

Forms of governance, learning mechanisms and localized innovation: A comparative analysis in local productive systems in Brazil

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1. INTRODUCTION

Since the early 1990s, the liberalisation of trade and financial markets and the important developments in transport and communication technologies have brought profound changes to the organisation of productive and innovative activities across nations and regions. In particular, these paradigmatic changes from the Fordist mass-production model to new forms of industrial and technological development may be seen as drawing extensively upon the context of a *knowledge-based economy* (Lundvall and Johnson, 1994). The main idea behind this concept is that in the contemporary stage of capitalism the economic performance of firms, regions and nations is increasingly dependent on their ability to learn. Although information and codified knowledge can be easily transferable across space some crucial elements of knowledge remain deeply rooted in specific locations and institutional designs (Lundvall and Borrás, 1997: 14). Following these arguments, the importance of territorial proximity for localized learning and innovative processes is reinforced by the perception that as the codified forms of knowledge are becoming increasingly ubiquitously available, the tacit forms of knowledge have become a key element for competitiveness and innovativeness (Maskell and Malmberg, 1999).

In this aspect, although remaining the primary unit analysis of innovation processes, firms are now widely recognised as learning organisations embedded in a broader institutional context. In other words, learning processes do not occur in an institutional vacuum (De la Mothe and Paquet, 1998). The institutional dimension, as the setting of norms and routines upon which productive and

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innovative activities are organised is a critical issue for the understanding of interactive learning processes and innovative strategies within industrial agglomerations. Moreover, as much as interactive learning process has become the key mechanism for economic and technological development, geographical proximity has also been taken as the best context for facilitating tacit-knowledge exchange. From this perspective, the region is seen as a cognitive space where shared values, trust and other intangible assets contribute to the success of interactive learning processes and minimise transaction costs between firms (Storper, 1997; Larson and Malmberg, 1999).

The growing interest in the localized nature of learning and innovation processes has resulted in a profusion of approaches and conceptualisations. Inspired by Marshall's seminal work on the concept of externalities, one of the key insights of such approaches is that firm-level innovation processes are generated and sustained by inter-firms relations and, particularly, by intraregional linkages between innovative actors³.

The importance of institutional and organisational designs associated to industrial agglomerations have been widely emphasised by these different approaches. However, until recently most of the work concerned with the study of local sources of innovation and competitiveness has focused on the experience of industrialised countries and, particularly, of successful cases. Notwithstanding their importance in providing new elements to the systemic and interactive approaches to innovation processes, many of their assumptions may be challenged when focusing a developing country context.

In recent years, a growing number of authors have emphasised that many of the innovative efforts undertaken by firms belonging to industrial agglomerations in developing countries still sustain a remarkable instability. First, the macroeconomic environment in developing countries has proved to be an important constraint to technological development in these countries (Cassiolato and Lastres, 1999). According to Cassiolato (1992), in the last decades, most of the firm's technological strategies in developing countries have been more affected by macroeconomic policies than by specific innovation policies. Second, the systemic nature of innovation processes that is a crucial feature of the systems of innovation conceptualisation is hardly present in developing countries due to the instability concerning the institutional designs supporting interactive learning and innovation activities (Arocena and Sutz, 2000; Cassiolato and Lastres, 1999).

In this sense, the emphasis on the role of institutional frameworks is particularly relevant to discuss the competitiveness and innovativeness of industrial agglomerations in a developing country context. This paper analyses the role of institutional and organisational designs on the shaping of learning mechanisms and innovative strategies adopted by firms within agglomerations in developing countries. In doing so, it uses the conceptual framework of the 'innovation system' literature and the approach on 'local productive and innovative arrangements' developed by RedeSist in Brazil⁴.

A preliminary analytical scheme is used to illustrate the discussion on some empirical cases in Brazil. These case studies comprise a sample of 26 local productive and innovative arrangements analysed in Brazil, from 1998 to 2000, and reflects a part of an ongoing research effort carried out by

3 The resurgence of the region as a central focus of innovativeness and competitiveness was fairly illustrated by the success of some experiences of highly dynamic regional economies and industrial districts drawing extensively upon local assets for their competitiveness: Industrial districts of Northeast-Central Italy, Silicon Valley, in California, Baden-Wurttemberg, in southern Germany, Toyota City and even other lesser known examples. (Storper, 1997)

4 For a comprehensive view on the conceptual framework on local productive and innovative systems developed by Redesist see Cassiolato, Lastres and Maciel (2003); Cassiolato and Lastres (1999).

RedeSist (Cassiolato, Lastres and Maciel, 2003). These selected case studies comprise agro-industrial and industrial agglomerations in the South of Brazil and are useful to illustrate the effects of diverse productive and knowledge systems' configurations over learning mechanisms and innovative strategies⁵.

Therefore, the paper seeks to provide some tentative answers to the overall question on how *the diverse organisational and institutional characteristics of local productive systems in developing countries affect their learning strategies and capabilities for innovation*.

In order to deal with this question the paper seeks to analyse the specificities of industrial agglomerations in terms of learning environments and innovative strategies emerging from the interaction of the diverse characteristics of production and knowledge systems.

The paper is organised as follows. The next section explores a preliminary analytical scheme to explain the influence of diverse institutional and organisational characteristics upon the competitive and innovative dynamics of industrial agglomerations. The third section departs from this preliminary analytical framework to discuss the empirical evidences from case studies on Brazilian productive systems. The final section highlights the variety of configurations emerging from the interaction of diverse characteristics of production and knowledge systems and brings some guidelines for both further research and policy implications on this topic.

