis.

We cover the first three dimensions predominantly through bibliographic research and the analysis of secondary data on production, innovation processes and intellectual property, flows of products and services, investments flows, etc. The fourth dimension can be partially covered through the same techniques but it must be complemented through the procedures discussed in the next sections.

¹¹ See www.redesist.ie.ufrj.br

¹² Specially the interest and exchange rates.

¹³ For details see Cassiolato et al., 2005 and Cassiolato and Lastres, 2008.

3.2. *The LIPS and its endogenous conditions*

In straight articulation with the external elements discussed above, we focus on the structures and processes that are inherently endogenous. As such, they require procedures for gathering primary information in field research. Here, we explore the main research dimensions and in another section we present the instruments for gathering this information.

First, innovation strikes out as a central determinant of the LIPS development. As mentioned above, the application of this framework required a broader understanding of what constitutes innovation in areas such as highly innovative service and cultural activities. Similarly, broadening the scope of analysis to small-scale and informal activities also challenges our understanding of innovation. Advancement of the research agenda of RedeSist sought to incorporate these nuances, undertaking successive rounds of improvement and adaptation of the analytical and methodological framework.

This framework therefore utilizes different strategies for information gathering seeking to identify and evaluate the following dimensions related to the innovative process:

- Efforts to search for innovation - activities of organizations from distinct entangled production segments aiming to promote changes in production and organizational processes, as well as to develop, produce and introduce new products;
- Sources of resources and the role of financing strategies - use of own and third parties resources, exploring the support instruments used, the capital structure of firms and the influence of different arrangements of financial institutions on production and innovation strategies;
- Introduction of innovations - strategies for the introduction of innovations;
- Pecuniary impacts - reduction in costs and in the utilization of inputs, as well as the impact on revenues;
- Broad impacts - perennial impacts, such as succeeding in entering new markets, expansion of firms' capabilities, strategic diversification, greater visibility and recognition, etc.
- Obstacles - factors that hindered or hampered innovation efforts.

The second main dimension of analysis refers to learning, i.e. the processes of productive and innovative capacity building. Capacity building in LIPS is conditioned by its historical trajectory and individual and collective learning capacity in connection with the external possibilities and constraints mentioned above. Particularly relevant is tacit knowledge, consisting of skills, competencies, beliefs, values of actors and organizations.

Several forms of learning are investigated: those that are internal (learning with own experiences in production, commercialization and use, as well as in search for new internal solutions, etc.) and those that are essentially external, including process of purchase, cooperation and interaction. Learning can involve advancements at the knowledge frontier but also imitation: reverse engineering, hiring of specialized personnel, etc. These social processes might mobilize different interlocutors such as: productive agents of the same segment (horizontal interaction), segments back and forth along the production chains, including suppliers, clients and end users (vertical interaction), and other complementary segments and service providers, as well as the science, technology and training infrastructure.

As the processes of generation, diffusion and use of knowledge do not occur in an institutional vacuum, their analysis necessarily requires a consideration of the institutional environment that influences them. Thus, information gathering and analysis procedures in the methodology seek to cover the following points:

- Internal learning processes - learning processes within the organization, either through the routinized circulation of information and the interaction between teams, or through directed efforts to foster interaction and engage in re-engineering, research and development as well as other activities to acquire, assimilate and use knowledge;
- Incorporation of knowledge and skills through human resources - absorption of qualified personnel, training efforts, participation in fairs and meetings, circulation of professionals in the local environment;
- External learning processes - through interaction with companies from different segments, education and S&T organizations, representative bodies, public organizations, civil society; considering their formal and informal character, as well as the multiple geographical locations of interlocutors. Identifying the relevance of interaction with actors from (i) the local environment, (ii) from the region, (iii) from the rest of the country and (iv) from abroad allows us to draw a comprehensive map of the network of interactions of the LIPS;
- Profile, performance and contribution of the organizations of the subsystem of science, technology and capacity building in the generation and diffusion of information, education and professional qualification;
- Impacts - expansion of productive, innovative and organizational capacities, knowledge and capacity to act in new markets, etc.

Third, another main dimension of analysis consists of cooperation among local actors. As highlighted by the theoretical framework, cooperation constitutes an important way to intensify and to amplify the potential impacts of the interaction between the agents in LIPS, as well as a means for pursuing collective strategies and overcoming hurdles that eventually are posed to small enterprises due to their lack of scale and power. It can be interpreted both as the outcome of strong feelings of identity and trust and as a processes that strengthens these very feelings. Our methodology considers the analysis of the following dimensions:

- Systematic exchange of production, technological and market information (with customers, suppliers, competitors and others);
- Interactions of various types, involving companies and other institutions, through common training programs, events, fairs, courses and seminars, among others;
- Integration of competencies, through the execution of joint projects, ranging from product and process improvement to research and development itself, between companies and between them and other institutions;
- Impacts on the firm's capabilities and on the strengthening of trust and collective strategies.

