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Cooperation, interaction and learning in local production systems: Evidence in Brazilian firms

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In a local production system (LPS), besides external economies, the interaction, cooperation, and learning are indicated by the literature as complementary ways of enhancing the LPS's competitiveness and gains. In Brazil, the greater part of LPSs, mostly composed by small enterprises, displays incipient relationships and low levels of interaction and cooperation among their actors. The size of the participating enterprises itself for specificities that engender organizational constraints, which, in turn, can have a considerable impact on their relationships and learning dynamics. For that reason, it is the purpose of this article to present an analysis of interaction, cooperation, and learning relationships among several types of actors pertaining to an LPS in the farming equipment and machinery sector, bearing in mind the specificities of small enterprises. To this end, the fieldwork carried out in this study aimed at: (i) investigating external and internal knowledge sources conducive to learning and (ii) identifying and analyzing motivating and inhibiting factors related to specificities of small enterprises in order to bring the LPS members closer together and increase their cooperation and interaction. Empirical evidence shows that internal aspects of the enterprises, related to management and infrastructure, can have a strong bearing on their joint actions, interaction and learning processes.

Key words: Local production system, cooperation, interaction, learning, small enterprise.

INTRODUCTION

The study of agglomerations of small enterprises characterized by their geographical proximity or pertaining to the same industrial sector has drawn the attention of many developing countries, such as Brazil, especially from the 1990's on. This organizational arrangement, known as "local production system" (LPS), is deemed important to these countries because it plays a relevant role in their economic development, both by increasing the competitiveness and efficiency of enterprises in particular of small and micro enterprises and, as a result, by generating more jobs and income. In other words, the importance of LPSs is widely acknowledged not only because they offer a satisfactory response to mounting competition among enterprises, evident in their constant

technological changes and innovations, but also because they promote the advancement of local socio-economic conditions.

Generally speaking, gains of competitiveness may be achieved by reducing costs, scale economies, reaching new market segments or niches, knowledge diffusion and fostering innovative processes. In addition, an advantage highly valued by enterprises may be expressed in terms of collective learning that is, broadening one's knowledge base by means of interactions with other LPS's agents. In Brazil this is evidenced by the dramatic increase in studies on LPSs as well as in the interest of government agencies in promoting them by defining and implementing favorable public policies, which may be attested in the new Brazilian industrial policy directives (known as PITCE) launched in 2004.

An LPS, which is a concept based on the studies of Belussi and Gottardi (2000) and Lombardi (2003) refers to groupings of enterprises agglomerated by geographic location and industrial sector, with related or similar

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capabilities, of different sizes, but with a large number of small and medium enterprises not vertically integrated. These enterprises, in turn, attract suppliers and other related and support enterprises, whose presence and importance in LPSs are exclusively determined by market forces. LPSs also give rise to local institutions that support these enterprises (Suzigan et al., 2004; Garcia et al., 2004).

The geographic concentration of these enterprises is relevant, in that there are economies that are external to the enterprise and internal to the agglomeration of producers. When enterprises take advantage of externalities such as the presence of qualified workers and suppliers of raw material, parts and equipment, and the occurrence of spillovers of technologies, skills and knowledge they can increase their competitiveness (Garcia, 2006). Nonetheless, in spite of their importance to local producers, external economies represent just one source of gains that enterprises can catch on it.

Joint actions with other LPS members made possible by their geographical and cultural nearness may also contribute to improving an enterprise's competitiveness and gains (Schimitz, 1999). In this sense, cooperation and interaction among agents within an LPS play a critical role in the development and competitiveness of an LPS as a whole. Cooperation and interaction may also advance learning processes, crucial to technological innovation (Garcia, 2006; La Rovere, 2003). Therefore, benefits from participation in external economies and joint actions provide enterprises within productive agglomerations with a basis on which to build their competitiveness (Nadvi, 1999).

Nevertheless, despite the advantages made possible by interactions and cooperation within an LPS, economic agents may not be competent or motivated enough to develop cooperative ties. This is especially true in agglomerations of the embryonic type, which, according to Suzigan et al. (2004), exhibit incipient relationships, with low levels of cooperation and interaction among actors. This is to say that strengthening existing relationships, cooperative practices and learning processes is fundamental to the advancement of an LPS as a whole. Brazilian LPSs are characterized by consisting of small enterprises and by having incipient relationships, with low levels of cooperation and interaction among actors. In addition, small enterprises, according to La Rovere (2001), usually have poor management capabilities, low technical sophistication, little innovation, unskilled workforce, low product quality and lack of financial support. These characteristics derive, according to Leone (1999) and Escrivão et al. (2005), from the very size of small enterprises.

It follows that an LPS composed mostly by small enterprises displays a dynamics that stems from specificities inherent to the size of its participating enterprises. Thus, when investigating an LPS it is imperative to analyze its interaction and cooperation processes (and their inhibiting

factors) and to take into account the specificities of the enterprises that make it up. In addition, it should be remarked that the advancement of Brazilian LPSs in the context of PITCE implies strengthening small and medium enterprises and promoting actions that foster interactions among local actors and participating institutions.

Given the relevance of cooperation and interaction to learning processes, productive/technological empowerment and the development of small enterprises within an LPS environment, the purpose of this article is to present an exploratory analysis of cooperation relationships existing in a system (by eliciting their motivational and inhibiting factors) and learning-related interactions and to describe its chief external and internal sources of knowledge. To this end, this article has been divided into six sections including the introductory one.

THEORETICAL FRAMEWORK

Main approaches to local production systems

Theoretical elements presented by present approaches to productive agglomerations were already under study by the end of the past century. The main reference found in these approaches comes from the studies of Alfred Marshall (1982), who emphasizes the importance of industrial agglomerations particularly of small enterprises to generate gains of scale and to benefit from external economies. These external economies stem from the presence of a qualified workforce, local suppliers, and the so-called technological and knowledge spillovers. According to Garcia (2006), the existence of experienced workers (with the precise skills demanded by a given industrial sector or segment) can greatly reduce the costs of some tasks, for training and instruction, for local enterprises. These enterprises can take advantage of learning processes that are exogenous to them, but endogenous to the agglomeration of producers and support agencies.

As regards specialized suppliers, they are led to establish productive, trade or service units in local systems, thus, engendering economies external to local producers. In particular, service suppliers play an important role because owing to them local enterprises have access at reduced costs to technical and market information as well as technical and organizational consultancy. These services may represent an important element in providing local producers with a competitive edge. From another angle, it is well known that agglomerations develop as a result of technological and knowledge spillovers of local enterprises, by means of which LPS agents' competencies are improved. Moreover, it should be remarked that the geographical proximity among agglomerated producers promotes the circulation of information and knowledge (by creating or

improving existing communication channels or tapping specific information sources). This can contribute to the development of new organizational and technological competencies, advancing learning processes of a local nature.

Despite the advantages presented by spatial agglomerations with respect to economic development, it was only in the 1970's that studies about agglomerations were carried out and scholars began to make attempts to understand this phenomenon in various sociocultural and economic contexts. Among the main approaches to spatial enterprise agglomerations found in the literature it is possible to identify the following ones; however, it is important to remark that, though presenting some divergent points, they should be seen as complementary, not opposites.

Industrial districts

Industrial districts began to be studied in 1970's and by a group of Italian authors based on Marshall's ideas. According to Becattini (2005), a population of enterprises (an updated definition of industrial district) comprises groups of specialized enterprises that work complementarily. In a community of people, individuals share a common identity or a sentiment of belonging to a given group and a system of values and beliefs that determines individual behavior. The Italian research suggests that the development of industrial districts is characterized not only by the geographical concentration of a large number of small enterprises specialized in a given industry and the extensive labor division among them, but also by the presence of strong socio-cultural ties that ensue trust-based cooperation and local governance (Suzigan. 2006).

Economy of enterprises

This approach, in essence, relates geography to competitiveness, and is largely grounded on the research carried out by Porter (1990), which introduced the importance of clusters to improve competitiveness. Porter (1990) defines clusters as geographical concentrations of interconnected enterprises, specialized suppliers, service suppliers, and institutions (for example, universities and business associations) that compete as well as cooperate. The location, according to this author, can strongly shape the excluding options between markets and hierarchies. Although, Porter mentions in his definition the relationship between people and community ties, contrary to other approaches, his theory does not place emphasis on social and cultural aspects.

New economic geography

The so-called "new economic geography", whose main

reference is the work of Krugman (1998), follows as another contribution to the study of LPSs. Research along this line, links an agglomeration to increasing returns of scale. In this approach, also based on Marshall's studies, external economies are of a purely accidental nature, and the economic spatial structure is determined by invisible-hand processes that operate centripetal forces (attracting enterprises) and centrifugal forces (counteracting enterprise concentration) (Amato Neto and Garcia, 2003; Garcia, 2006). An important aspect of this approach is that it reduces the possibility of adopting public policies. This reduction is caused by the exclusive nature of incidental external economies in LPSs (Garcia, 2006; Suzigan, 2001). This is to say that joint actions deliberated and carried out by local actors do not have a significant result with respect to increasing the competitiveness of local systems.