2. FRAMING AN EXPLORATORY ANALYTICAL FRAMEWORK

The framework proposed in this section builds on an analytical distinction between systems of production and systems of knowledge with the aim of exploring the role of institutional and organisational designs in shaping learning mechanisms and innovative strategies within local productive systems.

Although frequently overlapping in some of their conceptual assumptions, most of the approaches that explore the relationship between spatial proximity, innovativeness and competitive performance in industrial agglomerations also tend to focus some specific analytical characteristics related to the productive, institutional and knowledge dimensions comprised in industrial agglomerations. In this sense, some studies have overemphasised the externalities that emerge from inter-firm transactions of products and services as the main reasons for the local competitive advantages. However, these models fail to provide an explanation about the sources of such local competitive advantages, which are embedded in institutional and cognitive aspects of these local agglomerations. Other approaches that are mainly focused in the technological dimension of industrial agglomerations also fail to explain the localised nature of innovativeness and competitiveness once they tend to locate the source of such advantages entirely in the basic characteristics of the particular sector or industry.

In this aspect, it is important to notice that, firstly, the innovative and competitive dynamics of local productive systems cannot be understood without taking into account the institutional designs in which such agglomerations are embedded. In this sense, some authors like Amin and Thrift (1993) emphasise that the local *embeddedness* of innovation processes is defined through the notion of

5 The sample comprises the following case studies. In the State of Rio Grande do Sul are the tobacco agro-industrial complex in Rio Pardo Valley, the wine agro-industrial complex in the Serra Gaúcha region and the leather-footwear cluster in the Sinos-Valley. In the State of Santa Catarina are the textile and software productive systems.

“institutional thickness”. Also, the institutional thickness of a territory can be defined “as the combination of factors, including their inter-institutional interaction and synergy, a collective representation by many bodies, a common industrial purpose and shared cultural norms and values” (Amin and Thrift, 1993:417).

Secondly, the distinction between systems of production and systems of knowledge is crucial to understand how the main elements associated with the organisation of productive activities interact with those elements related to the organisation of knowledge flows in order to foster or hamper long-term innovative dynamism of industrial agglomerations. This kind of distinction has been emphasised in some strands of literature emerging from the analysis of technological systems of innovation (Carlsson, 1995; Carlsson and Jacobsson, 1997) and by authors like Camagni (1991) in the approach on *innovative millieux*. Others like Bell and Albu (1999) have departed from this important distinction to explore the differences in the organisational basis of cluster’s knowledge systems.

Although these analytical dimensions are obviously interrelated and interdependent, separately they might help to shed light on what relations and processes to focus in the analysis of learning mechanisms and innovative strategies within diverse configurations of local productive systems.

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2.1. Division of labour and governance modes: framing the institutional context of production systems

This first dimension intends to illustrate how different elements associated with the production system of industrial agglomerations might affect the interaction among local actors within a productive chain.

Most of recent empirical analyses on innovative and productive local systems emphasise two particular elements as characteristic of the production structure: firms internal organisation and inter-firms relations. These elements define *what* to produce, *how* production operates and what are the competencies required for the productive activities in the system. (Lundvall and Johnson, 2001 p. 11).

However, defining the structure that is relevant for analysis depends also on the framework set for the system. If this framework is based either on the kind of product or on the particular technologies in use, we have sectorial systems or technological systems. Insofar as we are interested in the analysis of localised innovation systems, the relevant analytical frame is geographical once the specificities of the configuration of productive structure emerge from the characteristics of the territory where productive relations occur.

The conventional view about industrial agglomerations has traditionally placed the spatial dimension as an outcome of processes driven by technological and organisational forces. According to this view, most of the analyses of the role of geographical proximity developed on regional economics has taken into account mainly elements regarding economic transactions such as the exchange of goods, information and human resources over geographical distance (Storper, 1997). In this aspect, one of the main features of the resurgence of regional economics in the 1990s is that the territory has become the “sedimentation” of specific and interrelated historical, social and cultural factors in local

areas. This characteristic generates significantly different development processes directly related to specifications” (Garofoli, 1993, p.24).

Along with this notion of territory, the typology of production systems created by these authors is based on the concepts of firm’s external economics that become territory’s internal economics. This typology suggests that high external economics combined with firm’s low internal economics tend to produce a “disintegrated network production” structure. In this kind of production’s territorial organisation, the labour division within the territory is wider, as well as the linkages in inter-firms transactions. If high external economics are combined with also high firm’s internal economics, the production structure may be of “large-scale assembly systems” type. In this kind of structure the degrees of vertical integration between firms are higher and a significant number of suppliers may be present. (Garofoli, 1993 p.26)

However, the effects of these different forms of “territorialised” productive activities organisation over the innovative trajectories of firms within industrial agglomerations need also to be associated with the specific governance modes that define the symmetry of forces that drive the productive chain at local level⁶.

Therefore, our analysis will benefit from a typology that combines the firm’s organisational aspects (through the concept of internal economics) with the inter-firms’ relations (through the concepts of external economics) characterising a territorial organisation of production. This organisation, along with the asymmetries of power between the firms, shows the modes of governance in the local.

