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Local Production Systems in Brazil: mapping, typology and policy suggestions

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Abstract

This paper sets out to advance further in the development of a methodology for mapping, classifying and characterizing Local Production Systems (LPS) in Brazil. Such effort is justified not only for the importance these systems have been amassing for generating jobs and social welfare, economic growth, exports and technological development, but also for the attention they have received from several public organisms and private institutions, many times lacking adequate methodological criteria, resulting in dispersion of efforts and waste of both public and private resources. Therefore, the main goal of the paper is to provide evidence that allows rationalizing public policies administration criteria and private actions directed to LPS, offering suggestions for policies and actions differentiated according to categories or types of systems with distinct characteristics according to their relevance to local or regional development as well as their importance in the context of the sector in which they are inserted.

Key words: Local production systems; industrial clusters; mapping, public policy.

JEL Classification: R12; R58; O18.

Local Production Systems in Brazil: mapping, typology and policy suggestions

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Introduction

This article sets out to present, in a very simplified manner and with specific application to São Paulo State, the results of a broader research project on local production systems (LPS) in Brazil. The project, which statistically identifies, geographically maps and structurally characterizes LPS, was the first step in a comprehensive methodology and has served as a foundation for case studies carried out within the framework of the study "Local Production Systems in the Brazilian Footwear Industry: Assessment and Policy Suggestions" (Sistemas Produtivos Locais na Indústria Calçadista Brasileira: avaliação e sugestões de políticas), conducted in 2001-03 with financial support from CNPq. Similar findings can of course be obtained for other states of Brazil, regions, and the country as a whole.

The effort to map, classify and characterize LPS is justified not only by the importance these systems have acquired in job creation and the fostering of social welfare, economic growth, exports and technological development, but also by the attention increasingly paid to LPS by several public and private Brazilian institutions, often without suitable methodological criteria, leading to a lack of focus and a waste of public and private resources.[1] The ultimate goal of this article, therefore, is to present evidence that will help rationalize the criteria for public policy administration and private actions regarding LPS, offering suggestions for the design and implementation of differentiated policy measures for the various categories or types of systems with distinct characteristics according to their relevance for local or regional development and their importance in the context of the industry to which they belong.

The article is organized as follows: Section 1 defines LPS, highlighting their relevance for public policy; Section 2 comments on selected aspects of the methodology used; Section 3 presents the chief results of the mapping and classification exercise for the categories considered fundamental from a policy perspective; Section 4 suggests a case study method; Section 5 discusses policy guidelines suited to each type of LPS; and Section 6 presents some final considerations.

1. Local production systems: definition and relevance for public policy

Local production systems (LPS) can be characterized in various different ways depending on a broad range of characteristics such as history, evolution, institutional organization, social and cultural context, production structure, industrial organization, governance, logistics, associativism, co-operation among agents, forms of learning, and dissemination of local specialist knowledge. This makes defining such systems no easy task, nor one immune to controversy. One of the most widely used definitions originated with RedeSist (Local Production & Innovation Systems Research Network),[2] which proposed two distinct concepts: (1) "local production arrangements are territorial agglomerations of economic, political and social agents focusing on a specific set of economic activities and with mutual connections, albeit incipient. They usually involve participation and interaction by firms ranging from producers of consumer goods and service providers to suppliers of raw materials and equipment, business consultants, marketers and customers, among others, with

[1] Over 20 public and private institutions are currently engaged in research and activities geared to fomenting LPS in the country. SEBRAE – Serviço Brasileiro de Apoio às Micro e Pequenas Empresas, for example, has recently announced a plan to support 500 clusters around Brazil (see "Sebrae negocia crédito para 500 *clusters*", *Gazeta Mercantil*, May 6, 2003).

[2] Cf. Cassiolato & Lastres (2003:27). See also the network's Website http://www.ie.ufrj.br/redesist/.

all their many forms of representation and association. They also include a range of other public and private institutions active in education and training (such as technical schools and universities), research and development, engineering, financing and policy making" etc; and (2) "local production and innovation systems are those production arrangements in which interdependence, articulation and consistent links result in interaction, co-operation and learning, with the potential to drive an increase in endogenous innovative capacity, competitiveness and local development. We therefore regard the institutional and regional dimension as a crucial element in the process of building production and innovation capabilities. Different contexts, cognitive and regulatory systems, and forms of articulation and interactive learning among agents are recognized as fundamental in generating and disseminating knowledge, especially tacit knowledge. These systems and forms of articulation may be formal or informal."