Collective efficiency

The focus of "collective efficiency" (Schmitz, 1995; 1999) is fundamentally contrary to Krugman's approach on the topic of deliberated joint actions. Schmitz believes joint actions play an important role in improving the competitiveness of enterprises. In this perspective, the effects of incidental external economies are essential, but not sufficient to explain the strength of agglomerations. Hence, the effects of deliberated joint actions become another essential component. The combination of incidental external economies and deliberated joint actions constitutes the core of collective efficiency, conceived as a viable way to develop, at a faster pace, small enterprises and to eliminate restrictions to growth with the context of LPSs in developing regions and countries such as Brazil (Nadvi and Schmitz, 1999). Their research indicates that: (i) industrial agglomerations constitute a relatively common phenomenon in many sectors, regions and countries, are of special importance to developing countries; (ii) participation in agglomerations of this sort is particularly important to small enterprises since they help them to overcome individual problems and enable them to participate in markets besides their own; (iii) collective efforts make it possible for local actors to get better training in order to be able to deal with challenges posed by global competition; and (iv) the concept of collective efficiency is an important tool to understand differences among performances of various types of enterprises and agglomerations, their level of trust and cooperation (Lemos, 2003).

Innovation economy

Innovation economy is seen as another important approach to the analysis of LPSs. This proposal is rooted in national, regional and local innovation systems. Its

chief authors (Cassiolato and Lastres, 2000; Edquist, 1997; Freeman, 1987; Lundvall, 1992) emphasize the local character of innovation and the role played by interaction among actors in learning processes. Its basic idea is that innovative performance depends not only on the performance of enterprises and teaching/research institutions, but also on how the former integrate and the latter affect the development of LPSs. Thus, innovation processes of enterprises are, in general, sustained by their relationships with other enterprises and organizations (Cassiolato and Lastres, 2005).

Innovation geography

This approach emphasizes the geographical dimension of innovation. It reinforces Marshall's pioneering ideas, that is, spillovers and industrial agglomerations. Some of its advocates indicate that innovative activities are mostly concentrated in enterprises whose production is also geographically concentrated. They also show the importance of existing research institutions, universities, skilled labor, and correlated enterprises (Audretsch and Feldman, 1996); Feldman (1993). Breschi and Malerba (2001) also believe that the transference of new knowledge, especially of a tacit nature, is more efficient when actors are in proximity of one another. Emphasis is also given to external relationships, deemed as important to emerging LPSs as they allow access to knowledge, skills, capital and information about new technological opportunities and markets as well as established ones as they allow the promotion or upgrading of their industrial base.

Cooperation in local production systems

According to Schmitz (1999), although, incidental external economies are important, they cannot explain the success achieved by productive agglomerations. Cooperation is seen as another critical element that explains the strength, efficacy, growth, and competitiveness of agglomerations. However, physical proximity devoid of interaction reduces the potential benefits of participation in an agglomeration. Interactions among individuals can change their cognitive capacity, ideas, and representations and affect knowledge transmission. Continuous interaction allows the establishment of processes conducive to the emergence of collective learning environments (Araújo, 2006). In particular, in view of growing international competition from the 1990's on, Iglioni (2001) sustains that it is fundamental that enterprises invest in joint actions. Likewise, Cassiolato, Britto and Vargas (2005) emphasize that new products, based on diverse scientific branches of learning, have been developed through integration of different technologies and that cooperation among different types of actors plays a

relevant role in this process.

In essence, the purpose of cooperation among enterprises is to meet needs that cannot be met when enterprises act separately (Amato Neto, 2000). In this manner, Camagni (1993) presents some basic reasons or possible gains that encourage enterprises to cooperate with other agents. Cooperation may also be good to several functional areas of enterprises, such as marketing, personnel, purchasing and production (Schermerhorn, 1980). Table 1 presents some of the main needs, motivations and benefits of cooperation among enterprises. Although, cooperation can be very advantageous, economic agents may not be motivated enough to develop cooperative ties. According to Meyer-Stamer (2002), the main reasons why business owners may opt for isolation are rivalry, macroeconomic conditions, transaction costs, trust and organizational culture (Table 2).

In this perspective, Altemburg and Meyer-Stamer (1999) point to the importance of supporting relationships among enterprises and suggest that incentives to cooperation may contribute to lessen opportunistic behavior, lack of trust and vertical integration of enterprises. Nonetheless, it should be remarked that small enterprises may have other reasons not to carry out joint actions besides the aforementioned ones, related to specificities inherent to their size, which must be taken into account when analyzing their interactions and cooperation relationships.

Interaction and learning in local production systems

The capacity for organizational learning in an economy increasingly based on innovation is of strategic importance to competitiveness. Lundvall (1988) sustains that in a fast-paced technical progress environment the development, introduction and diffusion of innovations usually occur by means of interactive learning processes, in which information exchange among producers and customers substantially increases the know-how of those involved. Learning allows the incorporation of new information into a knowledge base by which competencies of organizations are improved and developed (Keeble and Wilkinson, 1999). In a network of enterprises, such as an LPS, interaction and cooperation among enterprises and other participating agents are deemed vital to their strengthening and development.

According to Albagli and Maciel (2004), interactions may involve different types of actors (Figure 1). Interaction between local and external agents may be characterized as either by conflict and competition or by trust and partnership at different levels. In order to understand an interaction process it is also necessary to know about its actors (number, characteristics, motivations and goals), frequency, intensity, duration, problems and difficulties. The institutional environment where enterprises interact is of equal significance because it

Table 1. Needs, motivations, and benefits of inter-enterprise cooperation.

Needs	Motivations	Benefits
1. Need to combine competencies and take advantage of knowhow of other enterprises. 2. Distribute onus of technological research and share resulting knowledge. 3. Offer better quality products and more diversified lines. 4. Increase competitiveness to be able to enter external markets. 5. Strengthen purchasing power. 6. Share resources, especially underused ones. 7. Divide risks and costs in generation of new opportunities.	1. Generation of profit that cannot be obtained independently. 2. Stricter control of resources and competencies needed for innovation. 3. Synergy of economies of scale in production, marketing, and R and D. 4. Strengthening of ability to react to external shocks. 5. Control over potentially promising markets. 6. Economies of scope and emphasis on product differentiation. 7. Reduction and rationalization of R and D spending.	Marketing 1. New profitable product lines deriving from product development. 2. Reduction of costs and more efficient advertising. Personnel 1. Better personnel policies. Purchasing 1. Discounts from buying large quantities of raw material. Production 1. Reduction of costs through development of new production processes.

Source: Adapted from Amato Neto (2000), Camagni (1993), Schermerhorn Jr. (1980).

Table 2. Reasons for uncooperative behavior.

Main reasons	Description
Rivalry	Business owners often show resistance to cooperation because they see other enterprises in the same sector as rivals. Thus, they avoid closer relationships so as to protect their business secrets.
Macroeconomic conditions	Macroeconomic conditions may discourage cooperation among enterprises, e.g., high taxes, macroeconomic instability, and constantly changing "rules of the game".
Transaction costs	Although cooperation may reduce transaction costs, it can also engender them. It is well known that more intense relationships may give rise to conflicts, which demand effort and time from enterprises to solve them. Therefore, there may be some discrepancy between the incentive to cooperate and the intensity of desired cooperation in a large-scale perspective.
Trust and business culture	A business culture characterized by isolation and lack of trust is commonplace in an environment of vertically integrated enterprises where unsuccessful cooperation and predatory behaviors have occurred. These failures reinforce the idea that cooperation is unfeasible and frustrate efforts towards cooperation. On the other hand, successful joint actions encourage the development of social capital and improve conditions for cooperation.

Source: Adapted from Meyer-Stamer (2002).

affects their capacity for innovation (Albagli and Maciel, 2004).

Economic literature describes learning as a cumulative process through which enterprises broaden their knowledge, improve their search procedures and refine their ability to develop and manufacture products (Britto, 2001). In short, learning is much more than mere access to a body of information; it is a vital tool for enterprises to

deepen their knowledge about technological characteristics of products and productive processes. Organizational learning depends, in some measure, on the variety and structure of interactions. Innovation processes of enterprises are usually sustained by their relationships with other enterprises and organizations (Cassiolato and Lastres, 2005). Learning within an LPS, as pointed out by Keeble and Wilkinson (1999), is essentially a collective

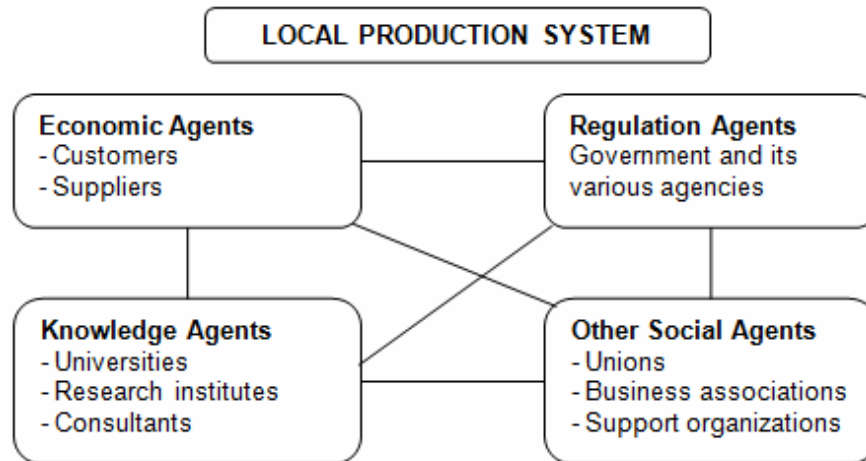


Figure 1. Characterization of an LPS according to types of actors. Source: Adapted from Albagli and Maciel, 2004.