A fourth set of topics encompasses the aspects of territorialization, embeddedness and governance. Understanding levels of territorialization requires the analysis of the articulation between the actors and the local environment and, specifically, with the organizations that conform the local innovation system. We investigate to what extent the characteristics of the local environment, the workers, the firms, the physical infrastructure, the financing and knowledge infrastructure, as well as other facets of the territory, influence and contribute to the development of productive and innovative capabilities of the LIPS. The degree of territorialization is associated with the locality's specific assets that can contribute to establish virtuous competitive differentials. Our research has confirmed that geographic proximity - favoring the share of economic, social and cultural values - is a source of local dynamism.¹⁴

¹⁴ See Matos et al., 2017 for details.

The degree of embeddedness refers to the intensity and quality of articulation of organizations with the local environment and its social, natural, cultural, technical-scientific and economic context. A multidimensional perspective of sustainability comes in and objective factors be analyzed might include: the level of value aggregation, quality of jobs and working conditions, origin and control (local, national and foreign) of organizations and the destination of production, technology and other inputs, use and impacts on natural endowments, urban space, etc.

Governance refers to the different mechanisms that characterize and guide the decision-making processes within the LIPS. It encompasses modes of coordination between different actors, such as local companies, representation and promotion organizations operating at its different levels, citizens and workers, civil society organizations, etc. In this sense, governance should not be understood as a simple institutional arrangement (among possible alternatives) that favors a good coordination of productive and market relations. It should be understood as the manifestation of the exercise of power by organizations and individuals, as well as the dispute for different forms of power, eventually resulting in unequal opportunities and asymmetrical forms of benefits appropriation.

Apart from firms and their strategies, understanding territorialization, embeddedness and governance requires analyzing the role played by public and private representation, support and promotion organizations. They exert important influence, creating or strengthening spaces for dialogue and the construction of collective strategies, influencing the directions and priorities in the scope of these collective actions, mobilizing and directing promotion instruments, acting on infrastructure dimensions, etc.

Thus, the methodology of RedeSist focuses on the following dimensions:

- Importance of different factors inherent to the local environment for the competitiveness of companies;
- Degree of articulation with the local economy in terms of the intensity of transactions with different actors of the system;
- Degree of articulation with local economy through subcontracting relations;
- Morphology of the productive and organizational structure and the power exercised by different actors;
- Use and impact on the natural, rural and urban environment;
- Role of representation and promotion organizations.

A final set of issues focuses on the LIPS performance, the support initiatives and policy propositions. We tackle the LIPS recent performance by observing the qualification of labor, output and revenue levels, access to regional, national and foreign markets (including destination of exports and origin of imports), as well as main competitive strategies. We analyze from the perspective both of support organizations and potential beneficiaries the ongoing promotion policies, specifying the public or private organizations that implemented it, the type, scope, level and nature of the policies. Finally, the critical articulation of all previous analytical dimensions enables to outline future perspectives for the LIPS and to propose suited policy initiatives to promote its virtuous development.

3.3. Case-studies definition

The first step here is to determine which cases could be taken into consideration and why. The possibilities vary from those cases economically, socially or politically more visible to their opposite: those more in need. It is never enough to stress that measurements, models and theories are not neutral and that of course they reflect the context that inspired their creation. Our different case studies

confirmed that most policy problems related to what in Redesist is summarized as the “de-territorializes mimetization” of imported models. The importation and use without adequacies reinforce dependencies, exclusions and distortions.

A traditional bias is the focus on cases that present a virtuous trajectory of development, that are best structured and would produce faster (financing, economic, social, political) results to support initiatives. Besides all sort of criticism, is the argument that this practice restricts the possibilities of analysis, disregarding the large universe of unstructured cases, which, precisely because of that, may be the ones deserving attention. The “invisible exclusion” is a challenge to be faced in all fields of science.¹⁵

Then, one of the objectives of the development of the LIPS concept was precisely to offer a broad perspective, capable of including all types of conditions. As seen above, in clear contrast to other frameworks, such as the cluster, industrial district or regional innovation system, there is no checklist of criteria for drawing a line between distinct LIPS cases. Here it is important to re-stress that the RedeSist framework encompasses all forms of production structures. The major difference, between this and other approaches, is that it attempts at covering all the agents and activities that together allow any sort of production activity to exist.