It should be noted that the ranking of these two concepts was changed by RedeSist, which had previously adopted a more general concept of local production systems and defined local production arrangements as an auxiliary concept with links among local agents not sufficiently developed to be called systems. Without wanting to engage in semantic discussions or polemics about conceptual terminology, and while agreeing with the essence of the definition currently used by RedeSist, the authors of this article prefer a single straightforward definition of local production systems in line with the traditional approach adopted by Italian researchers,[3] and bearing in mind that conceptual differences between systems are confined to variations in the degree of development, production chain integration, articulation and integration among agents and local institutions, and systemic capacity for innovation.

The key characteristic of these clusters of firms and institutions is the capacity to generate external economies. Whether these economies are created incidentally or deliberately, they enhance the competitiveness of the firms involved and thus drive competitiveness for the entire local production system. Indeed, external economies lie at the heart of the discussion about local systems. If incidental, such economies derive from (i) the existence of a vast pool of labor with skills of particular relevance to the local system; (ii) the presence and attraction of many suppliers specialized in relevant raw materials, components and services; and (iii) intense dissemination of knowledge, skills and information relevant to the industry or industries concerned.

Incidental external economies were highlighted by Alfred Marshall in his pioneering study of industrial districts in England. Alongside external economies, however, local agents (firms and institutions) can strengthen their competitiveness by taking deliberate joint action in areas such as raw materials procurement or vocational and management training, as well as setting up export consortia, retaining specialized services, establishing technology centers for collective use, running credit co-ops etc. The combination of incidental external economies with external economies created by deliberate joint action results in what is known as "collective efficiency", the key factor influencing the competitiveness of local firms (Schmitz & Nadvi, 1999).

Generally speaking, a local production system comprises firms of varying sizes but with the same or closely related capabilities. More often than not the majority are small and medium in size and are not vertically integrated. These firms in turn attract suppliers and firms in supporting activities whose presence and importance in the local system is determined solely by market forces. Eventually they are joined by local institutions that provide significant support to the firms involved.

Because of their potential from the standpoint of regional and local development policy, and even from that of industrial policy, agglomerations of firms by geography and industry have been the object of much research and public policy measures both in Brazil and elsewhere. However, it can be argued that particularly in the Brazilian case there is a certain lack of methodological criteria to identify and geographically delimit local production systems, classifying them into a few basic types according to their relevance for regional and/or local development and their importance in the respective industry or sector. Filling this gap would be a crucial contribution to the process of

[3] See especially Belussi & Gottardi (2000), and Lombardi (2003).

formulating public policy and also as a basis for private action. Hence the purpose of the present paper.

2. Brief comment on methodology

In previous work[4] we have developed a methodology to identify, geographically delimit and structurally classify local production systems (LPS) using the locational Gini coefficient and a specialization index or location quotient (LQ), combined with control variables or filters. This methodology has been applied to data on employment and production in São Paulo State using the Ministry of Labor's RAIS and IBGE's PIA databases. It has also been used in a number of case studies, presented in the same papers for the sake of illustration.

In the present study we set out to advance further in the same direction by mapping LPS in São Paulo State. Using the methodology developed elsewhere, i.e. the locational Gini coefficient and LQ, with the number of establishments and participation in specific industries in São Paulo State as control variables,[5] we identified agglomerations of industrial firms in accordance with more or less restrictive criteria. This can be considered a most important undertaking, not least for the development of more refined policy instruments to provide support for local systems.

This article applies the above methodology to employment data from the Labor Ministry's RAIS database, widely used for the characterization of LPS.[6] The main advantage of RAIS for this methodology is the high level of disaggregation by industry and geographic location. This dispenses with the need for special tabulations, providing spatially disaggregated data down to the municipality level and industry data to the four-digit level using IBGE's National Economic Activity Classification System (CNAE).

However, this advantage is offset by a number of deficiencies, as noted by several researchers including the authors of the present paper. The main problems with RAIS are insufficient coverage, limited to formal contractual relations; self-classification by firms in primary data collection; and the difficulty of classifying firms with multiple plants, allowed to declare the entire workforce as located at the same unit, or multiple products, allowed to allocate all data to a single core activity.

Using RAIS data for the year 2000, we calculated the locational Gini coefficient and regional LQ for a set of economic activities. These instruments are well known and widely used in regional economics research and analysis. The first step, as noted by Krugman (1991) and Audretsch & Feldman (1996),[7] was to calculate the locational Gini coefficient.

The locational Gini coefficient, an indicator of spatial concentration of economic activities, was calculated for 267 segments of the manufacturing industry in São Paulo State.[8] Gini coefficients range between zero and one: the closer to one, the more spatially concentrated is the industry in question. Thus there may be local production systems in segments with higher Gini numbers.

However, the Gini number only indicates that the branch of industry in question is geographically concentrated and does not serve to show the existence of LPS. This requires a second step. In a regional analysis the location quotient (LQ) is used to indicate the regions in which the industries most concentrated in geographic terms are located. The LQ is the ratio of a

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[4] See for example Suzigan et al. (2003a, 2003b).

