

# Inter-firm relations, Collective Efficiency and Employment in two Brazilian Clusters<sup>1</sup>

Leda Gitahy, Roberto Ruas, Flávio Rabelo and Elaine Antunes

*This study analyses and compares the nature of inter-firm relations within two different Brazilian clusters, i.e. the shoe industry in the state of Rio Grande do Sul (RS) and the metalworking industry clustered around the city of Campinas in the state of São Paulo (SP) and their impact on industrial competitiveness and employment. It attempts to identify the major obstacles to the establishment of the flexible specialization (FS) model in both clusters and to assess whether this model shows a trend toward a core-periphery segmentation of the labour force and whether it contributes to greater workers skilling. The study shows that the diffusion of innovations associated with the FS model in the two clusters surveyed has followed different patterns and affect employment and inter-firm relations in different ways.*

Keywords: inter-firm relations, flexible specialization, shoe manufacturing, metalworking industries.

## Introduction

Recent research has acknowledged the growing importance of inter-firm relations, particularly between large and small units, in the restructuring process which the Brazilian industry is undergoing. This networking process between large and small enterprises, especially in terms of subcontracting, is one of the ways firms are seeking to increase their competitive advantages in order to face a recessive home market and an ever more competitive export market. There is not, however, sufficient data to evaluate the impacts of these arrangements on the overall performance of the firms involved and on the nature and quality of employment. At this moment, it seems necessary to better define the nature and extent of these relations (specialization, complementarity, subcontracting, cooperation, etc.).

In earlier studies, two examples have been described: the shoe industry in the state of Rio Grande do Sul (RS) and the engineering industry in the interior of the state of São Paulo (particularly the area around the city of Campinas). Data collected in 1989 presents the shoe manufacturing cluster in RS as composed of 1986 firms geographically concentrated around the city of Novo Hamburgo employing a total workforce of 198,492 (SCT, 1992). This region is the main shoe manufacturing center in Brazil, producing approximately 150 million pairs of shoes in 1990 with earnings of US\$ 1.8 billion. Exports from the RS shoe manufacturing region account for 85 per cent of total Brazilian shoe exports. The shoe industry in RS can be considered an autonomous productive cluster with the following socio-economic characteristics: (a) clustering of many enterprises of the same sector in a geographical region; (b) predominance of small and medium-sized firms; (c) vertical inter-firm divisions and product specialization, and (d) widespread subcontracting relations linking large and small firms (Ruas, 1985, 1989; Ruas and Antunes, 1992). As observed in the above mentioned studies, this cluster also combines advanced forms of flexibility with more rudimentary ones. This is the result of the association between new forms of production management (i.e just-in-time, manufacturing cells and work teams) and microelectronics-based automation (infrequent) and precarious and unstable forms of workforce management.

Research in the interior of São Paulo state on firms producing auto components, machine tools and computers (Gitahy, Rabelo and Costa, 1988; Rabelo, 1989; Rabelo and Costa, 1989; Gitahy, Rabelo and Costa, 1990; Gitahy and Rabelo, 1992) pointed to a complex industrial network, where the production of large firms was relatively integrated to a number of small and medium-sized suppliers. Although most of the large firms presented a high degree of verticalization when

---

<sup>1</sup> Published in Portuguese as Gitahy, L.; Ruas, R.; Rabelo, F and Antunes, E. (1997) "Relações interfirmas, eficiência coletiva e emprego em dois clusters da indústria brasileira", in *Revista Latinoamericana de Estudios del Trabajo*, nr 6, pp 39-78, ALAST, São Paulo (ISSN 1 405-1311).

compared to similar enterprises in the industrialized countries, they clearly demonstrated a trend towards decentralization. In all the firms visited, efforts to help small suppliers enhance their quality and productivity was verified. The large firms were moving steadily towards supplier certification, a necessary step before transferring a large amount of their internal production to the subcontracting firms.

A pilot study was conducted in 1988 among six small to medium sized (from 28 to 280 employees) subcontracting firms offering machining services. This pilot study revealed three important conclusions: (a) the subcontracted firms based their competitive advantage on the use of advanced machining technology, all of them employing numerically controlled machine tools; (b) employment in these firms was much more stable during the 1981-1983 recession than in their large clients, a result similar to the one mentioned by Brusco (1982) in northern Italy; and (c) use of a skilled work force (machine tool operators and machine setters) better qualified in most cases than those employed in the larger clients.

Our paper proposes to compare the nature of inter-firm relations within these two clusters and their impacts on industrial competitiveness and employment. We hope to capture in our study some common modes of functioning and to be able to explain the observed differences. Some major points to be addressed are:

- (a) evaluate the nature of the inter-firms relations in the two clusters considering the concepts of "industrial districts" and "collective efficiency";
- (b) identify the major obstacles to the establishment of the flexible specialization (FS) model (supplier quality; economic instability; government industrial policies);
- (c) determine the main characteristics of employment in the firms operating under FS (including training, stabilization policies, job and wage structures), specially if FS contributes to greater employee skilling;
- (d) assess whether this model shows a trend towards the constitution of a core-periphery phenomena; and
- (e) analyze the perspectives and limits of the concepts of "industrial district" (ID) and "collective efficiency" (CE) in the study of industrial agglomerations in less developed countries (LDCs), including alternative strategies of employment and management.

## **Flexible specialization and collective efficiency in LDC'S**

The pioneering work which developed the concept of "flexible specialization" (Piore and Sabel, 1984) refers to two experiences of industrial organization which have proved to be effective in adapting firms to unstable and more segmented markets through greater flexibility and lower cost production. These two experiences are: (a) the vertically integrated production chains commanded by large firms present in the Japanese car industry; and (b) the association of more independent geographically concentrated group of small and medium sized firms in certain regions of northern Italy.

The so-called Japanese production system (referred to as "toyotism" in some studies have been using) has been widely discussed in organizational and managerial literature. Crucial to its success has been the ability to combine flexibility with standardization. From the viewpoint of work force management, these organizational innovations imply a shift from a model based in the extensive use of semi-skilled workers, to one based on the intensive use of a skilled, multifunctional and cooperative work force<sup>2</sup> (Gitahy and Rabelo, 1992).

---

<sup>2</sup> Quality control techniques such as statistical process control illustrate this point. Transferring quality control responsibilities to shop personnel, abolishing the traditional system based on inspector, usually requires wide retraining programs (Gitahy and Rabelo, 1992).

In the case of the geographically concentrated industrial complexes or "clusters", flexible specialization is based on an organization of the production process dominated by small and medium specialized firms which divide among themselves the various production stages of certain items or family of items (Schmitz, 1992). The principal features of this model include: (a) geographical concentration of firms belonging to the same industrial sector; (b) member firms of various sizes, while medium and small enterprises hold a prominent role; (c) productive specialization among firms along the vertical production chain, involving suppliers of all types of goods and services; (d) great flexibility in quantity and wide differentiation of products; (e) horizontal division of production among different firms through subcontracting and complementarity of activities; (f) the most effective of such industrial complexes base their competitive advantages on non-price factors; (g) low barriers to entry; and (h) access to information and service networks.

Such a structure is called a "cluster" of firms which enjoy "collective efficiency" through the ability of the cluster to create competitive advantages shared by all member firms, which the individual producer alone could not obtain. The major benefits provided by a cluster include: (a) proximity of clients to their suppliers; (b) the ability to create very dynamic market niches through the development of various suppliers of goods and services; (c) the presence of financial and technical aid institutions; and (d) the availability of a skilled work force. In regard to inter-firm relations, we must distinguish between vertical relations (complementarity in the production chain) and horizontal ones (which may range from fierce competition to some cooperative efforts).