Table 3. Learning: external and internal sources of information.

Internal sources	Learning-by-using	Related to adaptation of enterprises to novel technologies. It is favored by interactions between industry and customers and by physical proximity, which promotes closer monitoring of their needs.
	Learning-by-doing	It occurs in routine activities of enterprises. It is related to their productive processes.
External sources	Learning-by-interacting	It is promoted by relationships between enterprises and several actors (for example, customers, suppliers, competing enterprises, research centers, and universities).

Source: Adapted from Silva (2006).

activity, since knowledge is shared among actors and is intensified in their organizational activities. Learning processes may be engendered by several sources internal and external to the enterprise, as shown in Table 3. This research adopted the following types of internal learning: learning-by-using (Rosenberg, 1982) and learning by doing (Arrow, 1962). As regards learning engendered by external sources, this study prioritizes learning-by-interacting (Lundvall, 1988).

Johnson and Lundvall (1992), cited by Cassiolato (2004), formulate some hypotheses about the context within which learning by interacting takes place: (i) firstly, learning involves a social process, from which language concepts are developed among actors; (ii) the more complex the object of learning the more interaction is required to successfully accomplish it since transmitting knowledge of a tacit nature is more complicated; (iii) deeper interaction demands continuous improvement of communication codes and channels, which make up the infrastructure that makes information exchange possible; (iv) continuous interaction leads to new combinations of different types of knowledge, generating gains that are

not limited to increasing productive efficiency; there are also variety-related gains associated with product range and gains resulting from the consolidation of new markets; (v) the depth of learning achieved by means of interaction presupposes some selectivity in inter-enterprise relationships; this selectivity derives from the need to establish non-economic relationships among agents, by means of which mutual trust can be gradually built; (vi) learning by interaction demands time, not only due to obstacles associated with mutual trust building, but also because it requires specific investment.

It is important to remark that internal learning is a *sine qua non* condition for external learning, that is, enterprises should be well prepared to absorb, elaborate and assimilate new external knowledge. In other words, according to Malerba (1992), learning may be seen as a targeted process, carried out within the enterprise in the areas of production, research and development (R and D), marketing, and other organizational areas, related to different sources of knowledge, both internal and external to the enterprise, and cumulative, that is, broadening the enterprise's knowledge base.

Specificities of small enterprises

For a long time the dynamics of small enterprises has been seen and understood in the perspective of large enterprises. This paradigm has led small enterprises to adopt inadequate management principles, techniques and practices (Escrivao et al., 2005). Organizational theories stem for the most part from problems of large enterprises; therefore, their solutions and answers cannot be easily extended to medium and small enterprises since their specificities differ from those of the former (Leone, 1999).

This is in agreement with Lemos (2003), who claims that small enterprises should not be dealt with indistinctly; firstly, because their contexts are very diverse, and also because the institutional framework for their development and advancement implies the elaboration of tools that can suit a great variety of profiles. This is to say that a specific organizational theory that approaches their problems in the context of their size is wanting; hence, the unique dynamics of medium and small enterprises call for specific management models.

An organizational conception typology of small enterprise specificities, presented by Escrivao et al. (2005) based on administration theories, points to external and internal organizational aspects. The administration theories were divided by the authors into five movements: (i) the work-rationalization movement; (ii) the human-relations movement; (iii) the functionalism-structuralism movement; (iv) the open-systems movement; and (v) the environmental contingencies movement. The division of administration theories by movements resulted in five relevant organizational themes, which may be understood as organizational components: (i) technology; (ii) behavior; (iii) decision; (iv) structure and (v) strategy (Escrivao, 1995; Migliato and Escrivao, 2004). Figure 2 shows the organizational conception model and how its components relate to the environment. Thus, from the conception model the small enterprise specificities may be studied in light of administrative theories and categorized under organizational and environmental specificities (Figure 3).

Organizational specificities refer to internal organizational aspects and may be of a structural, behavioral, decisional, strategic and technological nature. On the other hand, environmental specificities refer to aspects external to the organization (Table 4). At any rate, it is important to remark that the main purpose of relating inhibiting factors to the specificities of enterprises is to identify which management-related aspects have the greatest impact on interactions and joint actions with the different types of actors present in the arrangement.

As regards LPSs predominantly composed by heterogeneous small enterprises, interaction and cooperation related to their specificities may provide the arrangement with a potential analytical tool to strengthen these relationships.

METHODOLOGY

The case study was selected as the methodology design to investigate the interaction and cooperation relationships among diverse agents participating in the farming equipment and machinery LPS in West Parana State, Brazil. It was carried out in 2008 by means of interviews, *in situ* observations and analysis of documents. The selected case was carried out with an intentional sample after studies by Rede Paranaense de Apoio aos Arranjos Produtivos Locais-Rede APL Paraná (Paraná State Support Network for Local Productive Arrangements), based on the methodology of LPS identification and characterization conceived by Suzigan et al. (2004). According to this typology the LPS in question is an embryonic productive arrangement. It was selected because this type of LPS demands greater analytical effort and presents more pronounced structural characteristics and incipient ties. Two interview scripts were used with the owners and managers of 17 enterprises and 5 institutions present in the LPS. The purpose of the first interview script was to ascertain its general and infrastructural characteristics, and the second aimed at identifying the characteristics of its participating enterprises. The questions regarding the enterprises were subdivided into three modules: (1) questions about their general aspects; (2) questions about their profile and that of their owners; and (3) questions about learning and relationships among them and between them and participating institutions with the intention of detecting and exploring motivating and inhibiting factors. In some questions the respondents were asked to rank the importance of these aspects. This index, from 0 to 1, was determined as a pondered average with weight attributed to every element on a 0 to 7 scale of importance. In order to bring to light any existing inhibiting and motivating factors the objective of the questions was first of all to identify the cooperation spaces and then to characterize and analyze the relationships among the enterprises and between them and the institutions.

As shown in Figure 4, initially the main products of the enterprises were identified by relating them to their chief market and location. In some cases the enterprises indicated other markets in addition to their chief ones, which may be termed "interest markets". After having identified their market, the competitive features of each product were identified. Then, the product shortcomings and deficiencies were isolated based on its producers' perceptions and views. Subsequently, the producer was questioned about which relationships within the LPS they thought were critical in order to overcome these deficiencies and promote their product in the markets indicated by them. After the enterprises had named the types of actors, it was observed whether they actually participated in these relationships. Afterward, the businessmen were asked to point out factors that inhibit and motivate these relationships. Finally, these inhibiting factors were categorized as organizational and environmental in light of the specificities of medium and small enterprises.

The preliminary phase of identification of these cooperation spaces is of paramount importance because they validate the very existence of these relationships. It is necessary to remark that the main objective of relating inhibiting factors to specificities of the enterprises is to detect which aspects related to their management have the strongest impact on joint actions and interactions among the actors pertaining to the LPS. When it comes to LPSs predominantly composed of heterogeneous small enterprises, interaction and cooperation processes constructed around their specificities can provide the LPS with a potential analytical tool to strengthen these relationships.

RESULTS

Local production system profile

The farming equipment and machinery LPS under

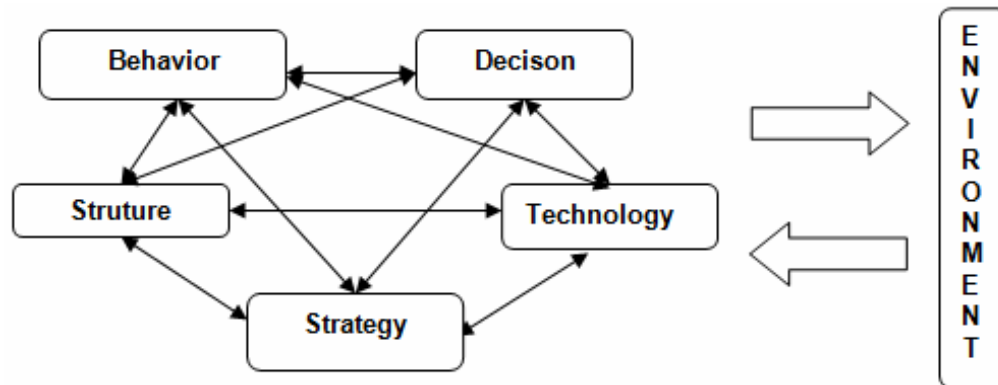


Figure 2. Organizational conception model. Source: Escrivão, 1995.