Specific criteria that usually orient the identification and selection of cases for study include economic, social and political elements. If criteria such as innovation, international competitiveness and new markets are in the forefront, certain types of LIPS are prioritized. If the priority is assigned to productive inclusion, creation of jobs and income, promotion of local development, etc. other cases might deserve priority attention. Of course there are important intersections. Sometimes, priorities aligned with national or regional policy plans or with the mission of leading support organizations orient this choice. In all cases, the most important is the researchers' knowledge about local realities, so that arbitrary demarcations or exclusions are avoided.

3.4. *Characterization of LIPS*

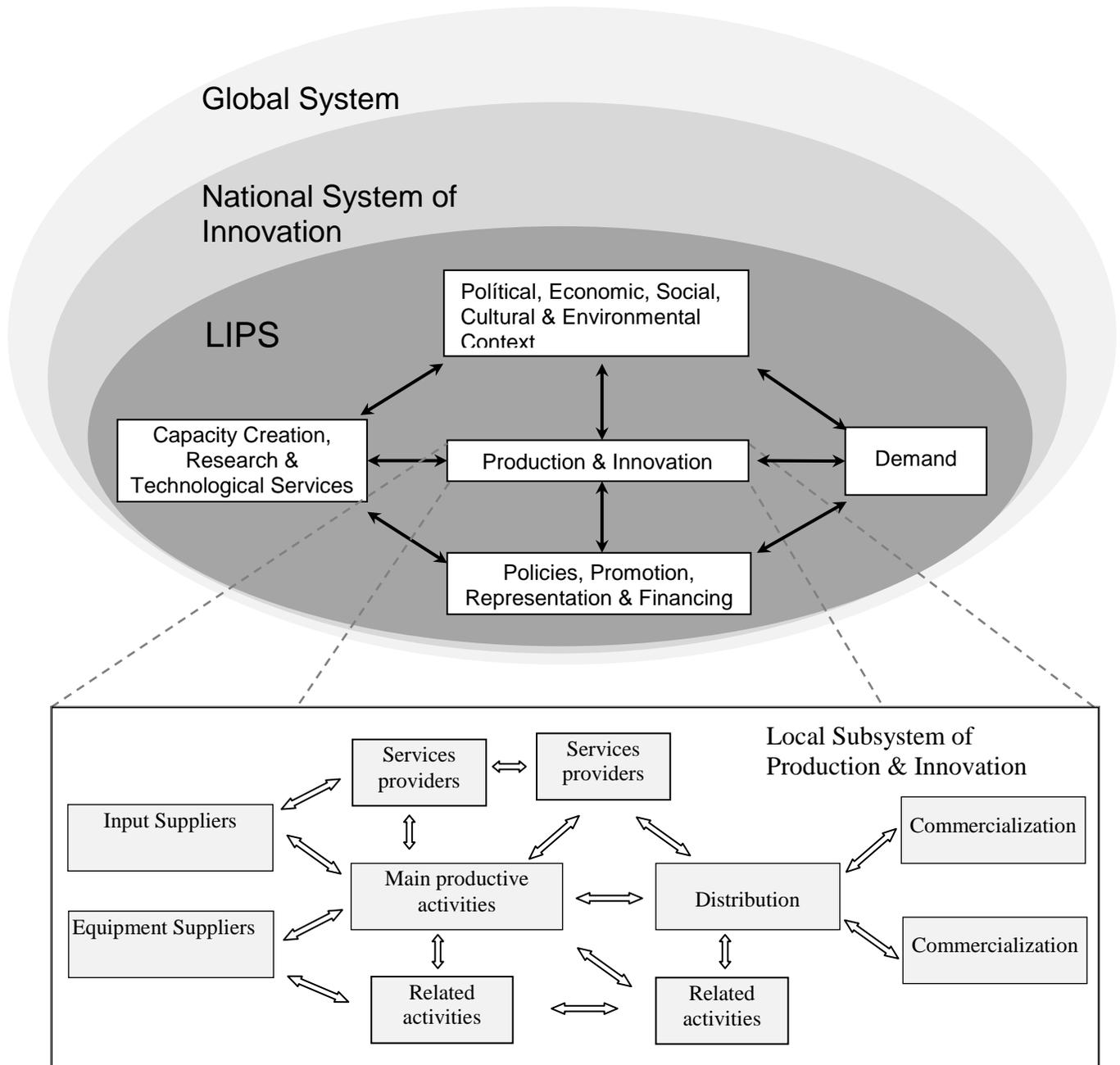
As pointed out, the LIPSs perspective goes beyond individual organizations, sectors or productive chains, establishing a bridge between the territory and the economic activities. Additionally, it offers a systemic perspective, taking a multiplicity of economic, political and social actors that contribute to shape local specific features and dynamics. It focuses on the whole context in which production and innovation occur.