[5] It bears repeating that this methodology can be applied to other states of Brazil, to larger regions, and even to the entire country.

[6] Many researchers have used the RAIS database for similar purposes. Based on their affinities with this article it is relevant to cite Brito (2003), Brito & Albuquerque (2001), Albuquerque et al. (2002), Diniz & Crocco (1996), and Saboia (2001), among others.

[7] Krugman (1991) calculated the locational Gini coefficient to measure spatial concentration for U.S. industry to three digits, while Audrescht & Feldman (1996) used the indicator to detect relationships between geographic concentration of innovation and the location of industrial activities in the U.S.

[8] Locational Gini coefficients were calculated for 267 categories out of a total of 296, since 29 declared zero employees in 2000. Our thanks to Prof. Rodolfo Hoffman, of IE/UNICAMP, for assistance in working out the methodology used to calculate locational Gini coefficients using RAIS data.

given industry as a proportion of the production structure in a given region to the same industry as a proportion of the total productive base in the state. Thus the higher the LQ the greater the degree of specialization in the region for that industry. LQs were calculated for all 63 microregions in São Paulo State and the same 267 industries using the CNAE four-digit code.

In addition to these two indicators, we used a number of control variables which served as "filters" to insert criteria for greater or lesser selectivity into the Gini and LQ. Using control variables was justified for two main reasons. Firstly, in some cases a high LQ was due to low density in the local industrial structure, potentially leading to overestimation of the local system's importance. To address this issue we used the microregion's relative share of the state total for the industry in question, thus controlling for economic importance.[9] Secondly, these control variables show whether a high LQ for a particular region derives merely from the local presence of a large corporation, which would not characterize a LPS. Accordingly we used data on the number of establishments to check for the presence of an agglomeration with a significant number of firms.[10] This filters out microregions in which a high degree of specialization, as indicated by a high LQ, derives from the presence of one or two large firms.

3. Results

The results of applying the above methodology to the RAIS employment data for São Paulo State in 2000, broken down into 63 geographic microregions and 267 industries using the four-digit CNAE for the state, are summarized in this section. Firstly, Table 1 presents statistics describing the information used to calculate locational Gini coefficients.

Table 1. Locational Gini for employment data in four-digit industries and microregions of São Paulo State - Descriptive statistics

Statistics	
N-sample	267
Mean	0.6303
Std. Deviation	0.1789
Variance	0.0320
Range	0.7781
Minimum	0.2018
Maximum	0.9799

Source: Authors elaboration.

The results show a wide range of Gini numbers, from 0.20 to 0.98. These must be refined, first of all by discarding segments with a Gini number of 0.5 or less. Statistically speaking, geographic concentration is present in industries with Gini higher than 0.5. Table 2 shows the significant Gini frequencies (industries).

[9] Alternatively, microregional employment levels for the industry in question could be used, equally indicating economic importance.

[10] It should be noted that RAIS is problematic on this point as it tells us not the number of firms but the number of *establishments*. This could distort the analysis if there are firms with multiple plants in a given region, as these firms would be counted more than once in the data on numbers of establishments.

Table 2. Frequency distribution of four-digit industries by ranges of Locational Gini (LG) coefficients for employment data, São Paulo State

Locational Gini ranges	Number of industries	(%)	Cumulative frequency	(%)
0,9 0 < LG ≤ 1,00	25	9,4%	25	9,4%
0,80 < LG ≤ 0,90	33	12,4%	58	21,7%
0,70 < LG ≤ 0,80	30	11,2%	88	33,0%
0,63 < LG ≤ 0,70	31	11,6%	119	44,6%
0,60 < LG ≤ 0,63	20	7,5%	139	52,1%
0,50 < LG ≤ 0,60	66	24,7%	205	76,8%
0,40 < LG ≤ 0,50	36	13,5%	241	90,3%
0,30 < LG ≤ 0,40	21	7,9%	262	98,1%
0,20 < LG ≤ 0,30	5	1,9%	267	100,0%
Total	267	100%		

Source: Authors elaboration.

From the data in Table 2 it can be seen that 205 four-digit industrial segments had a Gini coefficient higher than 0.5, showing some degree of geographic concentration in production and employment. It should be noted, however, this large number of segments with high locational Gini coefficients is a peculiarity of São Paulo State, which not only is the most industrialized region of Brazil but also is characterized by intense concentration of industry in the metropolitan area and nearby municipalities including Campinas, São José dos Campos, Sorocaba and the Baixada Santista coastal strip. This heavy regional concentration of a diversified industrial structure certainly stimulates the emergence of LPS but makes it hard to identify them statistically, as discussed below.