Not every cluster, though, shows a tendency to specialization and innovation. To a large degree, this will depend on the nature of the manufactured goods and market dynamics. In less developed countries, more than in the developed ones, competitiveness implies the ability to quickly adapt to unforeseen circumstances. Besides flexibility and collective efficiency, some other structural elements may establish the specific characteristics of a cluster. Among them we may include the low cost of labour and the existence of a reserve work force. Under these conditions, it is common to find competitive strategies based on low prices, guaranteed by low wages and precarious employment conditions.

This is important since the patterns of human resource management will to a reasonable degree be a result of the competitive strategy followed by the firm. Though we do not assume here a deterministic relationship between business strategy and personnel policies, it is much more probable that a firm competing on low prices, in a market niche where quality is not much stressed, adopts precarious employment relations (low wages, high turnover) than one competing on the basis of quality. That is firms following the low road strategy (Sengenberger and Pyke, 1990:10) are more prone to give low priority to its human resources.

To study in greater depth the functioning of clusters in Brazil, we have chosen two examples: the metalworking industry in the Campinas region, whose dynamic is largely influenced by the restructuring effort of the car industry, inspired by Japanese production methods; and the shoe manufacturing industry in Rio Grande do Sul (RS), whose functioning is closer to that of the model cluster and whose strategy, especially for exports, is based on low prices and the availability of raw materials .

## **Collective efficiency in the shoe manufacturing complex in Rio Grande do Sul**

Our use of the concept of collective efficiency (CE) regarding the shoe industry in RS requires some clarification concerning the structure of this industrial complex, particularly its links with foreign markets and its main internal relations.

In the context of the industrial restructuring process taking place world-wide, a large part of the labour-intensive processes and those employing more mature technologies began to be increasingly

transferred in the late seventies to Third World countries. The production of leather shoes was one of the sectors which were relocated, due to its technological characteristics (the significant use of direct labour) (Ruas, 1985).

Shoe production in countries such as the United States, Germany and the United Kingdom suffered a considerable decline, particularly in those sectors destined to lower-income consumers where price is the ultimate competitive factor. These countries became importers of shoes, mostly from countries with relatively low labour costs. Among these countries, the Asian producers and Brazil occupy an important place.

Industrialized countries, however, tend to maintain the portion of shoe production destined to the upper strata of consumers (specially France, Germany and the United Kingdom). The demand for high quality shoes in these countries is complemented by production within Europe itself in Italy, Spain and Portugal. Imports from Third World countries, therefore, are mainly directed to lower income consumers.

Some companies which used to produce shoes in the U.S. and the EEC adopted the strategy of organizing import and distribution pools to control the shoe market in their home countries. Besides having their own distribution networks, these groups control design and marketing in the more massified segments of the shoe market. Given their strong basis in the world shoe market, they spread their activities all over the world, negotiating with internal producers from a privileged position on questions related to price, design, batch size and delivery schedules.

Shoe manufacturing is not an expressive activity in the aggregate of the Brazilian industrial sector. However, if one considers its role in employment generation, it is among the largest employers of labour in Brazilian industry. Wages and labour productivity, however, are very much below average. The principal characteristic of the shoe industry in Brazil is its links to foreign markets. Recent data places Brazil among the main producers and exporters of shoes, especially leather shoes.

The shoe manufacturing complex in RS holds a strategic position in Brazilian shoe production, representing around 75 per cent of total output of leather shoes, 80 per cent of the value of leather shoe exports and 75 per cent of the volume traded in foreign markets. Furthermore, shoes occupy the fourth place in the ranking of Brazilian manufactured goods' exports.

Some structural aspects of the shoe manufacturing complex which are relevant for the use of the concept of collective efficiency are listed below:

- (a) **Structure of the shoe manufacturing complex:** This complex is located in a 30 km area and includes producers of all types of raw materials, components, machines and services necessary for the manufacture of leather shoes. Notwithstanding the recession of the Brazilian economy that substantially reduced internal shoe consumption between 1989 and 1992, the shoe manufacturing complex in RS is still composed by around 1,700 firms, employing a total of approximately 150,000 direct workers (SCT, 1992). Employment depends fundamentally on export performance. In terms of infrastructure, the cattle herd of 25 million heads in RS plays a pivotal role in sustaining the shoe manufacturing complex. There is also a petrochemical industrial site a few miles from this region which supplies chemical components needed for the production of glues and paints.
- (b) **Size of the firms:** According to recent data from the Industrial Federation of RS, approximately 45 per cent of all shoe producers in the state can be classified as micro or small enterprises (up to 100 employees). Medium-sized concerns (101 to 499) represent 35 per cent, and large firms (over 500) constitute 15 per cent of the universe (SCT, 1992). The majority of these micro and small enterprises direct the larger share of their output to the internal market.
- (c) **Shoe production and technology:** In industrial sectors such as shoe manufacturing, innovations with greater transformation effects occur in long-term cycles, usually by adapting

innovations developed in other industrial sectors. The leather sewing machine (adapted from the textile industry) provides a typical example, as well as the moving line (adapted from industrial activities with assembly functions). The diffusion of innovations in the shoe industry, as in other sectors employing mature technologies, occurs as piecemeal technological development, i.e., small localized advancements in products/processes. This manner of absorbing technological development is particularly linked to the production of leather shoes. In fact, this is an industrial process with a relatively low level of mechanization, involving a series of very simple and independent operations, which demands little specific skill from the operator. Due to this technological characteristic, shoe production is a more labour-intensive industrial process. Such a configuration favours international relocation in search of cheaper labour. It also favours the establishment of subcontracting relations with smaller firms or even home working as these operations may be executed in different plants and subsequently integrated in another location.

(d) **Labour management:** Alongside the technological characteristics of production, personnel policies are also strongly affected by market competition. In this market, price is the main competitive factor, although consumers are increasingly demanding higher quality. The relevance of price leads producers to a management strategy focused on cost reduction. Within this logic, labour force management is one of the most affected areas. An analysis of employment conditions in the shoe industry points to the following dominant aspects:

- Intensive use of labour, since prevailing technological conditions imply that human labour is as important as machine and equipment to the production process;
- Low wages - workers in the shoe industry receive lower remuneration than the industrial average;
- High proportion of unskilled workers - the prevailing forms of work division and organization lead to an intensive parcelling process, where a large number of unskilled workers perform the larger part of a group of extremely simplified operations. In some firms, however, a certain degree of change in terms of diffusion of new management techniques and quality/productivity programs are already being noticed. We shall deal with these changes latter in this text;
- Relatively high turnover rates - a policy of high turnover rates is a common measure in this industry to keep wages down;
- Low labour productivity rates - taking into account the factors mentioned above - low wages, low motivation, low level of skills, high turnover - it is hardly surprising that productivity should be low.

(e) **New tendencies in production management:** A tendency toward reducing batch sizes for exports has been recently observed. This tendency has awakened a concern for flexibility of the production system among managers. As a consequence, the use of subcontracted work has increased, especially through so-called "domestic workshops". The tendency towards flexibility, along with growing demands for quality and reliable delivery schedules has raised concern over management development in the shoe industry. This is much related to the implementation of new organizational techniques, specifically those associated with the Japanese model. One of the major organizational innovations is the creation of work groups (specially in the sewing section), leading to a change of lay-out (U format), reducing distances between work posts and multiskilling. One of the main advantages of work groups is the reduction in intermediary inventories. The concept of mini plants, organized according to models (sandals, women's shoes, etc.), however, is still at project level in many firms, although it may prove to be a very helpful tool to gain greater flexibility. It is worthwhile mentioning efforts in the direction of quality improvement, the introduction of participative schemes for employees and increased concern with training. All these new practices are related to the principles of just-in-time production, which are being introduced in the shoe industry. It should not be implied that these

changes affect the majority of the shoe industry; the number of firms that have in fact followed this path is still relatively low (Ruas and Antunes, 1992).