Therefore, a first practical step of field research is the elaboration of a detailed characterization of the local innovative and productive system. This scheme should take into account: (i) the different segments that constitute drives of the local system; (ii) the ample set of other segments that somehow relate to the central ones, such as different kind of services, suppliers of raw materials and capital goods and downstream distribution and commercialization activities; (iii) support and representative organizations; (iv) teaching, training, science and technology and accreditation organizations; and (v) public and private promotion organizations and financial institutions. That is, the analysis should cover all actors that directly or indirectly interact with the central actors.

The design of a LIPS should take into account local, regional, national and international specificities, including the geopolitical or political, social, cultural and environmental context, as depicted in Figure 1 above. Figure 2 complements the first one by detailing the potential set of actors of the subsystem of production and innovation at the local level.

¹⁵ See Matos et al., 2018.

Figure 2: The LIPS and its Subsystem of Production and Innovation



Source: Matos et al. (2017)

As depicted, the LIPS encompass, besides the productive chain or complex, other social, political and economic actors. First, it is important to identify the multiplicity of productive activities that constitute the core of the LIPS, considering how the production of goods and services occurs and, consequently, the types and intensity of the relationships established between these segments and others. Such relationships may be formal or informal, active or bureaucratic.

As highlighted in the literature on interactive learning and innovation, we include different types of suppliers, service providers (especially those that significantly contribute for learning, such as engineering, consulting and technical assistance), other directly and indirectly related activities, as well

as downstream business branches. Even if taking as starting point of reference an abstract representation of some production network, the final schematic characterization should reveal the specific way in which the firm landscape is structured in each territory.

Every LIPS has its specificities, so that every characterization is specific. In some cases, the scheme encompasses a greater number of different actors, particularly suppliers of inputs and equipment that interact intensively with producers of final goods, generating high synergies. In other cases there are no local equipment producers, significantly reducing this type of interaction.

With regard to central productive activities, in many cases we find a dense web of subcontracting relations, where several companies - formal and informal - carry out distinct stages of the productive processes. In other cases, main companies integrate vertically or only few phases are performed in the LIPS. In cultural or creative activities, for instance, flexible teams are established for each project based on the recombination of a diversified set of specialized small firms and individual professionals.

As discussed above, the LIPS framework covers a wide set of organizations. In figure 2 they are associated to different subsystems: (i) the subsystem of capacity creation, research & technological services: includes organizations focused on training and qualification of human resources, research and development; (ii) the subsystem of policies, promotion, representation & financing, including not only public support organizations but also trade unions, business representation; (iii) the subsystem related to the political, economic, social, cultural & environmental context, based on several informal structures and eventually counting with formal organizations that represent interest of wider groups, such as non-governmental organizations, organizations of the civil society, etc.; (iv) the subsystem of demand encompassing end users and the rich user producer interaction and its learning opportunities. Base on an in depth assessment the schematic characterization should depict the individual relevant organizations according to their relations of subordination, their functions and the links they establish in the territory.

Even if we focus on the specific local structures it is important to highlight that such a characterization should also encompass actors from any subsystem that are not located in the locality but constitute important interlocutor. Eventually big firms in upstream or downstream segments are main drivers of local dynamics. Universities and other S&T organizations might constitute major sources of relevant knowledge. Policy and financing organizations from outside might be major supporters. Thus these organizations would constitute part of the local system even if not physically located there and should be included in the schematic representation.

For the elaborating this schematic characterization we suggest one or two preliminary visits to the field. Secondary data sources might be used for constructing a preliminary picture, but they are limited to the formal economy and eventually only include firms firm a minimum number of employees. Thus, the direct interaction with local representative organizations, development agencies, state and municipal government secretariats might provide a broader and more complete picture of relevant actors and how they connect. This methodological step is especially important for preparing the ground for the next one, the planning of the sampling and empirical research.

3.5. *Planning the field research*

The planning of field research involves defining the set of organization that should be interviewed, using the tools presented in the next section. In the case of the subsystem of production and innovation made up by firms and other types of productive actors¹⁶, a representative sample is to be build, including companies in core activities, as well as their suppliers, service providers and other related segments. Sampling techniques can be probabilistic and non-probabilistic. Non-probabilistic sampling

¹⁶ These might include individual professionals, non-profit organizations, worker cooperatives, etc.

is a technique that does not use random selection. Instead, it uses the judgment of the research team to select the actors to be interviewed (e.g. convenience sampling, trial sampling, quota sampling, snowball sampling, etc.). Probabilistic sampling is a technique where each element of the population has an equal and fixed chance of being included in the sample (e.g. simple random sampling, systematic sampling, stratified sample, cluster sampling).