According to Humphrey and Schmitz (2001), “the governance issue arises as some firms in the chain work in accordance with parameters set by other firms (...) governance refers to relations between firms and institutional mechanisms through which the activities extra-market co-ordination within a chain is reached.” The co-ordination mechanisms are discussed by Humphrey and Schmitz (2000) who suggest three kinds of economic activities co-ordination in addition to market relations: those that occur within networks, quasi-hierarchy and hierarchy. Moreover, the governance categories may be either public or private and either global or local. Therefore, within this different forms there is a continuum ranging from the absence of governance, when relations occur solely through the markets, to a situation in which such relations are set through mechanisms emanated from the power of other firms or of public institutions and may also be influenced by the location of such power sources.

Thus, the analysis of the institutional and organisational characteristics associated with production systems within industrial agglomerations are described here according to two major dimensions: a) the division of labour within the local productive chain and; b) the predominant forms of governance

Concerning the division of labour, the following elements are considered: labour division intensity given either by the presence of productive segments within the local predominant production chain and by the number and size of the firms. These variables suggest as much the existence of productive complementarities and specialisations as the density of the production structure in the locality.

The analysis of governance modes seeks to explain, firstly, whether the power to affect the development of the production system is concentrated on the hands of few large firms or is spread over networks of small units. It is worth to emphasise that this aspect characterises the governance mode for the system as a whole. Nevertheless, we also take into account that inside the system there may be groups of firms with specific governance modes whether there are, for instance, subcontracting networks, or the presence of coordinating institutions aimed at particular groups of firms within the

6 That is, the innovative processes come up from the firms’ routines and are rooted in the production system. (Lundvall, 1992 p.9)

locality. This means the possibility of a predominant governance mode affecting the system as whole existing concomitantly to specific governance modes for particular groups of firms inside the system.

The table below summarise the effects of the production's structure configuration both on the governance modes and on the predominant characteristics of relations between firms of a local system.

TABLE 1: INSTITUTIONAL AND ORGANISATIONAL DESIGNS FOR PRODUCTION SYSTEMS

Division of Labor				
Low/ Few complementarities			High/ Many complementarities	
Mostly SMEs		Some large firms and SMEs	Mostly SMEs	Some large firms and SMEs
Predominant forms of governance	Predominance of networks (Type 1)	Predominance of hierarchies (Type 2)	Predominance of networks (Type 3)	Predominance of hierarchies (Type 4)
Complementary forms of governance:	Public/private coordination (ie.industry associations)	Public/private coordination (ie.industry associations)	SMEs Networks of subcontractors	Networks of subcontractors SMEs Networks of subcontractors

Table 1 shows that the possible kinds of relations and governance modes are given by the specific configuration of the agglomerations' productive structures. A first important note is that these modes and relations can exist or not within a particular productive structure, that is, in any case it is possible that no specific governance modes are present. We do not defend a direct causality determination, although we emphasise that governance modes and relationships require certain conditions defined by the configuration of the productive structures.

Type 1 shows a situation in which the presence of few segments in the productive chain and the absence of large firms suggest the existence of a governance in the form of networks that can be combined with the presence of associative institutions which have a significant role in the coordination of cooperative actions between the firms.

In type 2, the productive structure configuration differs from the prior regarding the firms' size distribution. The presence of large firms suggests hierarchic governance for the system as a whole. It can also be combined, like in Type 1, if there are associative institutions in the system, with specific governance by groups of firms, probably the smallest or those specialised in a particular segment of the chain. Difference is given by the forms of relations between the firms, once the high degree of vertical relations along with a reduced labour division tends to reduce the intensity of relations between firms.

In Type 3, a greater labour division increases the structure configuration density, in the absence of large firms; the governance by networks predominates in the system. Nevertheless, it is possible that more intensive relations between groups of medium and small firms occur through the formation of subcontracting networks.

Finally, in type 4, the productive structure configuration is the more complex of all types presented and suggests hierarchic governance for the system as a whole combined with a greater variety of other kinds of particular governance between groups of firms.

In sum, this first analytical dimension suggests that as the complementarities of division of labor increase, the diversity in governance modes tends to become more complexes. Moreover, the complexity in governance modes is also deeply affected by firms' productive strategies related, for instance to the degree of vertical integration. Therefore, both the division of labor and the governance modes have an important role in shaping the intensity of inter-firms' linkages within the territory.

2.2. Role of technological and training organisations and intra-firms learning mechanisms: framing the knowledge system

Knowledge systems might be defined as a set of knowledge stocks and flows used in order to generate and sustain changes in products, processes and in the organisation of productive systems (Bell and Albu, 1999: 1723). Although there is a clear overlap between knowledge systems and the production systems the very nature of such interactions is variable and implies, in general, in different sets of actors.

Therefore, as moving towards the institutional and organisational characteristics of industrial agglomerations' knowledge systems, it is possible to distinguish two key elements associated with the nature of innovative capabilities and the role of local actors in the generation and diffusion of knowledge namely, the role played by technology and training infrastructure and the nature of intra-firm learning mechanisms.

Concerning the role played by technology and training infrastructure of local productive systems, the reach of this first level of analysis is twofold. Firstly, it takes into account the existence of physical infrastructure like technological and training institutes, business associations, and other support organisations that provide information, generate and diffuse knowledge within local productive systems. Thus, this first level of analysis illustrating the role of the technological and educational infrastructure can be seen as comprising two extremes of the same spectrum: a) Unstructured and; b) structured.

The first category describes a situation in which the institutions and organisations aimed at the diffusion of information and knowledge are missing or does not carry out their functions. In this sense, the institutional and organisational characteristics of the knowledge system associated with the cluster can be considered as unstructured and restricted. Also, the channels to knowledge diffusion are mainly informal and not organised. In the other extreme, the role of the technological and educational infrastructure in managing knowledge sources is pervasive.