- (f) **Microelectronics automation** - Although relatively later than other industrial sectors, the international shoe industry has recently began to introduce microelectronics-based automation to its productive processes. This will certainly cause significant gains in terms of quality and productivity. The main changes are occurring in design (CAD system) and in cutting and sewing processes, through the incorporation of microelectronics controls in conventional machines. In Brazil, this is still a very incipient movement and the electro-mechanical automation is certainly the prevailing mode.

A study of the shoe manufacturing complex in RS based on the concept of clusters (Schmitz, 1992), allows us to identify some of the characteristics which sustain this model, such as: (a) the existence of a real cluster, directed to the manufacture of a specific product, including around 1,700 firms located within a 60 km radius. This area embraces everything from raw material producers to manufacturers of machinery and equipment and all types of related services; (b) inter-firm division and specialization within the vertical production chain of shoes in this area; (c) horizontal relations, particularly subcontracting, involving large and medium firms (contractors) and micro and small ones (subcontracted); (d) a proliferation of medium and small firms, estimated to comprise 30 per cent of the work force in the shoe manufacturing complex (SCT, 1992); (e) availability of a skilled work force and of technical resources capable of handling with the majority of problems related to products or processes; (f) technical aid services specific for this industry and model institutions by Brazilian standards: the National Service for Industrial Apprenticeship (which houses a Leather Technology Centre for Leather and a Shoe Technology Centre). There is also a Regional School (FEEVALE), where the problems faced by the leather and shoe manufacturing complex are discussed; (g) rapid delivery of materials, components, equipment and services; and (h) national leadership in the sector. The presence of strong business associations such as the Brazilian Association of Shoe Manufacturers (ABICALÇADOS) and the Brazilian Association of Shoe Exporters (ABAEX) provides evidence of this.

These points listed above confirm the existence of a cluster in RS shoe manufacturing. A more detailed analysis, however, is necessary if we wish to identify the nature, characteristics, stage of development and the stability of the relations established within this cluster. This was the purpose of the research for this study, whose results we present below.

A total of 24 firms comprised the research sample. Ten of these firms had between 100 to 300 employees; seven, from 301 to 500; and 7, more than 500 hundred. All of these firms used leather as the main raw material, while 30 per cent of these firms also used synthetic raw material in a smaller proportion. Their main product line was women's shoes (made by 83 per cent of the firms), followed by men's (22 per cent) and children's (17 per cent) shoes. Average production for 1993 in the sample firms was around 2,300 pairs/day, resulting from gradual growth over the last four years. In 1990, for example, this average was 1,800 pairs/day. Shoe prices also showed an increase in the last five years. In 1989, the average price was around US\$ 9.80, and in 1993 this increased to US\$ 13.30. This may be due to the fact that in these period firms directed a larger share of their production to the export market. Even though we cannot consider a sample of 24 firms as representative of the cluster, it is possible to argue that the data collected in this research presents a fairly clear picture of the main relations within the shoe manufacturing cluster in RS.

## **Vertical and horizontal inter-firm relations**

The first point to be treated in this section is inter-firm relations. According to Sengenberger and Pyke (1990:2) those clusters associated with the concept of flexible specialization (FS) present strong networks among member firms: "specialization combined with subcontracting divides among firms the necessary work for the manufacture of a specific product". There are two types of inter-firm relations: vertical and horizontal.

## Vertical relations: among shoe manufactures and their suppliers and exchange of information within the cluster

Vertical relations are which that form a sector's production chain, including various related branches. In our case study, this includes: leather manufacture, components, glues and equipment, along with marketing, commercial and technical services. A cluster following the principles of FS thus is one where the many component items are manufactured by independent firms closely linked to each other. "In the ideal case the industrial district comprises in one and the same local area all the various activities required for the development, manufacturing and commercialization of a product. There are final assemblers, the producers of parts and components, or firms engaging in one of the successive vertical stages of production, producers of machinery and equipment, product designers, marketing firms, export specialists, banks, etc. That is, the district provides all the activities and services up-stream and down-stream from the final product" (Sengenberger and Pyke, 1990:11).

Regarding the relationship of shoe manufactures with their suppliers, we shall deal with the following factors: (a) percentage of purchases within the cluster; (b) product quality; (c) services rendered and (d) customer attendance. The first factor compares the amount of goods and services purchased within the cluster with those bought outside. The second and third deal with the client's perception of the quality of the good or service delivered within the cluster. Finally, attendance refers to delivery within the planned schedule, in accordance with the client's specifications, the devolution of defective products and technical assistance. Another element to consider is the exchange of information directed to quality enhancement and product development between clients and suppliers, where we will emphasize the perception of the shoe manufacturers (Table 1).

**Table 1: Vertical Relations among Shoe Manufactures and their Various Suppliers**

Nature of relation with suppliers	Delivery of goods and services (%)			Intensity of information exchange (%)		
	Large amount of purchases within the cluster	Quality beyond satisfactory	Services Rendered beyond satisfactory	Frequent (%)	Occasional (%)	None (%)
Leather	73	83	94	----	----	----
Other raw materials	1	78	72	----	----	----
Soles	72	50	73	----	----	----
Chemical products	89	95	100	83	----	----
Machine and e-quipment	67	84	73	22	67	11
Maintenance services	80	----	----	----	----	----
Sales agents	100	----	----	----	----	----
With clients and buyers				19	47	34
With consultancy firms				11	33	56
Use of specialized libraries				----	33	67
Contacts with specialized services - SENAI				56	44	----
Contacts with technological services - CTCCA				50	44	6

As we have seen, relations with leather producers are very satisfactory. This relation is of vital importance to the industry since leather constitutes the main element in cost composition and plays a marked role in product quality. It is worth mentioning that in the investigated vertical relations the

main contention of the shoe manufacturers was the price charged. Information related to vertical relations within this cluster demonstrate that the supplier-client interface presents characteristics of collective efficiency (CE), particularly in the following two aspects:

- (a) **Delivery of goods and services:** A first point to be made is that most material and equipment are purchased from suppliers within the cluster (however, a larger share of is now being brought from Uruguay, thanks to the Mercosur trade Agreements). There is also an overall satisfaction with the quality and delivery schedules of the goods and services purchased within the cluster. These goods and services are price competitive compared to the international market, as evidenced by the preference for local suppliers. Considering these conditions, it is reasonable to associate the vertical relations in this cluster with the concept of collective efficiency.
- (b) **Exchange of information:** We must also mention that there are no significant client-suppliers' interactions in this cluster directed to the enhancement of product quality. In the case of machine suppliers and shoe manufacturers, it was observed that 78 per cent of the latter firms do not exchange information with their machine suppliers. The interaction with commercialization agents is also fragile. From this it follows that information regarding the wishes of shoe buyers are relatively restricted. In the same manner, relations with consultancy firms and the use of technical libraries are not well developed. This points to a major weakness in the cluster, i.e., lack of rapid diffusion of information related to management improvement.

The only exception is relations with raw materials suppliers, where these suppliers have a clear interest in developing a closer relationship with their clients. We are dealing here with the relation between producers of chemical products and shoe manufacturers. The former have been seeking advice from the latter regarding the best manner to adapt their products to the clients' specific needs. It is worth noting that the sample firms have made more intensive use of institutions providing technological services such as SENAI and CTCCA.

## **Horizontal relations**

There are many forms of horizontal inter-firm relations; three principal types emerge in the shoe manufacturing cluster:

- (a) Cooperation between two or more individual firms producing the same good with the purpose to pursue some joint initiatives. Examples: consortiums directed to further sales in specific markets (e.g. exports) or to import raw material, cooperation in training and in research;
- (b) Specialization and complementarity in the production of the same final good. In this case, firms divide amongst themselves the stages of the production process;
- (c) Subcontracting relations. This is similar to the previous type, with the difference that here production is concentrated in a large or medium firm, which then organizes smaller units to integrate its productive process. From this results a relatively dependent specialization process.