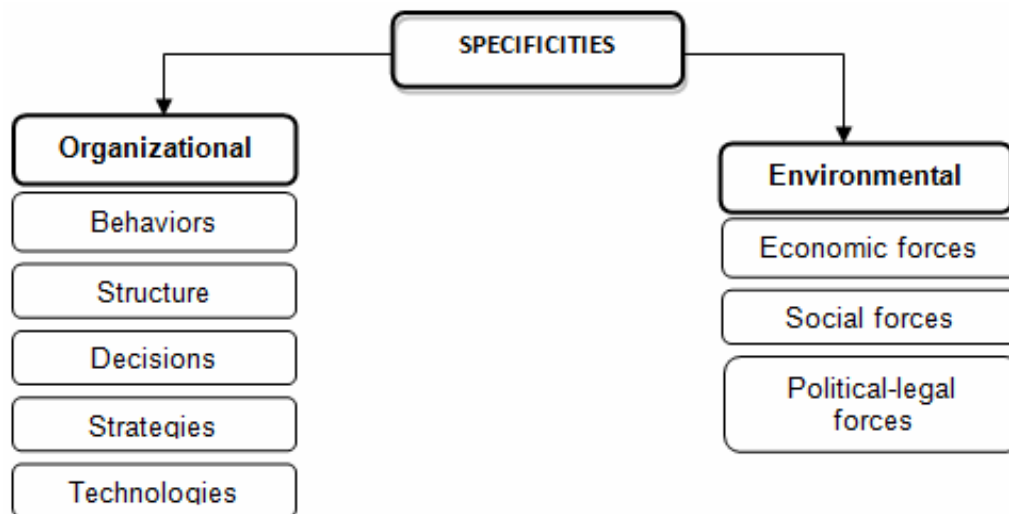


Figure 3. Categorization of specificities of small enterprises. Source: Elaborated by author.

investigation encompasses municipalities of two micro-regions in West Parana State, Brazil, for example, Cascavel and Toledo. Although, its origin may be traced back to the colonizing process of the region, its technological base actually began to undergo considerable change in the 1970's as a result of a swift modernizing process of its farming activities. This LPS does not have a single leading product; its participating enterprises manufacture several products, which explain its heterogeneous structure.

This agglomeration comprises of Brazilian-capital medium, small and micro enterprises. In addition to the participating enterprises, there are other organizations that make up its educational, institutional and scientific technological infrastructure. Its chief products are: equipment; machinery; parts and pre, post, and harvesting products. Their market may be described as primarily national, strongly regional (63.1%), with little foreign trade

(2.5%). Its educational and scientific-technological infrastructure comprises 14 universities (30,000 students in total), 3 research institutes and 7 professional training centers. Its institutional infrastructure encompasses several support institutions, unions and class associations.

Profile of local production system enterprises

In order to characterize the LPS enterprises some factors were taken into consideration, for example, workforce profile, management difficulties and obstacles, competitive capability, production and commercialization structures, externalities and learning dynamics (external and internal to enterprise). This study investigated a sample of 17 national-capital small enterprises, which employ 385 people altogether.

Table 4: Typology of small enterprise specificities.

Specificities		Description
External to organization	Environmental	Aspects external to enterprises, that is, macro-environmental forces, have a considerable impact on their management and performance. These forces may be economic, social, legal-political and technological. In the case of small enterprises these forces are important in that they have little or no control over the environment in which they operate. Examples of environmental factors are those related to fiscal legislation, financing, taxes, economic models, interest rates, etc.
	Behavioral	Aspects related to the enterprise owners' values, motivations, competencies, and leadership styles. Eliciting them facilitates the understanding of their behavior in respect of their tendency to be either entrepreneurs or business managers. Examples of behavioral factors are business vision, management style, and organizational culture.
Internal to organization	Decisional	Aspects related to decision-making processes involving problems and opportunities of enterprises. They encompass: strategic, administrative, and operational decisions; individual or collective decisions; planned or unplanned decisions; and rational or intuitive decisions. Examples of this group of specificities are paternalism, management style, and management knowledge.
	Technological	These aspects refer to the technological characteristics of enterprises, and the way they produce and make use of technologies in their processes. They involve process and service technologies, technological innovations, and information technologies. Examples of these factors are technology modernization, availability of technological resources, and product and process innovations.
	Structural	These specificities relate to how activities are assigned, organized, and coordinated at small enterprises. Examples of these factors are flexibility, agility, formalization, labor division, workforce qualification, and organization of technical and administrative functions.
	Strategic	These aspects refer to the internal and external vision of enterprises and how their strategies are developed. Some examples of these specificities are strategy formalization and planning, types of market and their reach, and programming of products and target-markets.

Source: Escrivão et al. (2005); Migliato and Escrivão (2004); Bigaton and Escrivão (2006).

Characterization of workforce

This study initially focused on schooling levels of the workforce in the productive, administrative, and technical areas of the enterprises. Table 5 shows that the majority of the employees have a high school diploma (47.1%), followed by 28.1% of elementary school graduates and 20.3% of college graduates. Just 3.5% of employees are unschooled whereas only 1% has pursued postgraduate education. Production employs approximately three fourths of the workers, followed by the administration (22.9%) and technical areas (4%).

The predominant schooling levels in the production area are secondary and elementary education. Less than 10% of production workers have a college diploma. The administration area displays the best schooling level;

approximately 50% of its workers are college graduates. The technical workers represent the smallest percentile of employees. Moreover, just one third of the enterprises have dedicated employees; in most of them professionals that work in the technical area work in other areas as well. Another important aspect related to workforce concerns training/qualification activities promoted by the enterprises (Table 6). The production area concentrates the biggest number of activities, in which 85% of the enterprises participate, followed by 76% in the administration area and 41% in the technical area. Just two enterprises reported not providing their employees with training/qualification opportunities.

Production is the most favored area as regards training and qualification. Production workers were offered the greatest number of training/qualification activities, and the

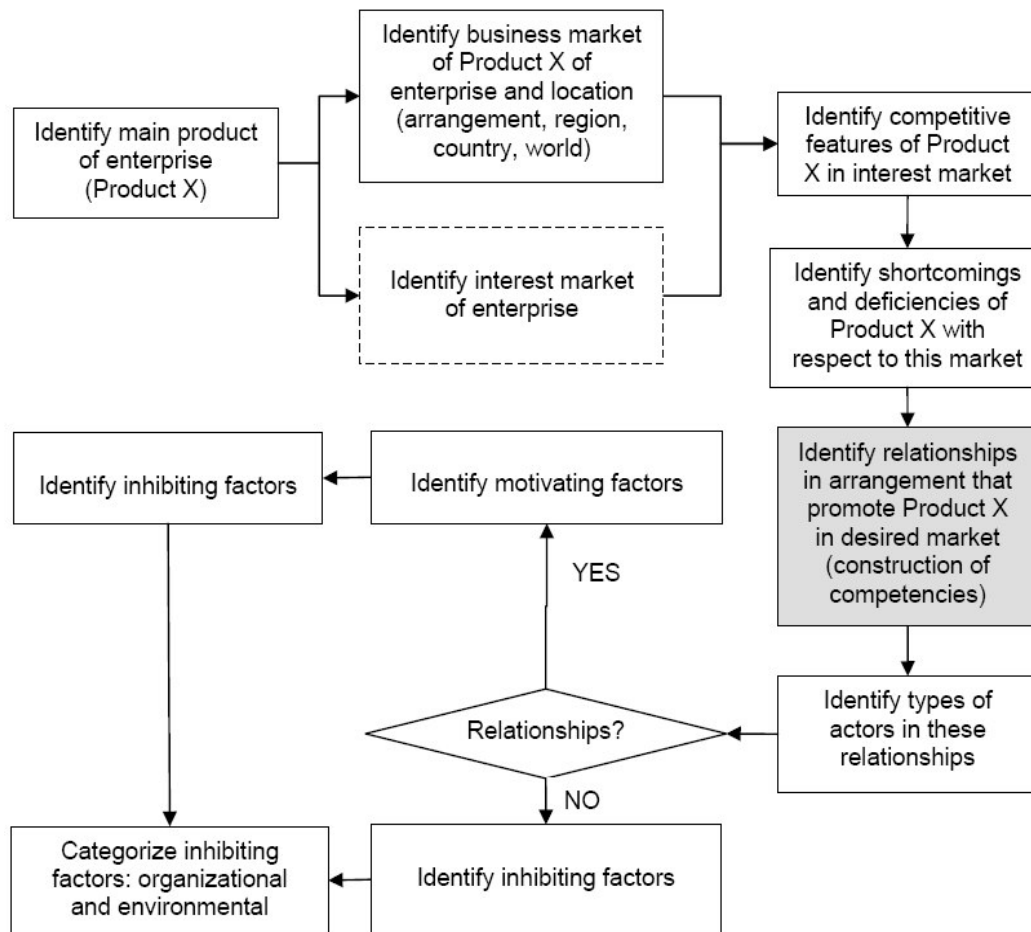


Figure 4. Flowchart to identify inhibiting and motivating factors. Source: Elaborated by author.

Table 5. Distribution of workforce by schooling level in production, administration, and technical areas.

Areas	Unschooling (%)	Elementary education (%)	Secondary education (%)	Higher education (%)	Postgraduate education (%)	Total (%)
Production	3.5	28.1	34.2	7.3	0	73.1
Administration	0	0	11.4	10.5	1.0	22.9
Technical	0	0	1.5	2.5	0	4.0
Total	3.5	28.1	47.1	20.3	1.	100

Source: Elaborated by author based on fieldwork data.

frequency of activities ranged from one to three times a year for 75% of the enterprises. Despite seeming low, this frequency is much higher than that of other areas. In the administration area the majority of the activities were held outside the enterprises. Thirty-eight percent of the enterprises that trained their employees did so from 3 to 6 times a year and 54% from 1 to 3 times a year. Only 8% of them offered training and/or qualification opportunities more than 6 times a year. Just two enterprises

provided training more than 6 times a year and only one from 3 to 6 times a year in the technical area. A large part of them (85%) provided training/qualification activities from 1 to 3 times a year and these were held outside the enterprises. These results clearly suggest that the businessmen should be more committed to overcoming production obstacles, be they quantitative or qualitative. Technological training with the intent of increasing competitiveness is mostly absent in the majority of the

Table 6. Training/educational activities for workers.