It is important to notice that the existence of a dense technological and training infrastructure at local level is not enough to explain the systemic features of knowledge flows, the analysis of knowledge structures also needs to consider the nature of the knowledge channels associated with the technological and training infrastructure.

A second level of analysis addresses some crucial issues that are mainly related to the nature of intra-firm learning mechanisms namely, the firms' role in promoting learning processes and the knowledge sources used by firms to promote product and process innovation. The first one intends to identify the active or passive role of the firms within the local productive system in relation to the development of learning mechanisms. The second one, is useful to distinguish whether the main knowledge sources are mainly generated inside the firms or through external linkages

A combination of these elements (knowledge sources and learning mechanisms) might be described through two categories. Such categories comprise a dichotomy that is largely focused on the nature of intra-firms learning mechanisms. At the first extreme, the firms have a small and passive role in the generation of new knowledge and it is reasonable to suppose that most of the knowledge and information sources used to promote changes in products or processes are external. At the other extreme, the firms not only have an important role in the generation of new knowledge through purposeful research but also in managing external knowledge flows through more complex forms of learning.

The table below seeks to summarise the interactions between the categories used to characterize the institutional and organisational dimension of industrial agglomerations' knowledge systems. In this aspect, it is assumed that the first category both interacts with and also overlaps the second one, making possible to sketch out four possible configurations of institutional and organisational designs for knowledge systems.

TABLE 2: INSTITUTIONAL AND ORGANIZATIONAL DESIGNS FOR KNOWLEDGE SYSTEMS

Role of technological and training organizations (knowledge infrastructure)			
Unstructured		Structured	
Intra-firms learning mechanisms			
Restricted and passive	Open and active	Restricted and passive	Open and active
Type 1	Type 2	Type 3	Type 4
Small or not-existent role of tech./training infrastructure and poor intra-firm learning mechanisms	Small or not-existent role of tech./training infrastructure and active intra-firm learning mechanisms	Persistent role of tech./training infrastructure and poor intra-firm learning mechanisms	Persistent role of tech./training infrastructure and active intra-firm learning mechanisms

Starting from left, the table's first cell (type 1) describes an agglomeration with an unstructured and restricted knowledge infrastructure. Also, the firms are assumed to have a limited reach in managing interactive learning processes and the main information and knowledge sources are most likely externally supplied. In this aspect, the local actors have a passive role in acquiring new knowledge through learning-by-doing or learning-by-use routines.

Moving right, the next cell (type 2) describes those agglomerations that, despite the lack of a structured knowledge infrastructure aimed at managing of knowledge flows, have a number of firms engaged in acquiring and/or generating new knowledge. However, these innovative capabilities tends to remain "encapsulated" in a few group of firms since there is a lack of diffusion channels within the cluster. As the institutional and organisational structures associated with the knowledge system have a very limited reach in promoting interactive learning processes, the innovative dynamics of the agglomeration as a whole remains poor.

The next cell towards right (type 3) describes a slightly different situation. In this case, although the institutional and organisational designs related to the generation and diffusion of information and knowledge are well structured and systemic, the firm's capacity to develop learning mechanisms is very low and externally based. So, even considering that the existing knowledge stocks provide a basis for the diffusion of innovations through interactive learning mechanisms, the competitive and innovative dynamics of the cluster is hampered by the passive nature of firm's learning mechanisms.

The cell in the far right (type 4) describes a case that can be seen as the perfect example of a dynamic and self-sustained local system of innovation. Firstly, knowledge infrastructure supporting diffusion processes at local level are structured and systemic. Secondly, the firms have high capabilities to manage interactive learning processes. Finally, the main sources of information and knowledge used to foster innovation processes are locally embedded and the local actors play an active role in managing knowledge flows from outside the cluster.

Finally, it is worth to notice that his framework has been built as a discrete representation comprising some of the possible interactions between the productive, institutional and cognitive determinants

of local productive systems' innovative and competitive capabilities. In this sense, each distinction allows the identification of several intermediary situations. There are, of course, many other examples, even more complex, emerging from the interaction between these analytical elements.

3. INSTITUTIONS, PRODUCTION AND KNOWLEDGE: EMPIRICAL EVIDENCES ON BRAZILIAN LOCAL PRODUCTIVE SYSTEMS

This section tries to sketch out some of the possible configurations emerging from the characterisation of productive and knowledge activities in local productive systems. In doing so, it tries to apply the main analytical elements discussed above to explain the innovative and competitive dynamics of local industrial agglomerations in a developing country context. As emphasized earlier, the empirical material presented in this section draws on five extensive case studies on Brazilian productive systems, though only some key characteristics of these surveys are discussed ⁷.

Therefore, this preliminary analytical scheme intends to provide a common ground for the comparison of empirical studies on local productive arrangements in Brazil developed by RedeSist. Moreover, it also seeks to pose some questions about the possible developmental tendencies of local productive systems according to changes in their productive and knowledge dimensions/variables. In another words, this analytical scheme may be seen either as a static representation of possible effects on learning mechanisms and innovative strategies resulting from productive and knowledge characteristics of industrial agglomerations or as a set of possibilities for evolution from one configuration to another as the conditions associated with different analytical elements change overtime. The table below presents a summary of the five case studies on local productive systems in Brazil according to the main analytical dimensions discussed above.