It is clear that horizontal relations differ from the vertical ones. When dealing with relations between firms producing the same good, we must not forget the very active competitive struggle within the cluster, making it harder to develop cooperation among firms. The more efficient clusters, however, manage to combine strong competition with the establishment of some cooperative efforts like purchasing groups, joint training and research initiatives, etc.

### **(a) Cooperative inter-firm relations**

As can be seen from Table 2, horizontal inter-firm relations are much more fragile than vertical ones within this cluster. The dynamics of horizontal relations are to a large measure governed by chance, instead of a systematic and coordinated process.

**Table 2: Horizontal Relations among Shoe Manufacturers**

Intensity of Relations (in %) Type of Relation	Frequent	Occasional	None
Participation in consortiums	---	---	100
Contracts for borrowing machinery	11	11	78
Information exchange among firms	22	67	11
Visits to other producers	11	89	---
Visits from other manufacturers	17	83	---
Information exchange in social gatherings	28	28	44
Use of the Manufacturers Association bulletin	44	39	17

Information circulates among final producers in a personal and occasional basis. The greater part is exchanged through informal and social meeting involving managers and executives of these firms<sup>3</sup>. According to some interviewees inter-firm competition, specially between those producing for the home market, is the main reason for the low level of communication between shoe manufacturers. There was, however, some evidence detected in our research that this situation is beginning to change. Some firm directors recognized the need for enhanced cooperation, despite fierce competition among shoe producers. An exception to this general situation is the membership of shoe manufacturers to a producers association, which actively defends their interests.

### **(b) Subcontracting: a specific type of horizontal relation**

Subcontracting is a widespread practice within this cluster. In this type of relationship, large and medium-sized firms act as contractors, and small units as subcontracted firms. In this cluster, these small subcontracted firms are called workshops due to their artisan character. All the 24 investigated firms had been using subcontracted work during the last five years. Most of these firms (62.5 per cent) had between 1 to 15 subcontracted workshops.

According to the interviews, the amount of subcontracted work had been increasing in most firms since 1991 and has followed the pace of growth of the shoe industry over the past years. One must clarify here that subcontracting does not constitute a mere occasional practice within the cluster, in response to demand fluctuations, but is a fundamental component of the whole production system.

The characteristics of the main types of workshops<sup>4</sup> are shown in Table 3. It is important to emphasize the role of domestic and temporary labour, specially female, in this productive unit. The main reasons for subcontracting work, as mentioned by the interviewed firms are, in decreasing order of importance<sup>5</sup>: (1) fluctuation in demand; (2) economy of machines and space; (3) efficiency of subcontracted work; (4) lack of skilled workers; (5) high turn-over rate of female employees; (6) differentiation of ordered models.

Firms tended to work with the same workshops, although there is no formal agreement in this sense<sup>6</sup>. Subcontracting arrangements are established according to demand, both verbally and informally. When hiring a new workshop the contracting firm asks for an initial trial order (which

<sup>3</sup> According to a series of interviews, inter-firm cooperation depends basically on existing friendships among owners and managers of these firms.

<sup>4</sup> It is important to mention here the difficulty of obtaining information about workshops. For one thing, most have not legalized their situation fearing government taxes. The workers also reluct to give interviews, since they may be placed in employers' "black list".

<sup>5</sup> These answers showed a certain degree of contradiction. A motive as "economy of machines" does not seem reasonable in a period of high excess capacity such as 1992. The same logic applies to "scarcity of labour".

<sup>6</sup> Among the 24 sample firms, only 11 have effectively been working with the same workshops.

may be followed by an employee of the contractor). All 24 firms laid very clear specifications regarding their orders to the workshops. Contractors control the quality of the workshops through inspection of incoming supplies. Few of them control quality directly at the productive sites of the workshops. In exceptional cases, both forms of quality control are employed. If the received batch is not approved, the workshop must either rework the goods or face the full costs of the rejected shipment. Subcontracting firms have a External Services Department that is responsible for controlling quality and output volume in the workshops.

**Table 3: Characteristics of the subcontracted firms**

<b>Manual workshops</b>	Responsible for the greater part of the subcontracted work. Small enterprises, generally family based, executing manual operations, which are conducted in their own home. More commonly, they employ 5 to 10 workers on a fixed basis (generally family members), and use temporary labor according to market demand (in certain periods, this number can be quite significant). Temporary labour is mostly female and is contracted in neighbourhood homes. These workshops may then appear as an agent that centralizes orders and distributes work among the women. This is why this activity is also called "home distributed work". The intense use of female home work is due to the fact that these women generally have children whom they must look after, making it unfeasible for them to hold a full-time factory job. It is common for them to be helped in the subcontracted tasks by the children themselves or elder family members. Work organization is very rudimentary and tasks are very simple.
<b>Sewing workshops</b>	These workshops are more organized than the former, yet utilized less frequently. They receive the cut leather pieced and instructions on work to perform. They have sewing machines, albeit technologically inferior to those used in the subcontracting firms. One also finds here a combination of regular and temporary labor. Generally the regular work force is between 10 to 20 employees, mostly women aged 18 to 45.
<b>Workshops of pre-fabricated parts</b>	This is the most well-organized and less common form of subcontracted workshops. Its basic activity is the production of soles. Its work force is mainly masculine. This is the only type of workshop with more industrial than artisan characteristics.
<b><i>Facção</i></b>	It is a new configuration (after the mid 1990s): small firm, sub-contracted to produce shoes integrally. The subcontracting firm establish the design, bath, and final price and add it's label to the product.

The main criteria for evaluating the performance of an workshop are: delivery dates, quality of service and "rapid return period"<sup>7</sup>. The latter is on average three days for the workshop to execute the first order. From then on, deliveries should be done on a daily basis. Services are paid 15 days after delivery. Price setting is based on a time analysis done in the subcontracting firm and then negotiated with the workshop. The hourly value paid to workshops is calculated, according to interviewees, based on wages paid in the contractor. To this sum, an additional 12 to 25 per cent to cover costs and overheads is added.

From some of the answers given by the contractors, we may conclude that they consider their relationship with the workshops to be "cooperative", especially regarding joint problem-solving in a quick manner. Some of the contractors help the subcontracted firms to organize their production; others offer transport for finished parts/services. In other instances they lend equipment and execute maintenance work in the machines of the subcontracted firm. This type of aid is usually rendered to traditional suppliers and in periods of high demand. Anticipated payments and training of employees of the subcontracted firms are quite uncommon.

<sup>7</sup> The "rapid return period" is a way to pressure the workshops for greater flexibility. This practice implies a reduction in the size of delivery batches and in their period of delivery (becoming more frequent). The aim is to reduce in-process production and immobilized capital, since the large firms provide the workshops with most of the necessary raw materials.

Some interviewees considered the skill level of employees in the subcontracted firms to be regular, although inferior to those of the contractor's employees. As a matter of fact, the workshops have no selection procedures and promote no training. The slower work rhythm, however, allows some good results. According to a contractor's manager, workshops "can make good shoes, sometimes even better than here, because they have more peace and quiet to perform their jobs". Others consider workshops' employees unskilled, even unruly: "they are the laziest ones, they don't like to work in a factory". Manual workshops do not sign the work documents of their workers, employing them on an unlawful basis. Some sewing workshops, however, comply with the labour legislation. Some sources from the sample firms believe that less than 50 per cent of the workshops' labour force is legally employed.