Place	Number of enterprises	Frequency	Area
At enterprise, in service	3	1 to 3 times/year	Production
	1	Over 6 times/year	Technical
	2	Over 6 times/year	Production
At enterprise, courses	3	1 to 3 times/year	Production
	2	1 to 3 times/year	Administration
	1	1 to 3 times/year	Technical
	1	3 to 6 times/year	Technical
Outside enterprise	9	1 to 3 times/year	Production
	5	1 to 3 times/year	Administration
	5	3 to 6 times/year	Administration
	1	Over 6 times/year	Administration
	1	Over 6 times/year	Technical
	5	1 to 3 times/year	Technical
	2	3 to 6 times/year	Production
No activities	2		

Source: Elaborated by author based on fieldwork data.

LPS enterprises and, to some extent, institutions.

Enterprise operation obstacles and difficulties

The goal of the questions related to enterprise operation was to identify and evaluate, from the owners' standpoint, its most important barriers and obstacles. After being elicited, the respondents attributed values of importance from 1 to 7 to them as shown in Table 7. According to the respondents, the greatest difficulties in enterprise operation were to be found when hiring workers and producing with quality. Although, the region offers a considerable number of professional qualification courses, qualified workers are lacking in some areas. The obstacle to manufacturing with quality partly due to the aforementioned lack of qualified professionals was ranked as medium. Other difficulties for example, insufficient capital to buy equipment and machinery and lack of working capital were also cited. The relevance of these difficulties is very relevant considering their need for modernization and efficiency in production and innovation.

Competitive capability

As shown in Table 8, the factors that most conduce to competitiveness are product quality and competence to introduce new products and/or processes. These factors are followed by service capability and quality of workforce. Other factors for example, commercialization

strategies, technological level, and product price were also evaluated. With respect to workforce it is important to mention that, in spite of the low level of qualification found in the enterprises, its owners thought it sufficed to meet the demands of their market niches. Notwithstanding, they acknowledged that their employees' qualification was insufficient to meet the needs of more demanding markets, especially in terms of product quality.

It is important to point out that the product price and commercialization strategy did not come up as relevant to product competitiveness, probably because there was little product supply in their market niches, as reported by the producers. The product technological level was also given an index of relatively low importance. According to the business owners, in order to remain competitive in their market niches it was not necessary to incorporate more technology into their products. Then again, they did recognize the importance of developing and using better technologies if they were to reach new markets.

Productive and commercialization structure

The LPS in question is chiefly composed of small and micro enterprises, a great part of which is under 25 years of age. They produce a wide range of products and operate in several market niches. Most enterprises (76.5%) manufacture three or more products, and in some cases the products are linked to demands of different market segments. This product/market diversity

Table 7. Obstacles and barriers to enterprise operation.

Barriers/difficulties	Level of importance							Index
	1	2	3	4	5	6	7	
Availability of qualified workforce	0	1	0	1	4	8	3	0.76
Production with quality	2	1	1	8	4	1	0	0.54
Sales	2	4	4	5	1	0	1	0.40
Working capital	2	5	2	5	0	1	2	0.45
Capital to buy equipment and machinery	1	4	2	5	2	1	2	0.51
Capital to buy or rent facilities	6	5	1	2	1	1	1	0.33
Acquisition of loans	4	4	1	4	2	0	2	0.43
Payment of loans	3	4	2	6	1	0	1	0.41

Source: Elaborated by author based on fieldwork data.

Table 8. Determining factors to maintain competitiveness of chief product.

Description	Index
Product quality	0.85
Capability to introduce new products/processes	0.77
Service (deadlines)	0.76
Quality of workforce	0.67
Product technological level	0.64
Product price	0.55
Commercialization strategies	0.42

Source: Elaborated by author based on fieldwork data.

Table 9. Level of importance of externalities.

Description	Index
Closeness to customers/consumers	0.54
Low cost of workforce	0.44
Existence of support and development	0.43
Proximity to input suppliers	0.35
Closeness to raw material sources	0.34
Availability of specialized technical services	0.32
Availability of qualified workforce	0.30
Proximity to universities and research	0.28

Source: Elaborated by author based on fieldwork data.

is largely due to the seasonality of farming goods, whose sales diminish considerably in the period between harvests. The main commercialization channels used by them are direct sales (100% of the enterprises) and commercial representation (65% of the enterprises). Although, their current needs can be met by these channels, their owners believe that investment in other commercialization channels, especially foreign trade, could boost sales.

The most cited commercialization factors were product price, product tradition and enterprise brand name, whereas the least important ones were post-sales service, product technological level and marketing. In addition, although, the majority of the LPS businessmen were aware of its relevance, product technological level was rendered irrelevant to commercialization by their realities (e.g., undemanding markets and low technological capabilities).

Externalities

On the whole, the producers were not capable of identifying many advantages to their local environment. Their inability is reflected on the indexes shown in Table 9. Access to qualified workforce considered to be one the chief externalities of localized agglomerations by theorists did not emerge as an advantage. Contrarily, according to the respondents, it is one of the most serious obstacles in their region. The interviewees said that the LPS heterogeneity contributed to this state of affairs. Among perceived advantages, there stand out proximity to customers and low cost of workforce. Support and development programs provide the enterprises with lesser benefits even when they are taken advantage of.

Closeness to input suppliers is also of little importance, which may be explained by their external origin (outside the LPS) of most raw materials. Universities and colleges, despite their being numerous in the region, are also deemed irrelevant. The producers know little about these institutions or do not recognize the value of services provided by them or the potentialities of joint actions.

Internal and external learning dynamics

As mentioned earlier, learning may be constructed as a process by means of which enterprises can broaden their knowledge base. Knowledge thus constructed is conducive to improvement, change and innovation in products and processes. It may derive from accumulated experience, internal sources related to the enterprise's main functions (for example, R and D, production, marketing, and organization), and external sources (through interactions with several types of actors, for example, institutions and other businesses).

Internal learning

Learning-by-using and Learning-by-doing: With respect to learning-by-using, it was generally observed that the enterprises under investigation displayed a relatively good ability to absorb, adapt and master new knowledge upon acquiring new equipment and machinery or technologies for their production processes. However, it should be pointed out that they were acquisitions of simple technologies.

The main purpose of these acquisitions was not to incorporate novel technologies into products, but to improve product quality and productivity. Just two enterprises reported the double objective of incorporating novel technologies and improving quality and productivity when purchasing new machinery and equipment. It is important to mention that the workers in most of the enterprises were not qualified enough to take full advantage of advanced technologies.

Five out of 17 enterprises did not acquire any capital goods within the three-year period prior to this research. The enterprises that incorporated novel technologies into their productive processes displayed substantial progress in product quality and in learning how to solve problems and improve main product features. The time needed to adapt and master the features of newly acquired equipment varied among enterprises, from some weeks to six months. In some cases it was longer than one year. The enterprises that aimed at incorporating novel technologies into their products took at least one year to do so; total mastery of their features could take up to 4 years. The businessmen considered this time to be too long because technologies changed rapidly, but its reduction demanded employing more qualified workers in

the productive and technical areas. With respect to learning-by-doing, it was possible to see that routine production activities had promoted many changes in product features in the previous three years. The most significant ones were related to product design, finish, and strength. Just two of the enterprises reported no changes in their products. Table 10 shows results and changes in products made possible by these two learning modes.

External learning

Sources of Information: The enterprises' main products and their corresponding difficulties, benefits, and improvements were taken into account when investigating external sources of information. The interviewees were asked to state which information sources their enterprises resorted to overcome difficulties and rank them on a 1 - 7 scale of importance (Table 11). As shown in Table 11, fairs and exhibitions, customers, and suppliers were the most cited external sources of information and correspond to the highest levels of importance found in this study.

This does not happen to professional training/support centers and specialized publications. These information sources, despite having been cited by 70% of the enterprises, were considered to be of medium significance to them. Business associations were also mentioned by over 60% of the businessmen, but were deemed of low worth. Below is presented a more detailed description of each actor.

(1) **Customers:** Customers are the most important external source of information according to the business owners. Interaction with customers has generated substantial learning and product improvement. Information exchange occurs informally by email, telephone and personal contact. Personal contact, for example, visits, constitutes the favorite interaction mode to obtain information so as to improve production and product quality. From contacts to meet specific needs of a given customer for new products, is often suggested. Among the benefits and improvements perceived by the businessmen are customer fidelization, product development and improvement, and supply exclusivity.

(2) **Suppliers:** Suppliers are also important learning sources. Interactions are mostly directed to improving product quality and occur mainly with suppliers of raw materials. It should be remarked that just one third of the enterprises work with suppliers within the LPS. The majority of the enterprises work with suppliers from other regions in Brazil. This fact is considered to be one of the major deficiencies of this agglomeration according to the enterprise owners.

(3) **Competitors:** Competitors are less important sources of information, and learning thus generated is not seen as relevant. Just 40% of the enterprises cited competitors as

Table 10. Results and changes in products via learning-by-using e learning-by-doing.