7 For a detailed discussion about these empirical cases see (Cassiolato and Vargas, 2003; Campos, Cário and Nicolau, 2003; Nicolau, Campos e Cário, 2001; Campos, Nicolau, Simioni, 2002; Cassiolato, Villashi and Campos, 2003; Vargas, 2000; Vargas and Alievi, 2003; Vargas, 2001; Villashi and Campos, 2002;).

TABLE 3: LOCAL PRODUCTIVE SYSTEMS IN BRAZIL ACCORDING TO INSTITUTIONAL AND ORGANISATIONAL CHARACTERISTICS OF PRODUCTIVE AND KNOWLEDGE SYSTEMS

Categories/empirical cases	Footwear	Wine	Tobacco	Software	Textile
Systems of production	Mainly type 4	Type 1	Mainly type 2	Type2	Mainly type 4
Level of division of labor	High with some large firms	Low with mostly SMEs	Low with some large firms	Low with mostly SME	High with firms some large
Main governance modes	Hierarchies w/ network of subcontractors and global chains	Diffused networks w/ public private coordination	Hierarchies through global chains	Only public/ private private	Diffused networks w/ public private coordination
Systems of knowledge	Type 3	Type 4	Type 2	Mainly type 2	Mainly type 3
Knowledge infrastructure	Structured	Structured	Unstructured	Unstructured with many training institutions	Structured
Intra-firms learning mechanisms	Restricted and passive learning-by-doing/using	Active and learning by searching and by interacting	Active Learning by searching	Active Learning by interacting with users	Restricted and passive learning -by-doing/using
Reflexes on productive and innovative capabilities					
Impacts on inter-firms' linkages	High Incentives for manly vertical linkages	High Incentives for manly horizontal linkages	Low Incentives for linkages	Low Incentives for linkages	High Incentives for horizontal and vertical linkages
Impacts on local learning strategies	Broad but focused mainly on productive capabilities	Broad and focused on productive and innovative capabilities	Restrict (encapsulated within MNCs subsidiaries) focused on productive and innovative capabilities	Restrict (encapsuled within medium and large firms) focused on productive and innovative capabilities	Broad but focused mainly on productive capabilities

Departing from of the characteristics associated with structure of production systems, two out of four cases (the footwear and textile cases) are characterised by a high division of labour within the local productive system.

In the footwear case, the local productive system comprises firms operating in all stages of footwear productive chain as shoes manufacturers, subcontractors, tanneries, equipment and machinery suppliers, component producers and export agents amongst others. Altogether the productive system currently counts approximately 500 shoemakers that operate primarily in the niche market of women's leather shoes (although there are also several firms producing men's and children's shoes). Despite being functionally linked to the footwear enterprises, it can be observed that the different segments integrating the leather-footwear productive chain at local level present variable degrees of autonomy and conflict respecting the shoes manufacturers, as well as, innovative strategies.

In the textile case, the local productive system is comprised by the set of the most significant segments of the textile and clothing chain including threading, weaving, dyeing and manufacturing of wearing apparel⁸. However, the firms receive their main raw material – cotton – and most of the

⁸ Its main products are articles of clothing (T-shirts, sweatshirts, pajamas, polo shirts, bermuda shorts, blouses, men's and women's underwear, etc), fabrics, towels and bathrobes, sheets, pillows, bedspreads, comforters, table-cloths, curtains, threads (cotton threads for knitting and embroidering, shoelaces, etc.), textile products for hospitals (surgical dressings, gauze patches, fabric diapers, etc.), elastic ribbons, and tags

equipment, fibers, synthetic fabric, and chemicals from suppliers located outside of the local productive system. Therefore, the main productive agents of the local system are the firms of the core textile and clothing industry. The division of activities in the local productive system (threading, weaving, finishing and manufacturing) makes possible a productive fragmented structure, with a wide diversity in the size of productive units, and with an elevated level of vertical integration of the firms. These features characterise an agglomerate of firms with high density, but little local complementarities.

As for the wine and software productive systems, the level of complementarities within the local productive system is lower and the core productive activities are performed mainly by SMEs. In the wine productive system, it is possible to identify three distinct segments of wineries. First, there are those larger wineries with high processing capacity that produce premium wines. In this segment there are as much national-owned firms as MNC subsidiaries. Secondly, there are small wineries that are dedicated mainly to the production of bulk and cask wines of lower quality. Finally, a third, restricted but important segment of small family-owned wineries (called “cantinas”) emerged during the 1980s within the universe of small and medium sized firms of the arrangement. The software productive system comprises approximately 32 software-houses (mainly small and micro enterprises). However, the revenues are mainly concentrated in a single large firm. The agglomeration is specialised in the production of ERP (enterprise resource planning) software’s. Finally, the intra-firms’ linkages are weak and mainly horizontal. (Nicolau et al, 2001).

In the tobacco local productive system in Rio Pardo Valley there are few large multinational conglomerates connected with the tobacco leaf processing and with the cigarette production. Besides these big conglomerates, there are also medium and small sized firms which join, total or partially, the productive process of the majors through the supplying of processed or *in natura* tobacco. The existence of distinct segments of firms according to markets size and dimension led to the establishment of an implicit division of labor. The small and medium sized firms are linked to the productive process of the two main tobacco-processing factories of the region as suppliers of tobacco leaf or primary processed tobacco.

The institutional and organisational dimension of any productive system cannot be fully understood without taking into account the governance modes associated with the division of labor in local productive systems. In this sense, the empirical cases presented in table 3 show a rich picture concerning the effects of diverse governance modes on the coordination of productive activities at local level.