Given the large number of industrial segments with some degree of geographic concentration in the state, we decided to refine the selectivity of the criteria for identifying agglomerations of firms configured as LPS by using filters or control variables by microregion. This was done in two stages. The first was to look at branches of industry to find how many branches were geographically concentrated in one or more microregions according to different combinations of filters. The number of possible cases depends of course on the rigor of the filter. The second step was to look at microregions to find how many branches of industry were regionally concentrated in each microregion. This step showed whether the selected microregions had production structures that could be defined as LPS.

The filters used were based on a set of three variables:

- Location quotient (LQ), indicating the relative concentration of an industry or production specialization in a given microregion;
- The relative share of a given industry in the microregion as a percentage of total employment for that industry in São Paulo State;
- The number of establishments in the microregion for that industry.

As shown in Table 3, the first application of these filters produced a number of possible agglomerations of firms in specific branches of the manufacturing industry in microregions of São Paulo State. The size of this universe resulted from the restrictiveness of the filters used. It should be noted that these are not yet LPS. They are the industrial segments with locational Gini coefficients of more than 0.5 and concentrated in one or more microregions according to the combination of filters used.[11] To identify LPS it is necessary to break the data down by microregion, as shown next.

[11] The total number of possible cases was 12,915, given by the number of industrial segments with a Gini of more than 0.5 (205) multiplied by the number of microregions (63).

Table 3. Number of four-digit industries concentrated in one or more than one microregion resulting from the application of filters

N° of plants	Location Quotient	Microregion share of total employment in the 4-digit Industry higher than ou equal to				
		...	5%	10%	20%	40%
⋮	Higher than 1	1713	713	432	233	119
	Higher than 2	1141	565	354	173	68
	Higher than 5	570	354	235	122	53
Higher than or equal to 10	Higher than 1	250	187	138	102	55
	Higher than 2	154	120	83	53	15
	Higher than 5	75	65	42	24	7
Higher than or equal to 20	Higher than 1	115	102	83	69	47
	Higher than 2	64	54	37	27	12
	Higher than 5	35	33	20	12	5
Higher than or equal to 50	Higher than 1	51	47	40	35	22
	Higher than 2	23	21	15	12	4
	Higher than 5	16	15	10	7	2

Source: Authors elaboration.

Thus if the filters are based on relatively permissive criteria the number of cases can reach 1,713 industrial segments with geographically concentrated firms in microregions of São Paulo State. Even accounting for the fact that LPS are generally concentrated in various interrelated industries, this is obviously an overestimation. The number of cases was reduced as the criteria became more restrictive.

For the purposes of this article, we opted to use more restrictive criteria, since the aim was simply to demonstrate application of the methodology. Thus in order to identify and characterize agglomerations of firms as local production systems, we established that for industries with a locational Gini of more than 0.5 the microregion must satisfy all the following filter parameters:

- LQ higher than 2;
- Accounts for at least 1% of total employment in the state for the industry in question;
- At least 20 establishments in the same industrial segment.

The result of this combination of criteria was the identification of 64 industrial segments in which there are agglomerations of firms in various microregions of São Paulo State. Before looking to see whether these agglomerations can be defined as LPS in a breakdown by microregion, we regrouped the 64 segments in accordance with the degree of specialization (LQ) for the microregion in each segment and the microregion's share of total employment in that industry throughout the state. As shown in Table 4, this produced four types of agglomeration covering all 64 segments.[12]

Table 4. Number of four-digit industries according to different combinations of filters

LQ	Microregion share of total employment in the four-digit industry		
	S ≤ 10%	S >10%	Total
> 5	15	20	35
2 < LQ ≤ 5	12	17	29
TOTAL	27	37	64

Source: Authors elaboration.

[12] The complete data for the agglomerations identified, organized by industrial segment and microregion, can be seen at http://geein.fclar.unesp.br/atividades/pesquisacluster/cluster3.htm.

Next, to find out whether these agglomerations could be defined as LPS, we set out to identify the microregions corresponding to industrial segments in each of the four categories in the above classification. Starting with the top right-hand quadrant, which comprised 20 industrial segments strongly concentrated in microregions with LQs higher than 5 and a share exceeding 10% of total employment in the segment, we found that these agglomerations could be characterized as highly important to the region (LQ > 5) and at the same time highly important to he respective industrial segment in São Paulo State (share of employment in the segment > 10%), as shown in Table 5. Hence these agglomerations could be termed *centers of industrial-regional development.*

Table 5. Number of four-digit industries located in each microregion of the type "*centers of industrial-regional development*"

Microregions	No. of industries	Microregions	No. of Industries
São José do Rio Preto	1	Pirassununga	1
Franca	4	São João da Boa Vista	1
Ribeirão Preto	1	Mogi Mirim	1
Birigui	2	Campinas	1
Jaú	1	Amparo	1
Piracicaba	1	São José dos Campos	1
Araraquara	1	Itapeva	1
Limeira	2		

Source: Authors elaboration.