### **c) Subcontracting, collective efficiency and employment practices**

Subcontracting is a common practice in this industry, involving large and medium firms (contractors) and micro and small ones - the workshops (subcontracted). Since subcontracting is mainly used for the production of more popular - and thus less expensive - models we may conclude that its use is linked to a cost reduction strategy. Subcontracting arrangements within the complex do contribute to greater productive flexibility. The practice of "rapid return period" implies a reduction in batch sizes and more frequent deliveries, pointing thus in the direction of flexibilization. This is specially true since contractors have to supply the workshops with raw materials, glue and paint so that inventory reduction represents a significant gain.

The model is characterized by an intense specialization of subcontracted work in line with the concept of collective efficiency: each workshop executes one or a restricted number of services, and the whole of the workshops encompass a large number of services. This endows contractors with many alternatives in terms of subcontracting.

Even though relations within the complex are marked by a high degree of informality, a tendency to work with the same workshops was observed in the subcontracting firms. Cooperation is normally limited to joint resolution of production problems, but more effective forms are already emerging. Contractors lend machines and give equipment maintenance to their more traditional suppliers. Other contractors have aided workshops to improve their work organization. Real technical assistance to workshops, however, is a very rare practice, and this is reflected in the quality of subcontracted work.

Although still hard to visualize, subcontracting relations are being affected by the new management practices based on the just-in-time concept. In the traditional system, firms worked with large production and process inventories, which also influenced subcontracting practices. The tendency now is to reduce inventories and establish more frequent delivery schedules. This requires providing greater monitoring and assistance to the workshops, while at the same time implies a greater amount of mutual trust.

When they point to "fluctuations in demand" as the principal motive for subcontracting work, interviewees are also referring to the high costs associated with the admission/dismissal process of temporary labour. A main reason for the use of subcontracting, therefore, is to reduce labour costs.

Employment relations within the workshops are very precarious: verbal and informal contracts and wages even lower than those paid to regular workers of the shoe industry (which already are among the lowest in the industry). Since no training is given to workshops' employees, the tendency is for these workers to remain outside the formal labour market, due to their low levels of skills.

### **Inter-firms relations and collective efficiency**

It is important to note that the characteristics of inter-firms relations within the cluster are directly associated to the main competitive strategy, i.e., produce with low prices. While this main the strategy of most firms, vertical inter-firm relations will be more associated to optimizing supply, through prices, schedules and services. This is why the concept of CE in this cluster is more linked

to purchasing conditions and easy access to material and services than to other interactive processes, such as the exchange of information.

Although these conditions are relevant for the sectors overall competitiveness, they are not sufficient to consider the client-supplier relationship as directly associated to the concept of CE. The exchange of information and client-supplier interaction are crucial features in the distinction between the spontaneously created and the advanced type of cluster. In this latter form of cluster, producers benefit through materials and equipment more adequate to their productive processes, while suppliers gain valuable information on the nature of their clients requirements. This same argument is valid for services suppliers. Such interaction generates efficiency, quality and innovativeness for the whole cluster.

There are however some client-supplier relations within the shoe manufacturing cluster that resemble the aforementioned model, such as with suppliers of certain raw materials, who are eager to have suggestions from their major clients. This would then be closer to the CE concept.

The dominant competitive strategy also influences horizontal inter-firm relations, i.e., possible cooperative efforts among producers of the same good. So far as price remains the main competitive weapon, though associated to low quality standards, competition among producers has been fierce, making it very hard to develop cooperative efforts. The research however has observed some changes in this situation.

### **Inter-firm relations and employment conditions**

When vertical inter-firm relations were analyzed it was observed that the level of cooperation between firms is still low. Therefore the impacts of these relations on the labour market, in each industrial segment included in the cluster, are still much restricted or difficult to identify.

We did not observe in our research any significant interaction between the various labour markets that compose the cluster (shoe, leather, chemical, capital goods, etc.). We can thus conclude that vertical inter-firm relations have not caused any major change in labor market characteristics within each segment. The only possible exception is the shoe metal artifacts producing segment, where employment conditions are more similar to those in the shoe than in the metallurgical sector. Employment conditions in this sector are more precarious than those prevailing in metallurgical firms.

What we can affirm is that the growing competitiveness of the shoe manufacturing sector in RS has caused an increase in the employed workforce in all industrial segments. From 1988 to 1993, for example, the average number of employees in the sample firms rose from 280 to 402 (70 per cent). The turnover rate, although still high, has showed a decreasing tendency in this same period: the number of employees dismissed by firms in 1993 was nearly one third of that in 1990.

Since horizontal cooperative relations are even less developed it was not possible to identify any impact upon employment conditions.

However, subcontracting does exert a strong influence on employment practices, when it regulates certain employment relations in the cluster, specially in periods of high demand (such as in 1992 and the first half of 1993). This regulating effect is in the sense of avoiding the growth of formal employment relations in periods of high demand (leading to widespread precarious relations) and keeping wages relatively low, particularly for unskilled workers.

### **Impacts on employment of the diffusion of the principles of flexible specialization (FS)**

Shoe manufacturers have been trying, specially in the last two years, to improve their production processes and adopt more efficient management techniques. According to our interviews, the main reasons for the diffusion of these techniques are: (a) perception of more demanding clients (94 per

cent of firms); (b) requests from export markets (78 per cent of firms) and (c) need to keep up to competitors (67 per cent of the firms).

The diffusion of (or plan to introduce) innovations in the sample firms are shown in Table 4. The introduction of these new methods is closely related to changes in demand patterns. This process has increased both the quality and flexibility of the sample firms. We can therefore affirm that most of these firms are adopting production principles associated to the FS concept. These changes have also a significant impact in workers' tasks and responsibilities. As a matter of fact, 62 per cent of the interviewed firms diagnosed a need to change work organization and industrial relations.

**Table 4: Diffusion of Innovations in the Sample Firms**

<b>Innovations in production management</b>	
Type of initiative	% of firms adopting it
Reduction of in process materials	94
Product simplification	72
Focalized lines	44
Quality control undertaken by line workers	44
Reduction set-up time	44
Statistical process control	39
Use of production cells	39
Improvement groups	22
Total productive maintenance	22
Kanban	22
<b>Innovations in work organization</b>	
Type of initiative	% of firms that plan to adopt
Quality control functions transferred to blue-collar workers	72
Reduction of quality control staff	56
Introduction of performance appraisal	50
Maintenance functions transferred to blue-collar workers	50
Work-groups	50
Reduction of hierarchical levels	33
Changes in the employee benefits schemes	33
Use of production incentives	28
Reduction in the number of maintenance employees	22
Reduction in the number of wage brackets for blue-collar workers	22

According to this data the main changes on the nature of workers' task and in personnel policies are: (a) increase in employee responsibility, including quality control over his own work process; (b) job enrichment, including maintenance tasks; (c) development of work groups; (d) creation of multifunctional workers; (e) greater control over worker performance, associated to the introduction of performance premiums and other production incentives linked to performance; and (f) possibility of greater worker participation in decision making over production, due to the reduction of hierarchical levels.

In order to prepare its work force to these changes, 89 per cent of the firms had initiated employee involvement programs. However, only 22 per cent of them were engaging direct production workers in this process through talks, conferences, videos, or group-meetings. At the same time, 72 per cent of the firms declared that they were preparing their top executives for the changes; 83 per cent developed programs directed to high level managers, and 78 per cent involved middle managers.

To encourage blue-collar workers 83 per cent of the firms were developing new benefits schemes: (a) medical and dental care (67 per cent); (b) transport: 50 per cent; (c) agreements with drugstores; (e) own cafeteria: 33 per cent; (f) basic employee family food needs basket: (33 per cent); (g)

agreements with supermarkets (22 per cent); (h) punctuality bonus (22 per cent); and (i) production/rationalization bonus (22 per cent).