The tobacco productive system captures most of the features of the power asymmetries emerging from hierarchical governance modes. Although the organisation of tobacco growing activities presents a considerable territorial dimension, the stages related to tobacco and cigarettes processing, distribution and trading are organised outside the local productive system, at international level. This kind of articulation between a global scale and a local one resulted in the establishment of an hierarchical governance structure in which the competition conditions faced by the big corporations in the international market set conditions to the role carried out by the local productive system in the international division of labor.

To a lesser extent, the footwear productive system in the Sinos Valley also shows this kind of hierarchical governance modes. At local level, the large firms have a crucial role in organising networks of subcontractors. The subcontractors segment comprises a quite heterogeneous universe of actors inside the footwear arrangement. Besides the ateliers, which use local labour and accomplish some tasks for the footwear manufacturers, there are some firms that hire such services directly from their employees, and there are intermediary firms which “distribute” tasks among home workers in the

region. The search for productive flexibility by the footwear enterprises during the 1990s resulted a significant increase in subcontracting some activities like sewing, cutting, modeling etc. Besides the role played by large shoe producers at local level, the global buyers also used to play an crucial role in fostering subcontracting networks within the local productive system.

At the opposite extreme, the wine and the software productive systems might be characterised by diffuse governance modes in which power relations are more symmetrical between firms within the local productive system. In the wine productive system, the existence of wineries operating in different product niches allowed the creation of several associations aimed at supporting the interests and specific needs of each segment. As for software the local industry association plays a central role in the local governance along with local government initiatives.

In the textile case, Considering the heterogeneity of the productive agents, in relation to their size and level of vertical integration, the dynamics of the local productive system are not characterized by the existence of a firm or group of firms acting as an 'anchor' firm or as a chain's coordination agent in the form of a firm network. The large firms stimulate the development of local externalities through their technological effort, which creates an internal flow of technological information, and also through their joint action with trade associations, which has resulted in the establishment of an infrastructure to provide technological services. But, the stimuli for the complementarity of the productive process occur mainly among the less verticalized medium and small firms, which create demand for several services and inputs, thus permitting investments in specialized services inside the local productive system.

Concerning the main features associated with knowledge systems, although to diverse degrees, the footwear, wine and textile productive systems account for a specific nucleus of organizations aimed to research and training activities. However, as already emphasized, the existence of these research and training organizations by itself is not enough to assure the existence of pervasive channels aimed at knowledge diffusion among local actors.

In this sense, the leather-footwear arrangement in the Sinos Valley presents an excellent infrastructure aimed at research, development and human resources training activities. However, despite the significance of the activities developed through the technological infrastructure of the arrangement, the interaction between the productive segment actors and the research and training centers of the region is still limited. It is important to stress also the existence of diverse learning and upgrading strategies among local shoemakers. On the one hand, a considerable number of firms within the local productive system remain integrated in global commodity chains and sustain innovative capabilities only in the sphere of production. On the other hand, a growing number of local producers have been committed to foster innovative capabilities on higher level of the footwear value chain like design and marketing (Vargas and Alievi, 2003).

The wine productive system in Serra Gaúcha also accounts for a considerable nucleus of organizations aimed at research and training activities in the wine sector. In contrast with the footwear case, the technological and training organizations in the wine productive arrangement have a pervasive role in promoting innovative circuits related to grapegrowing and winemaking activities at local level (Vargas, 2002; Cassiolato and Vargas, 2003).

The educational infrastructure related to the textile and clothing chain reaches all levels of education, from training up to college courses, and with recent specialization's in fashion design and textile chemistry. The technical and undergraduate courses indicate that there is a growing training infrastructure. The technological agents provide important services, which influence the products' quality. The laboratories for physical and chemical analysis of threads are the most important ones.

However, there is not an entity which may be characterized as a 'bridge' institution for the transference of technology.

Finally, the software and tobacco productive systems provide, by diverse reasons, an example of unstructured knowledge structure. In the software case, the knowledge infrastructure is mainly aimed at supporting training activities. Although some firms carry out considerable efforts in order to improve their innovative capabilities the interactions and link among firms are reduced and the main sources of information and knowledge are external the agglomeration. Nevertheless, there are some important interactive learning processes related to the linkages with clients and users. However, the importance associated with these learning processes decrease gradually during the commercialisation phase (Campos et al, 2002).

In the tobacco productive system, most of the local research centres and training institutes have only a minor role in the improvement of tobacco varieties and growing practices. This apparent paradox is explained both by the nature of the R&D activities associated with the global tobacco industry and by the institutional designs at local level. The main R&D efforts in the tobacco chain are focused towards the development of new hybrid and genetically modified tobacco varieties. Representing a strategic stage in the global tobacco chain, the adoption of innovations in tobacco growing is governed by the MNCs operating in the cluster. In contrast, in the tobacco processing stage, the incorporation of technological innovations happens predominantly through incremental improvements at specific points of the industrial processing. In this stage many innovations are adopted through user-producer relations established with machinery suppliers (Vargas, 2001).

Some explorations on the impacts emerging from the interaction of diverse characteristics of production and knowledge systems within local productive systems are discussed below.

4. FINAL REMARKS

The aim of this paper has been to analyse the role of institutional and organisational characteristics of local productive systems on the shaping of learning mechanisms and innovative strategies adopted by firms. In doing so, the paper has made an attempt to propose an analytical scheme that departs from the distinction between the main features associated with the organisation of productive activities and those features related to the organisation of knowledge flows within local productive systems. In this sense, some remarks must be stressed.