The upper left-hand quadrant of Table 4 contains 15 industrial segments in microregions with LQs higher than 5 but less than 10% of total employment in the segment throughout the state. Thus these agglomerations are highly important to the region but not materially important to the respective industry in the state and they are therefore termed *vectors of local development*, as shown in Table 6.

Table 6. Number of four-digit industries located in each microregion of the type "*vectors of local development*"

Microregions	No. of industries	Microregions	No. of Industries
São José do Rio Preto	1	Bauru	1
Campos do Jordão	1	Ourinhos	1
Dracena	1	Moji Mirim	1
Birigui	1	Capão Bonito	1
Jaú	3	Amparo	1
Araraquara	1	Tatuí	1
Votuporanga	1		

Source: Authors elaboration

The third quadrant in Table 4 contains 17 industrial segments classed in microregions that had LQs below 5, meaning they were relatively unimportant in terms of the local production structure but had a large share of total employment, indicating a high level of importance to the industry throughout the state. These agglomerations are typical of metropolitan areas and areas with high levels of industrial density and diversified production structures. They are therefore termed *advanced vectors*. The highlights are the microregions of São Paulo and Campinas, as shown in Table 7.

Table 7. Number of four-digit industries located in each microregion of the type "*advanced vectors*"

Microregions	No. of industries	Microregions	No. of Industries
São Paulo	7	Campinas	8
Limeira	1	São José dos Campos	1

Source: Authors elaboration.

Lastly, the bottom left-hand quadrant of Table 4 contains 12 industrial segments in microregions with LQs and shares of total employment indicating that the agglomerations in question are relatively unimportant both to the local economy and to the industrial segment throughout the state. These agglomerations are termed *embryonic local production systems*. Owing to the high level of rigor in the filters used, the number of industrial segments in this group was smaller than in other cases. However, a minor attenuation in the filters such as a reduction in the threshold for establishments from 20 to 10 would increase the number of industrial segments in this group to 37.

Table 8. Number of four-digit industries located in each microregion of the type "*embryonic local production system*"

Microregions	No. of industries	Microregions	No. of Industries
Ourinhos	2	Jaú	1
Bragança Paulista	2	Botucatu	1
Ribeirão Preto	1	Pirassununga	1
Rio Claro	1	Mogi Mirim	1
Limeira	2		

Source: Authors elaboration.

An additional step not described in this article for reasons of space would be to return to the LQ indicator in an analysis of microregions identified as LPS, especially those with larger numbers of industrial segments, ignoring the filters and aggregating all segments with LQs of more than 1. This would identify the related industrial segments present in the microregion, characterize the local production structure and, where appropriate, approximately evaluate the size of the production chain, thus determining the configuration of the local production system.

4. Local systems: a case study method

The methodology described above is efficient in identifying geographic agglomerations of firms, delimiting local production systems, and characterizing local production structures in general terms. As already mentioned, however, application of this methodology is only the first step, albeit an essential one, in selecting the most relevant agglomerations for case studies. These are indispensable in laying the foundations for support actions and public policy measures. Only field research can capture the specific features of each agglomeration, such as history, evolution, form of industrial organization, support institutions, and governance, among others.

Thus case studies on LPS should be carried out at two levels of analysis: first at the aggregate level, i.e. that of the system as a whole, and second at the level of the firms of which the LPS is made up. At each of these levels, collection of data and information through interviews and visits to firms and local institutions will cover the following items of investigation:[13]

[13] These items resulted from application, by the research team for the already mentioned CNPq project, of questionnaires that served as a script for interviews and visits to firms and institutions. The list of items was refined as case studies proceeded. Nine case studies had been performed by mid-2003, with approximately 150 visits and interviews.

Firms

- Characterization (foundation, location, size, ownership)
- Main products, production volume, markets (domestic, foreign)
- Sales channels
- Differentiators (price, quality, brand, design, after-sales services, lead time)
- In-house product development (R&D department, percentage of revenue invested, number and qualifications of personnel involved, differences between product development for domestic and foreign markets)
- Sources of information for product development and design
- Outsourced product development (local, regional, national, international)
- Co-operative/associative relations with firms in same industry and supporting institutions
- Location of main suppliers
- Interaction with suppliers of raw materials, components, machinery
- Product quality policy (programs, certification, testing)
- Sources of funding for capacity expansion, working capital, product development.