Learning-by-using results in products	Learning-by-doing changes in products
1. Production of new parts	1. Product finishing: changes in electrostatic painting process.
2. Improvement of product quality	2. Product strength: incorporation of novel welding processes that enabled greater tenacity, preventing ruptures.
3. Increase in productivity	3. Product packing: development of novel packing process used in furniture factories.
4. Elimination of outsourcing	4. Product makeup: changes in raw materials and chemical composition led to weight and cost reduction; this knowhow was later applied to other products.
5. Production of differentiated parts	5. Product design: improvement of finish and strength, which led to better equipment operation. Changes in product design also allowed better visualization of important product parts by means of novel materials technologies.
6. Reduction in manufacturing costs	6. Higher product efficiency.
7. Better qualification of workforce	
8. Reduction of lead-time	
7. Development of new models	
8. Operation of other operating machines	

Source: Elaborated by author based on fieldwork data.

Table 11. Importance of external information sources to organizational learning.

Information sources	Level of importance							No. of enterprises/ information sources	Index
	1	2	3	4	5	6	7		
Customers	0	0	1	0	4	4	5	14	0.81
Fairs, exhibitions, etc.	0	1	1	4	4	2	3	15	0.69
Suppliers	1	0	2	2	1	6	2	14	0.67
Research institutes	0	0	1	0	0	0	1	2	0.65
Universities	0	2	0	1	1	2	1	7	0.61
Consulting firms	1	0	0	1	2	1	0	5	0.58
Specialized publications	2	2	0	2	1	3	2	12	0.58
competitors	0	0	2	2	3	0	0	7	0.56
Training/support centers	0	2	2	3	2	0	2	11	0.56
License/patent acquisition	0	1	0	0	0	1	0	2	0.50
Other enterprises from same sector	0	2	2	1	1	1	0	7	0.44
Congresses, symposiums, etc.	2	1	1	2	0	0	1	7	0.41
Business associations	2	2	2	3	2	0	0	11	0.40

Source: Elaborated by author based on fieldwork data.

information sources. The respondents acknowledge the difficulty in obtaining information in this fashion, especially information regarding products. This sort of information is almost exclusively found in catalogs, specialized publications, and fairs and exhibitions. However, when effectively tapped, this source of information usually promotes the improvement of productive processes.

(4) Other enterprises from same sector: Other enterprises pertaining to the same sector are not considered to be important sources of information by the majority of the enterprises. The information they provide is limited to process improvement.

(5) Professional training/support agencies: They are considered to be of medium importance by most of the enterprises under investigation. The main agencies are SENAI (Brazilian industrial learning agency) and

SEBRAE (Brazilian entrepreneurial learning agency). SENAI is seen to provide useful information to the productive and technical areas whereas information from SEBRAE is linked to organizational management. It should be mentioned that SEBRAE cannot meet some of the enterprises' management needs. The same happens with respect to SENAI; this organization can meet only part of the respondents' qualification needs.

(6) Universities: In spite of the fact that the region has a good educational infrastructure, including several higher education institutions, most of the enterprises do not take advantage of them. Sixty percent of the enterprises in question have no relationships with these universities. There are cases in which it is the universities that seek the enterprises to obtain information for their research. It is important to mention that, despite some respondents doubting the academics' competence to solve their

technical problems, nearly all of them respected the potential knowledge of these institutions. Among the benefits obtained by the enterprises that make the most of their proximity to universities is the improvement of product quality and projects.

(7) Research institutes: Research institutes, as shown above, were only cited by two interviewees; one evaluated them as satisfactory and the other of little importance. The remaining enterprises did not have any relationships with these actors. Nevertheless, they were not able to say whether these institutions constituted important sources of information.

(8) Consulting firms: Consulting firms were barely cited. According to the respondents, they are of little assistance, as they do not have the desired/sufficient knowledge. Some respondents expressed highly negative opinions, showing distrust and resistance to these actors.

(9) Business associations: Most respondents did not deem business associations to be significant sources of information. Despite being mentioned by approximately half of the enterprises, the benefits for example, access to technical norms, professional qualification, and legal assistance were perceived by their owners to contribute little. In some cases these associations were able to help the businessmen to find new customers and suppliers, and to take part in fairs and events abroad. Other actions concerned remuneration issues, that is, issues concerning the employer-employee relationship.

(10) Fairs and exhibitions: Fairs and exhibitions are relatively important sources of information to 90% of the enterprises under investigation, especially because they provide information regarding competitors, new products and novel technologies.

(11) Specialized publications: Specialized publications all Brazilian are sources of information to approximately 70% of the respondents. One of the most cited periodicals is the one published by RETEC (Parana State Technology Network). RETEC periodical offers market and technological information directed particularly to medium and small enterprises. It also offers information on financing opportunities, at state and national levels, for technological development.

(12) License/patent acquisition: License and/or patent acquisition is used as a source of information by only two enterprises. Most of the businessmen were not aware of this information source.

In general, it may be affirmed that the enterprises in question considered the afore mentioned external information sources irrelevant to learning. They were often ignorant of the ways these information sources could benefit them. Nonetheless, it should be emphasized that they could foresee that interacting with these external actors would promote their growth and development. It is also important to mention that the stage of development of some of the enterprises under investigation precluded

interaction with certain types of external information sources, e.g., research institutes. For some enterprises that neither developed new products nor incorporated novel technologies into their products/processes, the information made available by these agencies was either ineffectual or irrelevant to their contexts.

Inhibiting and motivating factors

In order to identify and analyze factors that motivate or inhibit cooperation and interaction processes this study investigated the enterprise owners' points of view about their own products, markets, and businesses. These three elements were chosen as a starting point in the identification of cooperation spaces among the LPS agents in order to subsequently identify factors that inhibit joint actions. The actors present in the arrangement cited by the enterprise owners were suppliers, customers, competitors, consulting firms, other enterprises in the same sector, universities, research institutes, professional qualification centers, business associations and banking institutions.

Inhibiting factors

Universities were the most frequently mentioned actors with which to partner to promote products. Secondly, the businessmen alluded to competitors, professional qualification agencies, and enterprises from other sectors. Suppliers, customers, banking institutions, consulting firms and business associations were cited by approximately one third of the enterprises under investigation. Research institutes were the least cited agencies, by just one fourth of the enterprises. Below are presented, for every mentioned actor, the elements that hinder association or, in many cases, inhibit a first contact to establish cooperation and interaction among the LPS actors.

(1) Universities: Some enterprises have already established partnerships with universities, but their contribution was limited to improving project ideas. Unsuccessful experiences have led the businessmen to distrust these partnerships or doubt that they could produce any practical solutions to their technical problems. Conflict of interest was also mentioned by the respondents, for example, some of the enterprises believe that the universities are not sincerely interested in helping them, but in gathering data for their research activities. Lack of trust is also an obstacle to partnerships. The common perception that the university professors have hidden goals generates anxiety among the enterprise owners. On the other hand, they were not much acquainted with intellectual property laws and rules. On the other hand, insufficient information about partnership opportunities was one of the most frequently mentioned

inhibiting factors. Some businessmen, when questioned about technical resources and knowledge provided by the universities, reported not to know much about them and, consequently, not to take advantage of them. Many enterprise owners said that they did not have time to visit and get to know the universities participating in the arrangement with the intention of establishing partnerships.

(2) Suppliers: Some enterprises claimed not to have the capital needed to establish partnerships with suppliers to improve their products or that they did not know how to persuade them to establish partnerships. At any rate, the enterprises acknowledged the importance of interacting with suppliers and their potential in the development of their products. Another aspect is related to qualified workforce: there were not workers in the majority of the enterprises qualified enough to interact with suppliers as regards product development. Also, there were problems linked to facilities: some enterprises indicated that insufficient equipment and inadequate space were barriers to joint actions. In addition, in spite of reckoning that joint actions could assist them in problem-solving, some of the businessmen had never approached their suppliers. In this case, fear of losing supply exclusivity was the chief reason.

(3) Competitors: Reluctance to establish joint actions with competitors is more evident. Some enterprises limited their actions to borrowing/lending material and sharing machinery and equipment. Actions aimed at developing products were less common because the businessmen feared losing markets and not obtaining any benefits from working with competitors. Besides, because some potentialities were of great magnitude, most enterprises claimed that they did not have enough know-how or capability to develop joint actions. Again, there were enterprises that had never approached their competitors; some of them did not even know who their direct competitors were.

(4) Customers: It is important to mention that the businessmen considered customers to be much needed sources of information. Nonetheless, some enterprises reported that they did not establish partnerships with customers because they did not have sufficient staff or, for some actions, sufficiently qualified staff. On the other hand, many enterprises looked for customers with cooperation potential outside the LPS.

(5) Other enterprises from same sector: Some of the above difficulties and inhibitions also apply to other enterprises in the same sector. In some cases the respondents cited lack of trust deriving from previous unsuccessful experiences. A shortage of resources and personnel also emerges as an inhibiting element. It is interesting that the majority of the respondents had never thought about the prospect of establishing partnerships with other enterprises; some had never looked for them and others had no knowledge of them. Lack of time, initiative and capital were also cited by some enterprises

as barriers to partnering with other enterprises from the same sector. For instance, one of the enterprises had to give up the development of a product because of its rising cost, in spite of sharing it with other enterprises.

(6) Consulting firms: Generally speaking, consulting firms are not seen as potential partners. Some enterprises claimed that they had little information about these firms. One of enterprises also declared that, despite having confidence in consulting firms, they did not have enough money to invest in partnerships with them.