In most LIPS studies, a mixture of probabilistic and non-probabilistic sampling procedures is used. The first one might be chosen for systems or subsets of the production structure. In contrast, non-probabilistic procedures are important in those cases where there are organizations with outstanding relevance, either because they help to coordinate local productive structures or because they represent outstanding cases in terms of knowledge generation and diffusing and innovation. Snow ball like procedures are especially useful in those cases marked by high informality. During the interviews, other relevant organizations, not identified before, were pointed out. As a result, with some degree of flexibility, a representative sample of firms, and other types of productive actors, from each segment is selected to be interviewed.

3.6. *Tools for the field research*

The instruments used in the field research conducted by RedeSist consist of a questionnaire and interview guides. The questionnaire is directed to the sample of firms (and other productive actors), while interview guides bring up specific questions for other types of organizations¹⁷.

From a methodological point of view, our first step was to try to derive operational tools that allow us to analyze the dynamics of local processes of productive development, generation and use of knowledge and learning. In a special way, this methodology should necessarily favor mechanisms for collecting information that could capture dimensions not found in statistics based on traditional territorial and sectorial divisions. On the other side, the tools tried to reconcile information from the main secondary databases of IBGE (the Brazilian Geography and Statistics Institute), such as the annual surveys (PIA, PAS, PAC) and the Brazilian Innovation Survey (Pintec), of special relevance, given the emphasis of RedeSist on the processes of innovation, cooperation and learning. Although compatible, Pintec and the research on LIPS of RedeSist, there are significant differences¹⁸.

The questionnaire was designed in a way so that it is compatible with the methodology of the Brazilian innovation surveys, PINTEC (which is to a great extent aligned with the European CIS) and annual industry surveys, both undertaken by IBGE (the Brazilian Geography and Statistics Institute). But there are also significant differences¹⁹ and many additional elements are addressed in the questionnaire for LIPS given the aim to analyze systemic local processes. The questionnaire is divided into five blocks:

- The first block characterizes the firm in terms of size, origin and structure of capital and employed personnel. In addition a specific set of questions addressed to micro and small enterprises is inspired by entrepreneurship studies and seeks to capture the origin, development, characteristics of the founding partners, difficulties associated with the operation of small companies;
- The second block investigates issues related to the production process, labor qualification and competitive strategies, and maps recent performance in terms of sales, number of employees and destination of sales (origin or location of customers in the case of service activities);

¹⁷ The RedeSist questionnaires, interview guides and other methodological steps can be accessed and freely used, provided that the source is cited, at www.redesist.ie.ufrj.br/metodology.

¹⁸ For a detailed discussion of the differences between the Brazilian innovation survey and the LIPS framework, refer to Matos et al. (2017).

¹⁹ For a detailed discussion of the differences between the Brazilian innovation survey and the LIPS framework, refer to Matos et al. (2017).

- In the third block presents most questions directly inspired by the innovation system literature. They map the processes of generation, diffusion and use of knowledge and its impacts on innovative activities. In addition a detailed assessment of the firms' innovative efforts, outputs and impacts is made. The scope and intensity of cooperative relations is also surveyed. Finally the questionnaire considers the broad impact of all these activities in terms of capacity building;
- The fourth block focuses on characteristics specifically related to the local environment, investigating issues such as the level of articulation with local productive structures and the socio-cultural base, characteristics and relevance of local differentials, ranging from the qualification of the labor force to the physical and S&T infrastructure. Additionally, the questionnaire analyses how the firms see and engage in governance relations within the system;
- The fifth block of questions focuses on public policies. Firms are asked to what extent they know, perceive and benefit from policy initiatives. They are also asked to evaluate these initiatives and asses their effective and potential impacts. Finally, future policy initiatives that could foster the LIPS's development are explored.

Considering the richness of information that an empirical study of this type can gather, we suggest that the application of the questionnaire should not be limited to marking the predefined fields. In most cases, it is very interesting to record the details reported by the respondent when answering a question. In many cases, this type of information has been essential for understanding the specific processes and dynamics of a LIPS. Many issues not envisaged by the questionnaire come up, illustrative cases are reported and details help to better interpret the grades assigned to different issues. For example, specific characteristics of a new product that point to cooperation programs mobilized for its development and the involvement of universities, associations, etc. Eventually additional details are provided such as the use of specific credit lines and public policies, helping to articulate answers given to questions in different parts of the questionnaire.