Local production system as a whole

- Territorial coverage (city/region), location, logistics in relation to markets for products and inputs, population, employment
- History and initial conditions
- Evolution
- Institutional organization (supporting institutions, trade associations, specialized services)
- Structure of production and extent of production chain: specialization, division of labor, size distribution of firms, interrelations of firms in production, position in domestic and international markets, governance structures (coordination of power relations among firms)
- Forms of learning/knowledge dissemination
- Social, cultural and political contexts

Case studies selected by the quantitative methodology proposed here and following the framework of items suggested above can be used to characterize the local system and the firms comprised in that system so as to point with reasonable confidence to the most promising support actions and policy measures needed to address specific issues and stimulate growth in production, jobs and exports, foster technological development, and achieve other relevant goals for each case, including social objectives.

5. Policy

Among the challenges faced by the recent rebirth of forces favorable to industrial policy adoption is that of responding to the needs of economic development in a way that is both democratic and compatible with the scarcity of resources, undoubtedly far more severe than in the golden age of industrial policy (the 1950s and 1970s).

This dual requirement makes the engineering of industrial and development policy extremely tough. To be genuinely democratic, industrial policy must offer opportunities to different sectors and above all must contribute to the development of less favored regions. But at the same time, if it is to be sustainable in the present context of resource scarcity it must be economical and efficient, i.e. aim at optimal results with minimal expenditure. Combining ample opportunities with scarcity of funds is extremely important as well as difficult.

The methodology proposed here is intended to be a contribution to industrial policy building efforts. Local production systems have characteristics that enable them to be raised to the status of industrial, regional and social development vectors. Moreover, they can also make a valuable contribution to the effort to enhance the nation’s balance of payments if their production capacity can be complemented with new capabilities in trade and if they are directed to new markets.

While there is broad agreement on the importance of local production systems, this consensus is lacking with regard to how these clusters should be quantified and qualitatively assessed on an industry-wide and regional basis. How many LPS are there in each region or in the entire country? How important are they and what are their chief characteristics? Questions such as these have received unsystematic answers and research findings in this field are often uneven or downright contradictory.

Using the methodology developed and based on the results obtained, this study makes it possible to map a few basic types of LPS. The results were obtained for São Paulo State but without any additional difficulty can be extended to other regions or to the whole of Brazil.

Four basic types of LPS can be characterized using the methodology presented. The first type comprises LPS which stand out for two reasons: they are enormously important to a region and also to the cluster of economic activities concerned. The Birigui footwear LPS is evidently important to the town and to the region, but it also accounts for a significant proportion of the children's footwear produced in São Paulo, and indeed in Brazil. The same can be said of Franca (SP) and Novo Hamburgo (RS), for men's and women's footwear respectively; or of Limeira for semi-precious jewelry and bijouterie. The dual importance of these LPS for a region and the sectors to which they belong makes them *centers of industrial and regional development*.

Alongside these doubly important LPS, there are systems which are of enormous importance to a particular industry or group of industries (as reflected in their share of production and employment) but are as it were diluted in a much larger, more diversified economic fabric: despite their considerable importance to industry, regional economic development does not depend on them so strongly. Several typical LPS sectors have sizable portions of production and employment located in regions with such a diversified economic fabric that their local contribution is far smaller: the region is important to the sector but the sector is less important to the region. This occurrence is typically associated with large industrialized cities and above all metropolitan areas. A clear example is the clothing industry in metropolitan São Paulo. Given the characteristics of this industry and the development of entrepreneurial functions as a complement to production, these LPS can be considered highly developed, not least because they have very significant complementary resources, and hence they can be termed *advanced vectors*.

If these local systems are important to an industry or group of industries but not to a region, there are others in precisely the opposite situation: they are important to a region but do not make a decisive contribution to the main industry to which they belong. The importance of the Dracena region to the production of structural ceramics in São Paulo State is not especially great, but can anyone doubt the enormous importance of this activity for the region? Similar cases include the knitwear industry in the regions of Amparo and Campos do Jordão and furniture in Votuporanga. This configuration represents above all a *vector of local development*.

Lastly, there is a type of LPS that has little importance for its industry and coexists with other economic activities in the region. It represents as it were an *embryonic local production system*. Examples include leather footwear manufacturing in Ourinhos, ceramics in Pirassununga, and farm machinery in Ribeirão Preto.

Chart 1 shows a typology of local systems involving a combination of two variables: the importance of the economic activity involved to the region (measured by LQ, i.e. specialization), and the importance of the region to the industry (measured in terms of the microregion's share of total production and employment throughout the state in that industry).

Chart 1. Typology of LPS according to their importance to the region and to the respective industry in São Paulo state

		Importance to the industry	
		Low	High
Importance to the region	High	*Vectors of local development*	*Centers of industrial and regional development*
	Low	*Embryonic local production systems*	*Advanced vectors*

Source: Authors elaboration.