(7) Professional training centers: Interactions with professional training centers seem to take place very frequently within the LPS. These agencies are highly regarded by the businessmen. The enterprises that were partly assisted by professional training centers claimed that there was a lot of room for growth in these relationships.

(8) Business associations: With regard to business associations, there appears to be a shortage of information; some enterprises did not know exactly what these institutions could offer them. Other enterprises claimed that they were knowledgeable about their services, but they did not interact much with business associations because they had not met their needs on previous occasions.

(9) Financial institutions: Financial institutions were seen as important partners by the enterprises. Notwithstanding, there were some barriers to strengthening relationships with these agents. The greatest barriers were high interest rates and the amount of loan available to them, not enough to cover indispensable investments according to the businessmen.

(10) Research institutes: Few enterprises acknowledged how important and necessary it is to partner with research institutes. Even when this importance was recognized, there was the obstacle of not having sufficiently qualified staff. There were also difficulties in accessing these sources and a lack of knowledge about potential joint actions with them.

Based on the opinions given by the businessmen with respect to relationships among their enterprises and between them and the institutions pertaining to the same LPS it was possible to identify, as shown in Table 12, some elements or factors that hinder or inhibit more intensive interaction and the development of joint actions. After having identified the factors that inhibit interactions and joint actions in the arrangement, it was possible to verify that their characteristics, in general, are correlated to specificities of small enterprises, as shown in Table 13.

Motivating factors

The fact that few motivational factors were mentioned is mainly due to the enterprises having unsatisfactory relationships with other enterprises and actors in the

Table 12. Factors that inhibit interaction and cooperation in LPS.

Inhibiting Factors	Main Actors Involved	Description
Lack of information	Suppliers, competitors, universities, enterprises from the same sector, consulting firms, business associations, research institutes.	A lack of information, whether about enterprises and institutions or about interaction and cooperation benefits, is found in the majority of the enterprises. Despite some improvement, concepts such as agglomeration, partnership, and interaction must be better understood.
Shortage of capital and/or financial resources	Enterprises from the same sector, consulting firms.	Some enterprises are willing to interact and develop joint actions, but insufficient capital causes difficulties, especially when it comes to product development.
Low qualification and unavailability of workforce	Competitors, suppliers, universities, customers, enterprises from the same sector, research institutes.	Low qualification or unavailability of qualified workforce creates obstacles to partnerships with suppliers, universities, and research institutes with respect to new product development.
Difficulties in accessing universities	Universities, research institutes.	Some enterprises claimed that professors and technical departments were not accessible and too bureaucratic, and that contacting these actors could take too much time.
Facilities and equipment	Suppliers, enterprises from the same sector.	Some enterprises do not possess adequate facilities and/or equipment to develop joint activities. They lack organizational resources.
Organizational culture	Competitors, suppliers, consulting firms.	Some enterprises pointed to previous unsuccessful experiences, which had engendered insecurity and promoted the belief that partnerships were useless.
Lack of confidence	Competitors, suppliers, enterprises from the same sector, consulting firms.	This factor appears especially as regards partnerships with competitors, but it was also cited with respect to universities. In this case, they reported insecurity about intellectual property.
Limited capability/competencies of local enterprises	Competitors, suppliers, enterprises from the same sector.	Many of the partnerships and interactions are not established or strengthened because local enterprises are small and have technological limitations. More technologically developed enterprises would agglomerate more easily.
Conflicting interests between institutions and enterprises	Universities, professional training centers, research institutes.	A conflicting case cited by an enterprise involved higher education institutions. It appears that when projects do not address areas of interest of these institutions, partnerships do not occur.
Absence of a holistic business vision	Suppliers, competitors, enterprises from the same sector, universities, research institutes.	There is a weak perception of the elements of the enterprise on the part of the businessmen. There seems to be partial visions mainly related to the businessmen's areas of knowledge.

Table 12. Cont'd.

Accumulation of functions by businessmen	Universities, competitors, suppliers, enterprises from the same sector.	Most of the businessmen under investigation accumulated several technical and managerial functions. This situation left them with little time to conceive strategies and pursue partnerships.
Use of obsolete technologies	Suppliers, enterprises from the same sector.	Several enterprises declared that they had no technologically-advanced machinery and equipment. According to some respondents, resources based on simple technologies made it difficult for enterprises to cooperate and propose joint actions to develop or improve products.
High interest rates	Financial institutions.	High interest rates together with low availability of funds are the main obstacles to the establishment of partnerships with financial institutions.

Source: Elaborated by author based on fieldwork data.

Table 13. Correlation between inhibiting factors and specificities of LPS enterprises.

Specificities		Inhibiting factors
Internal to organization	Behavioral	1. Enterprises lack holistic vision
		2. Organizational culture
		3. Little initiative
		4. Lack of trust
		5. Low qualification of workforce
		6. Shortage of workforce
	Decisional	7. Lack of ability to manage time
		8. Little time for strategic decision-making
	Technological	9. Obsolete technologies
		10. Low rate of technological modernization
		11. Few technological resources
		12. Inadequate facilities and equipment
	Structural	13. Lack of organizational resources
		14. Accumulation of functions by businessmen
		15. Constrained organizational structure
		16. Minimal organizational structure
Strategic	17. Insufficient time for planning	
	18. Meager knowledge of markets	
External to organization	Environmental	19. High interest rates
		20. Deficient information

Source: Elaborated by author based on fieldwork data.

arrangement. Trust was indicated as a catalyst in bringing them together, especially in the case of competing enterprises. Cases of partnership in projects

and information search illustrate the times when the enterprises come together. Spending less on quality service was also cited; thus, processes and products

could be improved within their financial means. Other enterprises pertaining to the same sector and suppliers were also mentioned as partners and information sources. The search for these relationships is related to cost reduction for example, of raw material, obtained by means of joint purchasing and complementariness of competencies needed to develop and improve products. Some businessmen claimed that it was easier to be partners with enterprises from a different sector because they were more open to potential relationships. Another motivation was the complementary nature of the knowledge that these enterprises could provide.

Final remarks

This empirical research was useful to explore the relationships among the actors of the farming equipment and machinery LPS in Parana State, Brazil, focusing on the analysis of learning factors and aspects that motivate and inhibit these relationships. The results shown in this article allow us firstly to advance some considerations regarding the potentialities and shortcomings of this LPS.

The expressive presence of a technological-scientific, educational, and institutional infrastructure is one of its strongest points and may concur to the development of local productive activities. However, despite this favorable territorial configuration, relationships existing in this LPS are quite incipient and resources are seldom shared. In other words, the existence of such an infrastructure does not suffice to foster joint actions that can significantly advance the agglomeration as a whole. When these relationships are established, they are not strategic in nature, but limited to mere information exchange and operational actions.

Another potentiality analyzed in this study refers to the technological dimension. It was possible to verify that the group of enterprises in the arrangement has a considerable potential for incremental innovations concerning processes and products. Yet, these enterprises have intrinsic limitations with respect to financial, technical, human, and management resources. These limitations, in turn, interfere with interactions and joint actions with other enterprises and institutions, thus, affecting their learning from both internal and external sources. It should be emphasized that there have been efforts to promote cooperation among the LPS actors, through support institutions or LPS governance. These actions, despite encompassing a small number of the enterprises and meeting only part of their needs, should be deemed important to the advancement of the LPS constituents.

Some of the LPS shortcomings are associated with technical/managerial and market issues. The greater part of the enterprises under investigation lacks some necessary technical or organizational features. Many problems were verified in connection with the overall management of the enterprises, which affected their

productive, administrative, and technical areas. Many enterprises reported having difficulties in developing products, acquiring loans and defining strategies to increase their competitiveness. With regards to their market, most businessmen showed little acquaintance of its dynamics. This deficiency, in particular, is a serious limitation to growth because knowledge is crucial to the development of the enterprises, by providing them with a competitive edge.

Another important aspect to point out is the fact that the LPS in question comprise enterprises at dissimilar development levels, which, in turn, call for different resources. There are enterprises that require basic courses, for example, in financial management tools (flowchart), and others that have more complex needs inherent to more advanced development levels. However, it should be mentioned that government agencies and support institutions have helped them to overcome some of their development-related obstacles and have promoted the development of the LPS all together.

As to learning, the enterprises limit their use of knowledge sources to information about production in order to improve product quality and increase productivity. Their involvement is often limited to using simple technologies. Their workers' qualification is not high enough to take advantage of more sophisticated technologies. These limitations, internal to the enterprises, frustrate potential cooperation actions, thus impeding the incorporation of new external knowledge. When it comes to external knowledge sources, it should be remarked that their search is directed and restricted to production and management information; there are few interactions related to information about markets and technologies. This strategy is inadequate if more competitive markets are to be reached; in this case it is vital to incorporate novel technologies into products and processes. It was also noticed that lack of information about other types of actors or knowledge sources constitutes one of the chief factors that inhibit closeness and the development of joint actions with other actors within the LPS.