First of all, It is worth to notice that the analytical scheme proposed in the paper do not suggests a one-to-one correspondence between different degrees of division of labor and governance modes, nor between knowledge infrastructure and intra-firm learning mechanisms. Indeed, the empirical evidences from the five Brazilian local productive systems reported here have showed that there is a tremendous variety in the patterns of division of labor and governance modes associated to systems of production on the one hand, and the knowledge structure and inter-firm learning mechanisms on the other. This variety is also reflected on the impacts over productive and innovative capabilities.

Concerning the influence of the structure and organisation of knowledge systems within industrial agglomerations, It is important to highlight that although the role of technological and training infrastructure at local level is important in order to promote knowledge diffusion among firms, it is also crucial to take into account the intra-firms' learning strategies. For instance, configurations that combine an unstructured knowledge system with intra-firms' active learning strategies (like in the tobacco and software cases) reflects a weak basis for knowledge diffusion within the local productive

system. Therefore, the innovative capabilities tend to remain encapsulated within one or few dynamic firms. Alternatively, configurations that combine structured knowledge systems with restricted and passive intra-firms learning strategies will also difficulties to foster interactive learning mechanisms at local level. In this case, it is possible to suppose that firms' learning strategies will be focused in productive capabilities rather than on innovative capabilities.

Moreover, although the sectorial determinants of local productive systems are important for analysing aspects regarding the knowledge basis and technological regimes, the empirical evidences emerging from case studies on local productive systems in Brazil illustrate the remarkable differences on innovative and learning capabilities within local productive systems belonging to the same industry. In this sense, a solely sectorial approach tends to neglect specificities emerging from institutional and historical contexts which are specific to territories. Such diversity is of great importance when dealing with the adoption of policy measures.

Finally, one caveat should be introduced in relation to the analytical scheme presented in this paper. The purpose of this paper was not to provide a complete typology of local productive systems, but rather to explore some of the possible configurations emerging from the interaction between diverse productive and knowledge structures in industrial agglomerations. In this sense, this paper is meant to be an additional contribution in the search for a more solid analytical approach aimed at dealing with the complex context of local systems of innovation in developing countries.

REFERENCES

- AROCENA, R.; SUTZ, J.,(2000) Looking at National Systems of Innovation from the South. *Industry and Innovation*, v.7, n.1, p.55-76.
- BELL, M., ALBU, M. (1999) Knowledge systems and technological dynamism in industrial clusters in developing countries', *World Development*, v. 27, n.9, p.1715-1734.
- BRACZYK, H. J.; COOKE, P.; HEIDENREICH, M. (1998) *Regional innovation systems: the role of governances in a globalized world*. London: Bristol, Pa.: UCL Press.
- BRESCHI, S.; MALERBA, F. (1997). Sectoral innovation systems: Technological regimes, schumpeterian dynamics, and spatial boundaries. In: EDQUIST, C. (org). *Systems of Innovation: Technologies, Institutions and Organizations*. London: Pinter.
- CAMAGNI, R. (1991) Local milieu, uncertainty and innovation networks: towards a new dynamic theory of economic space. In: _____ (ed.) *Innovation networks - spatial perspectives*. Belhaven Press, London, p.121-144.
- CAMPOS, R.; CÁRIO, S.A.F.; NICOLAU, J.A. (2003) Textile and clothing local productive system in the Itajai Valley; local capabilities and partial interactive learning. . In: CASSIOLATO J. E., LASTRES H. M. M. e MACIEL M. L. (eds) (2003), *Systems of Innovation and Development: Evidence from Brazil*, London: Edward Elgar.
- CAMPOS, R. R.; CÁRIO, S. F. C.; NICOLAU, J. A.; VARGAS, G. Aprendizagem por interação: pequenas empresas em sistemas produtivos e inovativos locais. In: LASTRES, H. M. M.; CASSIOLATO, J. E.; MACIEL, M. L. *Pequena empresa: cooperação e desenvolvimento local*. Rio de Janeiro: Relume Dumará, 2003. p.51-65.
- CAMPOS, Renato Ramos; NICOLAU, José Antonio; SIMIONI, Mauro. Inovação e interação produtor-usuário nas empresas de software. In: SBRAGIA, Roberto; STAL, Eva. (Org.). *Tecnologia e Inovação: experiências de gestão na micro e pequena empresa*. São Paulo: PGT/USP, 2002, p.197-216.
- CASSIOLATO, J.E., (1992) *The role of user-producer relations in innovation and diffusion of new technologies: lessons from Brazil*, Tese de Doutorado, Science Policy Research Unit, Universidade de Sussex, Inglaterra
- CASSIOLATO, J.E.; VILLASHI, A.; CAMPOS, R. (2003) Local productive and innovative systems in Brazil: a policy perspective. In: CASSIOLATO J. E., LASTRES H. M. M. e MACIEL M. L. (eds) (2003), *Systems of Innovation and Development: Evidence from Brazil*, London: Edward Elgar.
- CASSIOLATO, J.E.; LASTRES, H.M.M.,(1998) Local Systems of Innovation in Mercosur Countries. *Industry and Innovation*, v.7, n.1, p.33-54.
- CASSIOLATO J. E.; LASTRES H. M. M. (eds) (1999). *Globalização e Inovação Localizada: experiências de sistemas locais do Mercosul*, Brasília: IBICT/MCT.
- CASSIOLATO J. E., LASTRES H. M. M. e MACIEL M. L. (eds) (2003), *Systems of Innovation and Development: Evidence from Brazil*, London: Edward Elgar.
- CARLSSON, B.; JACOBSSON, S. (1997) Diversity creation and technological systems: a technology policy perspective. In. EDQUIST, C. (ed) *Systems of innovation: technologies, institutions, and organizations*. London: Pinter.
- COOKE, P.; URANGA, M. G.; ETXEBARRIA, G. (1998) Regional systems of innovation: an evolutionary perspective. *Environment and Planning*, v. 30, n.9, p.1563-1584
- COOKE, P.; MORGAN, K.(1998) *The associational economy : firms, regions, and innovation*. Oxford [Inglaterra]; New York: Oxford University Press.
- De LA MOTHE, J.; PAQUET, G.,(1998) *Local and*