Using this proposed typology the various LPS in the São Paulo State manufacturing industry identified in previous sections can be classified in one of the four quadrants. Some LPS in each type are shown in Chart 2.

Chart 2. Tipology and examples of LPS in São Paulo State

		Importance to the industry	
		Low	Low
Importance to the region	High	Araraquara – textile and clothing Amparo – knitwear Campos do Jordão – knitwear Dracena – structural ceramic Jaú – leather goods Votuporanga – furniture São José do Rio Preto – jewelry	Franca – leather footwear Jaú – leather footwear Birigui – plastic footwear Limeira – semi-precious jewelry and bijouterie Ribeirão Preto – medical equipment S. José Campos – electronic material
	Low	Ourinhos – leather footwear Pirassununga – ceramic tiles Limeira – machine-tools Mogi Mirim – ceramic tiles Ribeirão Preto – farm machinery	Campinas – textile Campinas – optical equipment and telecomunications São Paulo – clothing São Paulo – printing São Paulo – precision instruments

Source: Authors elaboration

This characterization may be valuable when formulating a comprehensive and consistent industrial policy for the highly diverse LPS universe. There are so many LPS in São Paulo State and throughout Brazil that an industrial policy designed to foster development of this sector would have to include "incentive packages" capable of encouraging local actors to offer active responses and effective commitments. The success of industrial policy depends on the involvement of private agents and social actors. Ensuring this involvement must be built into the policy and its instruments from the start of the design process.

Centers of industrial and regional development have developed vigorously and have a long history in almost every case. Given the intrinsic characteristics of this development process their manufacturing dimension is hyperdeveloped in relation to their commercial functions, including marketing. For this very reason an appropriate industrial policy designed to help these systems reach a higher stage of development and competitiveness would include a combination of commercial and industrial functions geared to moving beyond dependency on channels and other forms of selling, and to encouraging a focus on product development, brand equity, patent registration, design, certification, and quality.

Overcoming subordinate market insertion and a production function tied to high volume coupled with low price requires integrated and consistent development in both dimensions. The industrial policy "package" offered to systems of this type should include these two aspects and treat them in an integrated manner. A typical strategy for promoting these centers of industrial and

regional development would include education and training in higher technical skills and autonomous selling and marketing capabilities. The former can be provided by extending the existing education and training facilities, but the latter involve bringing together dispersed competencies and setting up new business associations or special legal vehicles.

Embryonic local production systems are the most numerous type, although the number of cases can be reduced if more rigorous filters are included in the methodology used. If the resources required for a policy of fomenting these embryonic LPS can be considered modest in individual terms, the number of such LPS and the probably incipient nature of the local fabric of organizations entails greater risks. Thus the industrial policy package for embryonic LPS should be associated with a concatenated sequence of conditioned stages, each clearly requiring matching local contributions in the form of funds, resources or some other involvement. Although in several respects embryonic LPS are diametrically opposite to the previous type described above (*centers of industrial and regional development*), it is important to avoid making the mistake of trying to force them to follow in a linear way all the developmental stages of their developed "predecessors". After all, today these veterans find themselves in the "blind alley" of high volume and low prices, and it will be no easy task to find a way out.

To avoid this trap industrial policy must from the word go take pains to encourage embryonic LPS to conduct market research that will help identify segments or even niche markets capable of being exploited by coordinated promotional activities. This is the best way to sidestep the temptation to focus on mere expansion of production capacity and downward competition, which drives down prices and quality. Industrial policy should include coordinated measures to provide the conditions for them to acquire the necessary technical and production-related capabilities for them to develop these market segments.

The systems comprised by *local development vectors* are those industrial policy is best equipped to foment. On one hand they have passed the embryonic stage and have the critical mass for their local importance to be recognized. On the other they do not yet face the difficulties inherent in *centers of industrial and regional development*, such as having to act as trailblazers and possibly make mid-course corrections. Because they are at a certain distance from these centers, *local development vectors* can avoid repeating mistakes and more easily identify opportunities. Their main challenge is to build a trajectory on the basis of sporadic or localized opportunities.

Advanced vectors, unlike all the other types mentioned, pose considerable difficulties for policy makers aiming to integrate them with a predominant dimension of regional development. They have minimal significance in regions normally much more developed and with a diversified and integrated economic (and social) fabric. This does not mean this type of local system is less structured or does not have strong links and relationships among its constituent elements, although they may not be very visible. However, the fact is that the surrounding economic fabric has multiple ingredients that can be mobilized to promote the development of the constituent elements of advanced vectors: this is a characteristic that differentiates them clearly from local development vectors and a fortiori from the other types.