In addition, it was verified that potential interactions and joint actions may be hindered or rendered unviable by some internal organizational aspects (for example, infrastructure and management). This is to say that even when enterprises are disposed to develop joint actions or interact more intensively, insufficient financial, technical and human resources can impede them. Nevertheless, it is important to mention that, in spite of having tenuous cooperative ties, the enterprises acknowledge the importance of interacting with different actors to improve their problem-solving and development processes. As regards public policies for the advancement of small enterprise LPSs, they should take into account when encouraging interaction and cooperation among their multiple actors not only their contextual specificities (that is, socio-cultural, institutional, and spatial), but also the specificities inherent to the size of the participating enterprises (for

example, technical and organization deficiencies). As Dandridge (1979) put it, it has been long since people have conceded that a child is not a small adult; thus, analogously, it is time people recognized that small enterprises do not have the same administrative nature, problems and solutions as large enterprises. Moreover, it is fundamental to take into account when analyzing this study that Brazil's experience in LPSs is rather brief and that many issues related to their advancement are still open to investigation. Although, there are many studies and experiences in other countries, similarities between Brazilian and foreign LPSs are virtually restricted to structure and agents involved in them.

Fragmented and unarticulated productive structures are a commonplace feature of Brazilian LPSs. When compared among themselves, they are also quite heterogeneous and neither follow similar strategies nor have the same priorities. Diversity in socio-cultural, economic and spatial contexts makes each LPS experience singular. Therefore, empirical studies like this one should be taken as a reference, not a model to be indiscriminately transferred to other realities in Brazil (or elsewhere for that matter), which implies the need for further research on and support to small enterprises, which constitute the foundation of Brazilian LPSs.

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REFERENCES

- Albagli S, Maciel M (2004). Information and knowledge in innovation and local development. *Ciência da Informação*, 33(3): 9-16.
- Altemburg P, Meyer-Stamer J (1999). How to promote clusters: policy experiences from Latin America. *World Dev.*, 19(9): 1693-1713.
- Amato Neto J (2000). Productive cooperation networks and regional clusters: opportunities for small and medium sized enterprises. São Paulo, SP, Brazil: Editora Atlas.
- Amato Neto J, Garcia R. (2003). Local Productive System: Searching for a theoretical reference. Ouro Preto, MG, Brazil: Proceedings of the 23th ENEGEP.
- Araújo Filho G (2006). Cooperation in clusters: Prospects about Manaus industrial pole. Brasília, DF, Brazil: Paralelo 15.
- Arrow KJ (1962). The Economic implications of learning-by-doing. *Rev. Econ. Stud.* London, 29(3): 155-173.
- Audretsch DB, Feldman MP (1996). R and D spillovers and the geography of innovation and production. *Am. Econ. Rev.* Nashville, 86(3): 630-640.
- Becattini G (2005). From the industrial segment to the industrial district: some remarks about the survey sample of the industrial economics. The industrial district: the new way of understanding the economical change. Torino: Rosenberg and Sellier.
- Belussi F, Gottardi G (2000). Evolutionary Patterns of Local Industrial Systems: towards a cognitive approach to the industrial district. Aldershot: Ashgate.
- Bigaton ALW, Escrivão Filho E (2006). Organizational specifics of the small company: a study inside the São José do Rio Preto's metal-mechanical segment. Bauru, SP, Brazil: Proceedings of the 13th SIMPEP.
- Breschi S, Malerba F (2001). The Geography of innovation and economic clustering: some introductory notes. *Industrial and Corporate Change*, Oxford, 10(4): 817-833.
- Britto J (2001). Technological Cooperation and Collective Learning in Inter-firm Networks: A systematization of empirical concepts and evidences. Salvador, Brazil, Proceedings of the 29 th Anpec.
- Britto J (1998). Technological Diversity and Industrial Networks: An Analysis of the Modus Operandi of Co-operative Arrangements, Science Policy Research Unit, University of Sussex.
- Camagni, R., 1993. Inter-firm industrial networks: the costs and benefits of cooperative behaviour. *J. Ind. Stud.*, 1(1): 1-16.
- Cassiolato JE (2004). Interaction, learning and technological cooperation. Rio de Janeiro, RJ, Brazil: Serie Contribuciones – Red Iberoamericana de Indicadores de Ciencia y Tecnología – RICYT.
- Cassiolato JE, Lastres HMM (2000). Local systems of innovation in mercosur countries. *Industry and Innovation*, Sydney 7 (1): 33-53.
- Cassiolato JE, Lastres HMM (2005). Innovation systems and development: the policy implications. *São Paulo em Perspectiva*, 19(1): 34-45.
- Cassiolato JE, Britto JNP, Vargas MA (2005). Cooperative arrangements and innovation in the Brazilian industry. Innovations, technological patterns and performance of the Brazilian industrial companies. Brasília, DF, Brazil: IPEA.
- Dandridge TC (1979). Children are not "little grown-ups": small business needs its own organizational theory. *J. Small Bus. Manage.*, 17(2): 53-57.
- Edquist C (1997). System of innovation: technologies, institutions, and organizations. Londres: Pinter.
- Escrivão Filho E, Carvalho KC, Benze RP, Albuquerque AF (2005). Understanding the dynamics of the small companies: organizationa chart as tool of the administrative action. *Revista de Ciências Humanas e Aplicadas*, 1(1): 20-40.
- Escrivão Filho E (1995). The executive's job nature. Florianópolis, SC, Brazil: Thesis (doctor), Federal University of Santa Catarina.
- Feldman MP (1993). An Examination of the geography of innovation. *Industrial and Corporate Change*, Oxford., 2(3): 451-470.
- Freeman C (1987). Technology policy and economic performance: lessons from Japan. Londres: Pinter Publishers.
- Garcia R (2006). External economies and competitive advantages in local productive system: the Marshall, Krugman and Porter's views. *Ensaos FEE*, 27(2): 301-324.
- Garcia R, Motta FG, Amato Neto J (2004). An analysis of the characteristics of the governance structure in local production systems and its relations with the global chain. *Gestão e Produção*, 11(3): 343-354.
- Igliori DC (2001). Industrial clusters economy and development. São Paulo: Iglu.
- Johnson B, Lundvall B (1992). Closing the institutional gap? *Revue d'Economie Industrielle*, 59: 111-123.
- Keeble D, Wilkinson F (1999). Collective learning and knowledge development in the evolution of regional clusters of high technology SMEs in Europe. *Regional Stud.*, 33(4): 295-303.
- Krugman P (1998). What's new about the new economic geography?. *Oxford Review of Economic Policy*, Oxford, 14 (2): 7-17.
- La Rovere RL (2003). Competitive strategies in systems of micro, small and medium companies: the importance of the information management. Small company: cooperation and local development. Rio de Janeiro, RJ, Brazil: Relume Dumará.
- La Rovere RL. (2001). Perspectives of micro, small and medium sized enterprises in Brazil. *Revista de Economia Contemporânea*, 34: 137-154.
- Lemos C (2003). Micro, small and medium companies in Brazil: new requirements of policies for the clusters promotion. Rio de Janeiro, RJ, Brazil: Thesis (doctor), Federal University of Rio de Janeiro.
- Leone NMCG (1999). Small and medium firms specificity. *Revista de Administração*, 34(2): 91-94.
- Lombardi M (2003). The evolution of local production systems: the emergence of the "invisible mind" and the evolutionary pressures towards more visible "minds". *Res. Pol.*, 32(8): 1443-1462.
- Lundvall BA (1992). National system of innovation: towards and

- theory of innovation and interactive learning. London: Printer.
- Lundvall BA (1988). Innovation as an interactive process: from user-production interaction to national system of innovation. In: Dosi, G. et al. *Technical change and economic theory*. London: Pinter.
- Malerba F (1992). Learning by Firms and Incremental Technical Change. *Econ. J.*, 102(413): 845-859.
- Marshall A (1982). *Princípios de economia*. São Paulo. Abril Cultural.
- Meyer-Stamer J (2002). Clustering and the Creation of an Innovation-Oriented Environment for Industrial Competitiveness: Beware of Overly Optimistic Expectations. Institute for Development and Peace, University of Duisburg, Germany, and Fundação Empreender, Brazil. International High-Level Seminar on Technological Innovation.
- Migliato ALT, Escrivão Filho E (2004). The small company and its specifics: a proposal of classification based on a organizational conception model. São Paulo, SP, Brazil: Proceedings of the 7th SemeAd.
- Suzigan W (2006). Innovation and knowledge: regional indicators for São Paulo state. *Revista de Economia Contemporânea*, 10(2): 323-356.
- Nadvi K (1999). Collective efficiency and collective failure: the response of the sialkot surgical instrument cluster to global quality pressures. *World Dev. Oxford*, 27(9): 1605-1626.
- Porter ME (1990). *Competitive Advantage of Nations*. New York: Free Press.
- Rosenberg N (1982). Learning by using. In: *Inside the black box: technology and economics*. Cambridge: Cambridge University Press.
- Schermerhorn JR (1980). Inter-firm cooperation as a resource for small business development. *J. Small Bus. Manage. Milwaukee*, 18(2): 48-54.
- Schmitz H (1999). Collective efficiency and increasing returns. Cambridge. *J. Econ.*, 23(4): 465-483.
- Schmitz H (1995). Collective efficiency: growth path for small-scale industry. *J. Dev. Stud.* 31(4): 529-566.
- Suzigan W, Furtado J, Garcia R, Sampaio S (2004). Clusters or Local Production Systems: Mapping, Classification and Suggestions for Policies. *Revista de Economia Política* 24 (4): 543-562.
- Suzigan W (2001). Industrial clustering focusing on policy implications. *Revista de Economia Política*, 21(3): 27-39.