These benefits may be seen as a compensation policy to support a new productive system where more responsibilities are given to workers and where new tasks are added to their jobs. One of the important aspects of these new methods is the promotion of job development, specially concerning the transfer of quality control and maintenance activities to blue collar workers. The new pattern of job description in the shoe manufacturing cluster in RS is therefore moving towards the concept of multifunctional worker. As a consequence of this our research observed a change in selection criteria: greater schooling and experience is now being demanded by most firms. As part of this process, 67 per cent of the sample firms said they are trying to reduce turn-over rates through increased benefits, a more competitive wage policy and more concern with human resources management.

The new attitude towards personnel management is requiring a training program for managers and foremen (78 per cent of the firms are adopting such programs). Training for blue collar workers is still very limited: around 60 per cent of the firms lacked a training program. The most common training mechanisms in these firms is on-the-job training with the aid of foremen. That is why the training of foremen is such an important factor (Antunes, 1993).

Until the end 1993, the employment level in the shoe industry in RS has been stable, increasing in some periods. This is due to two factors: (a) continuous growth in the production output of the cluster (with the exception of the late 1980s); and (b) slow diffusion with this industry of work rationalization methods, that along with the economic recession has been causing serious employment problems in the rest of the country.

These new work organization methods however are challenged by a competitive strategy based on low prices, still very characteristic of the sector, that is linked to a low wage policy and high employee turn-over rates. The constitution within this cluster of a labor market associated to the flexible specialization principle will depend on a large measure on the rate of diffusion of the new personnel management policies listed above. As our research showed this diffusion is still relatively limited.

### **Core-periphery phenomena in the cluster's labour market**

Data on subcontracting policies gathered in this research supports the hypothesis that in some aspects core-periphery phenomena (Piore, 1980 in Brannen, 1983) is present in the shoe manufacturing industry in RS. Within this frame, the labour market constituted by shoe manufacturing firms would be the core labour market, since here all firms have legally regulated employment relations, some of them even providing more generous benefits packages. On the other side, employment in the workshops forms the periphery labour market, particularly the manual and sewing workshops, where domestic labour is widespread.

In the peripheral labour market workers are less skilled than those in the core, since the former are engaged in more manual tasks, not having to deal with sophisticated equipment. This is particularly valid for the workshops rendering manual services. In the pre-fabricated workshops there is a need for a somewhat more skilled work force.

We can identify some particularities in the cluster's labour market that constitutes far more complex dynamism than the dual core-periphery phenomena. First of all the core labour market is not so skilled in terms of general employment conditions: low wages, most jobs are undemanding in terms of skill, low inter-firm mobility, lack of formal training policies and low concern for human resources management. Therefore if we compare this labour market configuration with employment condition in the metallurgical industry, we can only say that the shoe manufacturing labour market is a second rate core.

As regard the peripheral labour markets of the workshops there are also some caveats. In the first place, a large part of the work is of a domestic character, done by women who are also engaged with their household tasks, while their husbands are frequently employed in the core market. These women are barred from the core market by family, economic and cultural reasons, and their employment by workshops constitutes an effective form of increasing the household's earnings. Core and periphery are thus linked in an attempt to increase domestic earnings. Also contrary to the classical theory of labour market duality, we observed in our research mobility between within the two segments. There is the skilled employee that after years of work in the core market decides to open a subcontracting workshop. This decision may be due to the worker's own initiate or linked to seasonal economical conditions and difficulty in finding another job. Azevedo (1993:99) makes a very interesting comment based on this dynamic: "...if it is certain that some segments of the (informal) sector constitute a space for survival strategies of the excess work force in the developing countries, other sectors form a favorable soil for the establishment of small businesses, that in many instances are a more interesting alternative to wage labour".

There is also the case of skilled workers of the core markets (specially cutters or skilled sewers) who move to the periphery where they work as foremen in the workshops, helping the owner to supervise and train the work force. Another instance of mobility common among the more unskilled workers of the core market ("general services") is that were the employee asks to be dismissed, thus gathering the dismissal benefits. Afterwards he requests the unemployment dole (which is very low) and starts working in a informal basis (by piece work) with some workshop. Through this strategy some of these workers manage to earn more then in their former jobs in the core market. There is however the serious social risk that in periods of low demand these individuals are driven to the underworld life.

## Subcontracting networks in the metalworking industry in Campinas region

This case-study explores subcontracting relations in the Campinas region between three leading engineering firms (subcontracting firms) and a group ten of their micro and small metalworking suppliers (subcontracted firms). Tables 5 and 6 provide basic information on these firms. We initially approached the three subcontracting firms and asked them to list a number of their small suppliers of these services<sup>8</sup>. The subcontracted firms were then visited (some more than once) and a questionnaire dealing with general management procedures, technology, quality system, personnel policy was applied.

**Table 5: Characteristics of the Subcontracting Firms**

	Number of employees	Revenues/year 1992 in US\$ 1000	Localization	Main products
LF1	896	35,9	Indaiatuba	Friction elements for brakes
LF2	1.543	58,5	Sta Bárbara	Machine tools
LF3	342	36,5	Campinas	Brakes

The aim of this research was to investigate if and how the restructuring process taking place in the Brazilian metal-working industry was affecting relations between large and small firms, specially regarding impacts on employment conditions. That is why we chose to analyze three large firms in different stages of a restructuring process, affected in distinct manners by the current Brazilian economic crisis. Micro and small suppliers of these firms were included in this sample, since

<sup>8</sup> Firms with less than 50 employees.

according to the literature it is these type of firms that are more liable to succumb to a low road strategy, being as the weaker link in the productive chain.

**Table 6: Characteristics of the Subcontracted Firms**

	Number of employees	Revenues/year US\$ 1000	Localization	Activity	Supplier of
SF1	18	400	Sta Bárbara	Metal shaving	LF2
SF2	43	600	Indaiatuba	Die-making machining	LF1
SF3	1	24	Sta Bárbara	Metal polishing	LF2
SF4	5	108	Jundiaí	Die-making	LF1
SF5	7	156	Indaiatuba	Die-making	LF1
SF6	26	2,160	Campinas	Drawing	LF2
SF7	26	600	Indaiatuba	Machining	LF3
SF8	12	255	Sta Bárbara	Die-making	LF2
SF9	29	1,200	Sumaré	Machining	LF3
SF10	31	600	Piracicaba	Machining	LF1

It is our hypothesis here that the nature of subcontracting relationships suffers a notable change when there is a greater focus on quality. Of course contractors always demanded some conformance with preestablished standards from their suppliers, but price tended to outweigh by far quality considerations when choosing a supplier. Clients usually kept a group of subcontracted firms for the supply of the same service in order to stimulate competitive bidding. As a consequence the subcontracted firm lacked stimulus to invest in equipment, technology and manpower so as to execute that service in a more productive manner, since it could easily lose that contract to a competitor. For many small subcontracted firms the only way to keep reasonable profit margins was to follow a low wage policy for their workforce and disregard a large sum of the social benefits. Since most small metalworking subcontracted enterprises interviewed were founded by skilled workers from large firms, these owner/managers could take direct responsibility for product quality (maybe hiring one or two skilled workers), maintaining the rest of their employees unskilled and underpaid. In fact, most traditional literature on subcontracting point as one of the advantages of this system the lower wages paid in the medium and small subcontracted firms. When quality comes to the fore however, choosing the supplier mainly on the price factor may turn out to be a costly procedure.