Thus policy measures to foment advanced vectors should focus on mobilizing local resources to prevent the erosion of competitiveness which insertion of their products at the bottom of the market would inevitably cause if these systems were to depend on a cheap and plentiful supply of factors in areas (urban or metropolitan) where such factors are certainly far more expensive.

The policy instruments best suited to each of these types of LPS are evidently very different. The activities to be considered for embryonic local systems may be numerous but they will certainly be more basic. Experience in the field shows that in these cases basic ingredients such as courses on cost accounting and management are extremely useful and can be inserted in the initial stages of longer, more ambitious development programs. As for the more advanced types of LPS, be they centers or vectors, the appropriate policy instruments will involve larger volumes of funding and other resources, while also entailing greater risk in terms of the resources involved.

In any of the four cases discussed, policy should offer conditions for local protagonists — firms, entrepreneurs, workers, public and private entities, and the formal or informal associative fabric — to use their capacity for mobilization in favor of development. This means the policy cannot and must not take the place of local actors. Moreover, if it is to avoid failure from the start it must not include measures that weaken or stultify the autonomous development of the local system and its social forces. Protagonism of local institutions must be preponderant in any policy for LPS.

In addition, it is of crucial importance from the initial stages on to set a priority in the policy for *embryonic local production systems*. It is a commonplace in Brazil to acknowledge that LPS have developed only to a limited extent the co-operative mechanisms which, according to the paradigmatic view, characterize these configurations in other countries, especially in Europe and above all in Italy.

Co-operation is not something you invent, of course; nor can it be created by decree. But through incentives associated with local involvement and collectively assumed commitments, policy can lay the foundations for a strengthening of the local fabric and of local associativism, allowing co-operation and more effective collective actions to grow out of that. Thus the incentive package that is part of industrial policy for local systems should be geared to creating collective spaces and institutions, with shared management and public funding (to be phased out over time) as well as private funding (to be phased in over time). The initial stimulus provided by the policy through competition should explicitly and contractually require tangible matching contributions and institutional mechanisms of collective management, preferably shared among the social groups.

The mechanisms introduced to foster competition among local systems should ensure two significant results from the policy perspective. The first is tangible reciprocity, i.e. the contribution of local matching funds in proportion to public funds allocated to local systems under the policy. Thus for example the right to join a program of technical and vocational training centers or management courses should also be evaluated in terms of the local contribution. The second is evaluation of local membership (a priori), which could be used to prioritize demands from local systems, and evaluation of the results obtained (a posteriori) to help decide whether a program continues and/or should be redesigned.

At the opposite end of the LPS spectrum, i.e. for the promotion of *centers of industrial and regional development*, the same system of public competition for the resources offered by the development policy should produce responses in both dimensions, tangible and intangible. With regard to the former, it is possible to imagine reciprocity in each relevant aspect of local system development, regardless of whether the system through its collective institution(s) applies for resources under the policy only for some of the programs offered. Thus application for collective facilities for technology development should be approved only in exchange for efforts in other dimensions, e.g. education, training and the development of new commercial competencies. In respect of intangibles, it is both desirable and feasible that projects submitted for approval by public-sector development agencies should be appreciated in terms of a global vision of local system development and expansion strategy.

6. Final Considerations

This article sets out to advance further in the development of a methodology for identifying, delimiting and evaluating local production systems (LPS) by offering evidence that can serve as a basis for public policy measures and private support activities. To this end we have mapped LPS in São Paulo State and noted that this can be done without any difficulty for other states and regions. We have also proposed a classification of some basic types of LPS, presenting a series of policy guidelines for each of these basic types.

Formulators of a policy for fomenting and promoting LPS face significant dilemmas. On one hand the measures involved are potentially democratic because in most cases they relate to small firms often located outside metropolitan areas and belonging to economic and social fabrics that are relatively homogeneous. On the other hand, these policy measures and the possibilities they open up may fall far short of meeting the multifarious needs of the economic systems in question,

which are scattered over the entire country. These two elements should serve as a warning against discretionary effects of policy making and ensure that policy is geared to democratic and transparent management based on general criteria that are equally accessible to all LPS.

The interest of the methodology developed and presented here lies precisely in the fact that it allows LPS to be stratified into relatively homogeneous categories, for which packages of incentives and support measures can be provided in exchange for reciprocal contributions by local stakeholders. "Competition" for the incentives offered by such a development policy would thereby encourage LPS to mobilize local stakeholders, through representative entities or special-purpose vehicles, for more consistent and effective action. This would ensure that the policy would not have discretionary elements, stimulating active responses and carefully structured demands on the part of local stakeholders. Policy and local production systems alike would stand to gain substantially from this approach.

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Centers of industrial-regional development

Vectors of Local Development

Advanced Vectors

Embryonic Local Production System