The set of tools for field research also includes three types of interview guides directed to the following organizations:

- The first is directed to organizations from the subsystem of capacity creation, research & technological services. It asks questions about the main activities and lines of research, characteristics of the courses, the main partners and clients and prospects for enhancing the local pool of capabilities within the system;
- The second focuses on representation entities, evaluating their efforts to mobilize local actors, intermediate conflicts, promote dialogue and eventually coordinate collective initiatives. Their initiatives might also encompass technological training for members, mobilization of knowledge gatekeepers for overcoming specific shortcomings and interaction with public organizations for proposing and attracting support initiatives;
- The third interview guide aims at promotion organizations, evaluating the initiatives directed to the LIPS, such professional training and technical training, participation in fairs and exhibitions, technical advice, credit lines, tax incentives, grants, support to emerging companies or incubators; etc. Additionally, some questions seek to assess their opinion about the initiatives that might be needed for the LIPS development.

The interview guides provide basic guidelines for interviews. Taking into consideration the specificity of each case calls for including additional questions. Similarly, as interviews evolve, new issues come up and a flexible application of the guiding question is advised. Additionally, it is important to stress that many questions in the interview guides are complementary to questions in the questionnaire directed to the firms. This enables researchers to confront perspectives and build up a more critical

evaluation. For example, support initiatives can be evaluated both from the perspective of the organizations that are implementing it and from the point of view of potential beneficiaries. Contrasting these perspectives might help to better understand the potentialities and weaknesses of those initiatives, allowing researchers to propose more appropriate policies that could have greater chances of success.

3.7. *Information treatment*

The analysis of LIPSs based largely on a qualitative approach, seeking to understand the productive and innovative dynamics within a context, influenced by historical trajectories and social, cultural and institutional factors, as well as the macroeconomic context itself. On a complementary manner, information resulting from field research allows constructing firm-level and LIPS-level indicators and the undertaking of quantitative analysis. These two complementary dimensions of analysis - qualitative and quantitative - are discussed below.

With regard to the qualitative analysis, in order to answer the questions highlighted in the second section, we suggest a structure for the research report, which seeks to articulate all relevant research dimensions:

- (i) International and national context - analysis of the broad economic, technological, social, political-institutional and environmental context of which the LIPS is part, thus constituting the bridge between local, national and global spheres, focusing in particular on supply structures, patterns of competition and technological regimes at national and international levels;
- (ii) Profile of the local innovative and productive system - characteristics of LIPS, focusing on its origin and development, characterization of the main actors in the productive segment, coordination and representation organizations, general infrastructure, and knowledge infrastructure in particular. Recent performance of LIPS and the development strategies adopted, as well as the existing promotion policies;
- (iii) Productive and innovative capabilities - analysis of the formal and informal mechanisms for the generation, diffusion, appropriation and use of knowledge and the processes of innovation in the LIPS and the links with the local, national and global innovation system;
- (iv) Perspectives and policies suggestions - study conclusions, focusing on the main potentialities and challenges faced and policies proposals that can guide and stimulate the evolution of the LIPS, emphasizing the promotion of productive and innovation capacity for its sustained development.

The main research questions raised by the conceptual and methodological framework can be answered by combining the different information collected. Although questionnaires and the interview guides are applied to individual actors, the treatment and the articulation of the results seek to privilege the collective and systemic dimension. In addition to the information obtained during field research, secondary data and information from bibliography converge for such characterization and analysis.

The **characterization of the economic and non-economic actors** is one of the main axes of analysis. The questionnaire applied to firms (and other productive actors) poses a series of questions regarding the size of the company, structure of its capital, specific characteristics of its founding partners, input and equipment suppliers, characteristics of the consumer markets, as well as the firms evolution over the time in terms of the number of people occupied, volume and destination of sales. Issues related to the difficulties faced in production and related to the factors considered determinant for the maintenance of innovative and competitive capacity (block 2 of the questionnaire) converge with the previous ones, allowing outlining a profile of the productive structure and development strategies. Based on information obtained through interviews with teaching and research institutions, representation entities, promotion organizations, etc. it is possible to draw a profile of the institutional

framework and knowledge infrastructure present in the LIPS, evaluating the relationship of these agents with the productive activities and the impacts on strategies and on productive and innovative performance.

Productive and innovation capacity building is a central focus of the analysis. Internal learning of firm can be addressed through the importance assigned to different areas of the company (such as production, sales and R&D) as internal sources of information (question 4 of block 3).

As LIPS are seen as 'networks of relationships' that potentialize the generation and diffusion of knowledge, equally relevant are the interactive learning processes. Questions that investigate the importance of interaction with different actors allow an approximation of the processes of learning-by-interacting. It is worth mentioning the questions that seek to assess the importance of other firms, educational and research institutions and other types of actors as sources of information for learning (question 6 of block 3 of the questionnaire), as well as partners in cooperative relations (question 8 of block 3). Another relevant issue is the location of interaction partners, based on the premise that the existence of such agents in the local sphere favors a closer interaction, enabling more intense processes of generation, assimilation, use and diffusion of knowledge, especially those of a tacit nature that are specific to that environment.