It seems fit to explain why we consider that the Campinas region serves to illustrate the concepts of industrial district and collective efficiency. The Campinas region is formed by 83 municipalities<sup>9</sup> and is the most important economic area in the state of São Paulo, surpassed only by the metropolitan region (Negri, 1990: 88). In 1990 the population of this region reached the number of 4.5 million (13 per cent of São Paulo state's population). The region is characterized by a very dynamic industrial sector: in 1970 it accounted for 10.6 per cent of the value of industrial output of São Paulo; in 1980 this grows to 15.8 per cent, reaching in 1987 the amount of 17.6 per cent. With this last percentage the industrial production of the Campinas region constitutes 44 per cent of the total industrial production of the interior of São Paulo state and bit less in terms of total industrial employment of the interior. In 1987 the industrial sector of the Campinas region was responsible for 9 per cent of Brazil's industrial output. Within this industrial structure the most important segments are in decreasing order: chemicals, engineering, textiles and food processing. The output of the engineering industry of Campinas region is around one fifth of São Paulo state's total engineering output. The engineering industry has a long tradition in the area dating back to the thirties when

<sup>9</sup> Of which Campinas is the largest (circa 800,000 inhabitants). There are ten other municipalities in the region with a population between 100,000 to 200,000 inhabitants. The rest are small cities with less than 100,000.

some major national companies were founded: Dedini (machines and equipment for the sugar processing plants and alcohol distilleries); Nardini (machine-tools) and Romi (machine tools). Other important groups also established their plants in the Region on a later date: Robert Bosch (1958); Clark (1959); Varga (1945). The agro-industry (particularly alcohol, sugar, orange juice and paper manufacturing) are also important economic activities in this region.

Another relevant factor is the existence of many University campi in the region, along with various research centers (specially dedicated to informatics, telecommunications and agricultural research), and a large network of technical schools.

This complex economic scenario is supported by a extensive transport and services network, that is a model for the rest of the country. It is within this structure, closer to the notion of industrial zone than to industrial district, that some cooperative efforts between large and small firms, governmental and private teaching and research institutions has emerged.

### **Recent changes in the Brazilian autoparts industry and their impacts on the subcontracting networks**

The growth of autoparts industry is intimately tied to the performance of the automobile market. The first growth cycle of the Brazilian automobile industry began with the expansion in the 1957/62 period, which was followed by five years of relatively slow expansion. During this initial cycle a large number of component firms were established in Brazil, a significant number of them belonging to multinational companies. Besides the favourable outlook of the Brazilian market the arrival of the multinational firms may be also explained by the pressure of the automobile manufactures to have their traditional suppliers near them as a way to reach the required nationalization levels. An evidence of the growth of the autoparts sector is that already by 1962, nationalization levels reached rates of 86.4 per cent to 94.3 per cent depending on the type of vehicle (Tauile, 1984:9). The growth rate gains impetus again in the 1968/74 period and tends to decline from then onwards.

From the structural point of view there are two important aspects of the autoparts industry that is relevant for this study: a large proportion of medium and small firms and significant geographical concentration in the State of São Paulo.

Since the beginning of the crisis in the 80's the autoparts sector has pursued an aggressive strategy of penetrating in the foreign markets. Exports grew continuously from 1980 to 1989 (with the exception of 1982 and 1983). In 1989 exports reached the amount of US\$ 2,119.7 million, with a forecast of US\$ 2,300 million for 1990. It is worth noting that 62 per cent of these exports were destined to the North-American market and that a significant amount of them corresponded to motor parts, that is, to the "noble" parts of the vehicles (Sindipeças, 1991).

Throughout the decade the performance of the autoparts sector accompanied that of the economy as a whole, but tended to be somewhat more dynamic for its participation in the GNP grows from 2.2 per cent in 1980 to 3.2 per cent in 1989. Employment behaviour was much more unstable, reflecting more clearly the effects of the crisis. Employment fell more rapidly and significantly than the earnings of the firms, to regain only in 1986 the 1980 levels. From then on it maintains approximately the levels of 1980, reaching a peak in 1989.

Comparing employment figures of March 1989 with those of March 1990, one can see that of the total of 316,000 employees around 10,000 were dismissed after the Collor I Plan (Exame, 1990: 115). This phenomenon is due not only to the Brazilian crisis and the retraction of the internal market, but also to the restructuring process in course in the sector throughout the decade and that is part of the process of globalization and accentuation of competition going on at the international level.

The new government that came to power in March 1990, headed by President Fernando Collor de Mello, announced a major shift in the country's industrial policy. One of the main points of this new approach was a revision of the country's imports policy, giving it a much more liberal character. In a research undertaken by one of the authors among 19 leading autoparts firms in the State of São Paulo it was noted that the great majority of firms (16) did have some type of formal supplier quality evaluation, although only less than half (7) did assist suppliers in quality enhancement efforts. Quality training had been provided to purchasing department personnel in fourteen firms.

In two of three large firms analyzed in this study final purchasing decisions must come out of a consensus between the Purchasing Department and the people responsible for Quality Guarantee. In some cases people with experience in quality management are allocated in the Purchasing Department.

Under this new system the subcontracting firms have been trying to follow a strategy of reduction in their numbers of suppliers heavily based on their quality performance (price always remains an important factor) in some cases leaving only one supplier for each service/product. The idea then is to establish a more cooperative relationship with the selected suppliers. Cooperation can assume different forms:

- (a) aid the subcontracted firm in the development of better production technologies;
- (b) advise the subcontracted firm as to the improvement of their quality systems;
- (c) establish longer term purchasing contracts; and
- (d) early supplier involvement in the development of new products.

Previous research on subcontracting networks in the Campinas Region (Rabelo, 1989; Gitahy, Rabelo and Costa, 1990) yielded interesting information on the small and medium subcontracted suppliers. The sample was constituted of six firms located in the Campinas Region. The significant increase in employment and performance of these firms, are even more impressive when we consider that the early 80's were a period of severe recession in the engineering sector. In some of the sample firms employment levels remained almost unaltered during the worse years. Exploring the history of these companies, it was observed that with the exception of one firm, all others were founded by former workers with a reasonable experience in metalworking. In many cases these enterprises became the suppliers of the companies from where their owners originally came. The most common process is that in which a more specialized worker has an idea of the type of services the enterprise requires and sets up his own business to fill this gap in the market. The parent enterprise often encourages this process, because of its desire to decrease its verticalization levels. Close ties with one or some larger enterprises represented an important growth factor for subcontracted businesses. The small enterprises in this research avoided however becoming too dependent upon a sole client.

It is important to note that the enterprises in this sample, are among the most successful in their field. Their performance has allowed them to invest in more advanced technology - numerical control. According to one of the entrepreneurs interviewed, the most common course for this type of business is that after some years they can no longer meet their expenses with equipment, refraining from new investments and end up obsolete. The effort to constantly modernize equipment is generally very expensive. There are some companies, for example, that acquired their first NCMT at higher values than their fixed assets. Evaluating the technological capability in terms of knowledge of numerical control metalworking of each firm, gives an idea of the modernization effort of these enterprises. Purchases are heavily concentrated between 1985-1987, partially because of the euphoria during the "Plano Cruzado". No enterprise however demonstrated regret over the purchases nor financial difficulties because of them.

This stock of machinery is largely made up of relatively simple NCMTs; only two enterprises had a little more sophisticated machines (Milling Machines and Machining Centres). In the extreme of the

sample there was two firms: the first, which had only recently acquired a small NC lathe and the other, that had the most advanced machines, such as milling machines and machining Centres. Thus, they are enterprises that operate in very distinct market segments. This is also reinforced by the fact that they were located in different cities. The division of the market by location is also considerable in the sector, especially regarding smaller enterprises. Larger ones have a wider range of action.

In terms of manpower use the most important finding was the effort to stabilize the workforce noted in these firms and already mentioned in the beginning of this section. In order to satisfy the more stringent quality requirements of their clients some of the medium and small subcontracted firms have had to review their manpower policies. Many entrepreneurs recognize that low wages, high turnover rates and disrespect of the labour legislation are an obstacle to the constitution of a skilled and motivated workforce that is necessary for quality improvement. As we shall present in this paper the rate in which this change is happening depends to a large degree on the nature of the process technology, the firm's history and its position in production chain.