- regional systems of innovation*. Economics of science, technology, and innovation ; v. 14., Boston, Mass.: Kluwer Academic Publishers.
- EDQUIST, C. (1997) *Systems of innovation: technologies, institutions, and organizations*. Science, technology and the international political economy series, London ; Washington: Pinter.
- FREEMAN, C. (1994) The Economics of Technical Change: a critical survey. *Cambridge Journal of Economics*, v.18, p.463-514.
- FREEMAN, C e PEREZ, C. (1988), Structural Crisis of Adjustment: Business Cycles and Investment Behaviour, In DOSI, G. et al. (eds) *Technical Change and Economic Theory*. Londres; Pinter Publishers.
- HUMPHREY, J.; SCHMITZ, H. (2000) Governance and upgrading: linking industrial cluster and global value chain research. *IDS Working Paper 120*, Brighton: Institute of Development Studies, University of Sussex.
- JOHNSON, B. (1992), Institutional Learning. In: LUNDVALL, B.-Å (ed.) *National Systems of Innovation*, Pinter, Londres, 1992.
- LARSSON, S; MALMBERG, A. (1999) Innovation, competitiveness and local embeddedness: a study of machinery producers in Sweden. *Geografiska Annaler*, v.81 B, n.1, p.1-18.
- LUNDVALL, B.; BÓRRAS, S (1997) The Globalising Learning Economy: Implications for Innovation Policy. OECD, DG XII – Science, Research & Development. TSER programme.
- LUNDVALL, B.A.; JOHNSON, B. (1994) The learning economy. *Journal of Industry Studies*, v.1, n.2, dec, p.23-42.
- LUNDVALL, B. A.(1988) Innovation as an interactive process: from user-producer interaction to the national system of innovation. In DOSI, G.et al. (eds.) *Technical Change and Economic Theory*. London: Pinter
- LUNDVALL, B. A. (1995) *National Systems of Innovation: Towards a theory of innovation and interactive learning*. London: Pinter.
- MARSHALL, A. (1890) *Principles of Economics*, Londres: MacMillan.
- MASKELL, P.(1996) Localised low-tech learning in the furniture industry. Alborg, Danish Research Unit for Industrial Dynamics - *Working Paper 96-11*.
- MASKELL, P.; MALMBERG, A. (1999) Localised Learning and Industrial Competitiveness. *Cambridge Journal of Economics*, v.23, n.2, p.167-185.
- MASKELL, P. et al. (1998) *Competitiveness, localised learning and regional development*, Specialisation and prosperity in small open economies. Londres e Nova York: Routledge.
- NICOLAU, José Antônio; CAMPOS, Renato Ramos; CÁRIO, Silvio Antônio Ferraz. Arranjos produtivos locais: o caso da indústria de software de Joinville. In: TIRONI, Luis Fernando. (Org.). *Industrialização descentralizada: sistemas industriais locais*. Brasília: IPEA, 2001, p. 499-533.
- PIORE, M.; SABEL., C.(1984) *The second industrial divide: possibilities for prosperity*. New York: Basic Books.Inc. Publishers.
- STORPER, M. (1997) *The Regional World*. Territorial Development in a Global Economy. Londres: The Guilford Press.
- STORPER, M.; HARRISON, B (1991) Flexibility, hierarchy and regional development: the changing structure of industrial production systems and their form of governance in the 1990's. *Research Policy*, v.20, n.5, p.407-422.
- VARGAS, M.A.; ALIEVI,R (2003) Learning trajectories and upgrading strategies in the footwear productive system of Sinos Valley/RS. In: CASSIOLATO J. E., LASTRES H. M. M. e MACIEL M. L. (eds) (2003), *Systems of Innovation and Development: Evidence from Brazil*, London: Edward Elgar.

VARGAS, M.A.(2001) Forms of governance, learning mechanisms and upgrading strategies in the Tobacco cluster in Rio Pardo Valley - Brazil'. *IDS Working Paper 125*, Brighton: Institute of Development Studies, University of Sussex.

VARGAS, M.A., (2000) Local Systems of Innovation in Developing Countries: A study of technological Learning in Local Productive Arrangements in Brazil. In: *Druid's Winter Conference on Industrial Dynamics: Hillerod, January 6-8*.

VARGAS, M.A. SANTOS, N.; ALIEVI, R. (2000) Learning, Innovative Linkages and Proximity: empirical evidences from selected case studies of local productive arrangements in Rio Grande do Sul, Brazil. In: *Third Triple Helix International Conference, Rio de Janeiro*.

VILLASCHI, A. e CAMPOS, R. (2001) From local to national systems of innovation: empirical evidences from the Brazilian case. In: *DRUID International Conference, Aalborg University, Aalborg, Dinamarca*.