When analyzing the processes of learning-by-interaction, the local institutional infrastructure also deserves special attention. Combining answers of firms and of universities and research institutions about the characteristics and relevance of interaction helps to better evaluate its effective contributions for capacity building and innovation. Furthermore, university-firm interaction is not analyzed as a binary relation between two blocks of actors but rather from a perspective of a complex network with varied nodes and qualitatively distinct links. This is especially relevant to understand how the knowledge infrastructure relates to the technological strategies of firms or how it could eventually relate.

Another important form of capacity building is **training and qualification of human resources**. In order to identify such efforts, the questionnaire (question 5 of block 3) investigates whether companies have invested in the training of human resources. Such information can be contrasted with those related to the level of qualification of the local labor force (question 2 of block 2) and the requirements presented by the companies regarding the qualification (question 3 of block 4), allowing to evaluate the quality and adequacy of the labour force in relation to the pattern of productive and technological specialization of firms, as well as their strategy. In addition, information obtained from interviews with teaching and research institutions allows for the identification of the teaching infrastructure (first and second level teaching, technical and vocational courses offered, etc.) that can contribute to those training effort.

In addition, **structured processes of innovative search** can be characterized through the analysis of answers to questions about the degree of formalization of the innovative effort (question 4 of block 3) the types of innovative activities and whether they are carried out routinely or occasionally (question 2 of block 3).

Given the essentially systemic nature of technological endeavors, the questionnaire investigates whether agents engage in formal or informal co-operative relationships that translate into joint technological efforts, such as the development of new products and processes (question 9 of block 3). The analysis of the importance of different partners involved in cooperation, their location, the degree of formalization of relationships (question 8 of block 3), the strategies adopted, as well as the articulation with the knowledge infrastructure, allows to identify the degree of asymmetry, convergence or complementarity of the technological strategies developed in the LIPS and its potential to generate positive effects on the whole LIPS.

After investigating the processes of generation, assimilation, use and dissemination of knowledge, the research program seeks to identify potential impacts of these efforts in terms of increased skills, competitiveness and efficiency. The potential impacts of learning and training processes are investigated, in terms of increasing the stock of knowledge relevant to the company's performance, as well as the better use of productive techniques, equipment, etc. (question 11 of block 3). Likewise, another question investigates whether the cooperation processes led to the acquisition and use of new knowledge, as well as whether these efforts allowed for a better performance of the enterprise in terms of its productive process, innovation, commercialization, etc. (question 10 of block 3).

As emphasized in the conceptual and analytical framework of LIPSs, a central element of analysis is the innovative performance of actors and the LIPS as a whole. Aligned with most innovation surveys, question 1 of block 3 investigates the introduction of new products, processes and organizational aspects and whether the innovations are new only for the firm or for the national or international market. In terms of impacts of the introduction of innovations on company performance, both quantitative measures (participation in sales of new or significantly improved products) and qualitative measures (evaluation of potential impacts in relation to efficiency increases, participation in markets, reduction of factor cost, etc.) (questions 2 and 3 of block 3) are considered. These questions combined seek to obtain information on outputs and impacts that go beyond those usually considered in innovation research, such as bibliometric and patent indicators.

In addition, it is important to identify the links between actors and the local environment, and specifically the local innovation system. The aim is to analyze the importance of the local dimension for the development of productive and innovative capacities and the relationship between the innovative environment and the economic performance of the region. In a broad way, questions seek to identify the aspects of the local environment that are considered as advantages for the location of firms (question 1 of block 4) and what is the intensity of commercial transactions carried out locally (question 2 of block 4). On a complementary manner, the articulated analysis of interactive relations with local partners and of local subcontracting relationships (issues 4 to 6 of block 4) help us to better understand how production links help to build up a rich learning environment.

An objective of the LIPS study is to evaluate and provide elements for 'suited policies'. An initial step consists of the characterization and evaluation of the recent policy initiatives. Interview guides applied to development and representation institutions, as well as to public authorities, identify the policies that affected and affect the formation and / or development of the LIPS, providing details about their type, scope, level and nature. The impact and effectiveness of such actions can be identified, directly, through information obtained from firms and, broadly, through the evaluation of the various issues discussed above. In terms of direct impact, the questionnaire presents a series of questions that assess the companies' opinion about the performance of these organizations and which are their main policy demands (questions 1 to 3 of block 5).

In a broad perspective, the evaluation of all the information obtained in the research, with emphasis on those related to the production and innovation performance of the individual actors and of the LIPS, allows identifying the impact and possible shortcomings of policies. Articulating past experiences with the strategies pursued collectively, the technological capabilities and hurdles that exist, as well as the characteristics of the market, may help to propose policies for the LIPS's development that are appropriate and have greater chances of success.

In addition to the qualitative analyzes, a vast set of quantitative techniques can be mobilized. The methodological efforts of RedeSist have also allowed its researchers to advance in the construction of quantitative databases and in the proposal of systemic indicators for local processes. It is beyond the scope of this paper to discuss the construction of these indicators and to explore the various analytical

techniques can be employed. But the main references are available in the works of La Chroix et al. (2003), Matos and Stallivieri (2009) and Matos et al. (2015 and 2016).

4. Concluding remarks

In this paper we aimed to recuperate the experience accumulated by RedeSist over twenty years on the methodology for analyzing local innovative and productive systems (LIPS). This paper does not allow detailing the elements and instruments²⁰, nor embarking in a comprehensive discussion on the specificities related to activities apart from manufacturing, such as agriculture and several areas of services. As highlighted above, RedeSist has been engaged in the study of small-scale and family farming activities, cultural LIPS and also of essential public services, such as basic health care. Main differences of these activities, compared to those in the manufacturing sectors, relate to the knowledge base and the patterns of appropriability, business models, structure and organization of companies and networks, among others. Taking the specificities of the distinct activities into account required several adaptations and improvements of the interview and analytical tools.

As stressed several times along the text, the conceptual and methodological framework of RedeSist is an ongoing construction, which is done collectively through using a common framework by many colleagues and building upon their constructive feedbacks. Thus, nowadays there are interesting challenges to the research agenda. As the innovation system literature is exploring ways on how to effectively incorporate a multidimensional perspective of sustainability, especially fruitful are the contributions that explore the environmental and the social dimension: inclusive, frugal, “below the radar” innovations. On the one side, interesting contributions provide broad theoretical overviews and organize stylized facts on relevant processes. On the other side, many studies provide empirical evidence based on virtuous cases.

However, it is still an open challenge to advance in two complementary fronts. First, in articulating the many dimensions of sustainability – namely the social, the cultural, the environmental and the economic – in a comprehensive theoretical framework, which sets them as main metric for determining success in terms of development. Second, in consolidating this perspective within an analytical and methodological framework, applying this multidimensional perspective of sustainable development to the analysis of any innovation system or LIPS. This would provide very relevant policy implications.

Finally, we argue that our experience in RedeSist has confirmed that the LIPS approach indeed constitutes a framework much more advanced and adequate than notions such as sectors, clusters, production or value chains. And that it represents a very useful tool, that allows not only to capture and better understand the processes of generation and use of knowledge and the dynamics of production and innovation, but also to orient their development. As a matter of fact, in Brazil, the different LIPS studies carried out in distinct parts of the countries, as well as the pragmatic use of this approach to support production and innovation development have generated an intensive learning process, which has contributed to enrich both research and policy initiatives.

It seems worth noting that the Brazilian policy experience focused on LIPS has been considered by national and international experts as “the main novelty and most relevant industrial policy initiative in Latin America in recent decades” (Peres 2011, p.3).²¹ In the same way, the approach is perceived by international specialized literature as one of the most important analytical proposals developed for understanding the phenomena of territorial productive development, being among “the specific categories of localized systems ... that... have had notable success in the academic literature and by

²⁰ They can be found in www.redesist.ie.ufrj

²¹ “*Sebrae programmes to support APLs in Brazil are the most important in the region*” (Peres, 2011, p. 3).

policy makers who have had remarkable success both in the academic literature and in decision-making centers and promotion policies and in their 'means of impact communication' (Torre and Zimmerman, 2015, p.25).²²

Mazzucato and Penna, 2016, on their turn note the spread of the systemic approach in orienting Brazilian policies, and stress that those “to promote technological and industrial development have recognized that the agglomeration of firms, and the benefits generated by their collective interactions, can contribute to sustainable competitive advantage. The concept of ... LIPS ... (in Portuguese Arranjos Produtivos Locais), or APLs, plays an important role in national development policy and STI policy” (p.28).

The results of the RedeSist investigations also confirm these conclusions. They also show that the focus on LIPS (i) has allowed groups of informal and small producers and their activities to be supported by industrial and STI policies, and in many cases for the first time in the history of the country; and (ii) has become a ‘passport for inclusion’ and a reference for policies committed with inclusiveness and the reduction of social and territorial inequalities.

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²²As published at the *Revue D'Economie Industrielle* 2015 that presented a survey on the world literature on the theme: “on peut signaler ... catégories particulières de systèmes localisés qui ... ont tous connu un succès notable que ce soit dans la littérature académique, au près des décideurs publics: ... les APL, ou Arrangements Productifs Locaux (Cassiolato et Lastres, 2003)” (Torre and Zimmerman, 2015, p. 25).

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