At the time it was not possible to compare wages, social benefits, training policies in the these subcontracted firms with those in the large subcontracting companies. This will be a major focus of our present study. To analyze effects of the subcontracting networks on employment we have chosen the following items: (a) training; (b) stabilization policies; (c) job and wage structures; and (d) remuneration policy (including social benefits).

According to the proposed model the medium and small subcontracted firms would have to engage in more active human resource strategies in order to achieve the desired quality plateaus. That would mean greater investment in training and in then stabilizing the more skilled labour force. In fact in order to qualify for an ISO 9000 Certificate firms must take some measures in the personnel arena. Auditors require that employees demonstrate a full knowledge of the production procedures (including inspection measures). Participative programs, for example, are mentioned by some large firms as an important method of achieving this personnel related goals. It is important to compare employment condition in the large clients with that in the subcontractors to see if there is a tendency for the core periphery phenomena. The tendency in the leading autoparts firms (Gitahy and Rabelo, 1992) is to work with a reduced, better remunerated and more skilled workforce.

### **Technology, quality and employment in the sample firms**

Among the large firms of our sample, two are producers of autoparts and the other manufactures machine tools. This last firm has a long tradition in terms of product innovation, having been the first firm to produce NCMTs in the country (in 1978). Even though all three firms have been strongly affected the economic recession of the early 1990s, the machine tools manufacture, as all the capital goods sector, was the more severely hit<sup>10</sup>. Employment fell heavily in all three firms. LF2, for example, had 5000 employees in 1980, reducing this number to nearly 2000 in the 1981/83 crisis, having then climbed to 4000 in 1987, falling afterwards to the present level of 1563. Another case is that of LF3, a firm that was established in the Campinas region in 1981 and reached a level of 500 employees in the late 1980s. Following a restructuring process began in 1990 and affected by the recession this number reached the present level of 340 employees. The difference between the two most recessive periods of recent Brazilian industrial history (81/83 and 91/92) is that in the second, a good number of firms is undertaking a restructuring project aimed at creating a leaner structure. This means that in the event of economic recovery these firms do not intend to reach former employment levels, since they plan to regain production with fewer, more skilled workers (Table 7).

---

<sup>10</sup> The less restrictive commerce policy adopted in this decade has also worsened this firm's situation, since imported Numerical Controls are much more competitive.

**Table 7: Ownership, Earnings and Employment in Large Firms**

Firm	Ownership	Earnings 1990	Earnings 1992	No of employees 1990	Nr of employees 1993
LF1	100% national	49,0	35,9	ND	896
LF2	100% national	88,8	58,5	2321	1563
LF3	100% American	30,4	25,4	396	342

Table 8 presents employment behaviour in the subcontracted firms. Only three of these firms were created prior to 1980, three were founded in the 1986-87 period, and the remaining three, between 1990 and 1991. The foundation of these last three seems more closely associated to the outsourcing process going on in the large firms (Table 10).

In the case of the older firms, we can see that employment follows production levels from 1985 to 1989, falling during the economic crisis of the early 1990s. In the firms created in the mid-1980s there is some growth from 1989 to 1990, followed by a decrease and then stabilization. In the last three, we observe a small growth in employment since their foundation. Anyhow, employment tend to fluctuate less in the small firms then in their large clients.

**Table 8: Employment in Small Firms**

	1980	1985	1986	1987	1988	1989	1990	1991	1992	1993
SF1	-	-	-	-	-	-	-	14	16	18
SF2	70	60	nd	nd	nd	93	nd	50	45	43
SF3	-	-	*	1	1	1	1	3	1	1
SF4	-	-	-	1	nd	nd	nd	8	5	5
SF5	-	-	-	-	-	-	-	2	2	7
SF6	-	-	-	-	-	-	10	30	26	26
SF7	nd	19	24	nd	28	35	35	35	30	26
SF8	8	25	nd	nd	nd	nd	nd	15	12	12
SF9	-	-	nd	nd	nd	nd	28	28	28	29
SF10	-	-	3	nd	nd	75	35	nd	nd	31

\* only the owner  
nd: Data is not available

In terms of a restructuring strategy, the three large firms are in quite distinct stages. LF3 is clearly the most advanced, having completely reorganized its layout adopting the concept of cellular production and just-in-time. The program followed is a very systematic one and has always had strong support from the President and chief executives. The whole job classification and career structure has been adapted to this new philosophy, providing the guidelines for multifunctional employees. This firm is now preparing itself for certification according to the ISO 9002 norm by the end of 1993. It has recently obtained top grades in evaluations made by their main clients. In firm LF2 the quality enhancement program, that had considerable scope in the mid-1980s, was virtually paralyzed with the crisis of the early 1990s. Only its foundry unit has kept up progress in this area. Other productive units are presently having their quality control function reorganized in a very slow pace. There is a general lack of resources and personnel. Notwithstanding this it is regarded the more reputable of the national producers of machine tools. Firm LF1, after trying to introduce a series of piecemeal quality improvement techniques is no success, started two years ago a more comprehensive quality program. It is still in the initial phases but has gained strong executive support. A steering committee was created, involving all top executives, that jointly establish aims with the consultants. Table 9 give a picture of the situation of the large firms.

**Table 9: Innovations in the Large Firms**

<b>Innovations in production management</b>			
Type of initiative	LF1	LF2	LF3
Use of equipment employing microelectronics based automation	yes	SFM CNC	CNC
Reduction of in process materials	yes	yes	yes
Product simplification	no	yes	yes
Quality control undertaken by line workers	yes	yes	yes
Reduction set-up time	yes	yes	yes
Statistical process control	yes	yes	yes
Use of production cells	no	yes	yes
Improvement groups	yes	yes	yes
Total productive maintenance	no	yes	yes
Kanban	no	no	yes
Just-in-time internal	no	no	yes
Just-in-time external	no	no	introd.
Supplier development	yes	yes	yes
<b>Innovations in work organization</b>			
Type of initiative	LF1	LF2	LF3
Quality control functions transferred to blue-collar workers	no	no	yes
Reduction of quality control staff	no	yes	yes
Introduction of performance appraisal	no	yes	yes
Maintenance functions transferred to blue-collar workers	no	yes	yes
Work-groups	yes	yes	yes
Reduction of hierarchical levels	yes	yes	yes
Changes in the employee benefits schemes	yes	yes	yes
Use of production incentives	no	no	no
Reduction in the number of maintenance employees	no	yes	yes
Reduction in the number of wage brackets for blue-collar workers	yes	yes	yes

All three large firms are adopting supplier development programs with the purpose of increasing their present outsourcing levels. This aid to suppliers is specially relevant to the smaller ones<sup>11</sup>. This process involves an initial effort to evaluate the suppliers quality level and its willingness to introduce quality improvements. The aim is to reduce the number of suppliers keeping only those with required quality standards or that are demonstrating a capacity to reach. Again LF3 is the more advanced in this process, what is a direct reflection of its more systematic and mature restructuring strategy. The reduction in supplier number implies a shift from the traditional practice of price bidding among suppliers of the same part to the development of more cooperative relations with the selected suppliers. These latter will then have a more stable production forecasting allowing them to undertake greater investment towards quality improvement. The large firm will benefit, among other things, by eliminating quality inspection from deliveries by these selected suppliers. Both LF1 and LF2 affirmed a willingness to follow the same strategy. LF2 has been particularly active in aiding former employees to start their own business, becoming them their privileged supplier.

In Table 10 we have a history of the small firms of our sample. Most of them were founded by former employees of large firms of the region, with considerable experience in their respective fields, associated to a many informal contact network chains formed during their careers. It is through these chains that the prospective entrepreneur gears his firms to some precise market niches. Some of the small firms included in our earlier research are now medium-sized and have their own product along with the machining services line. In many cases the large firm aided their

<sup>11</sup> The three firms have a cooperation agreement with the University of Campinas (UNICAMP) and the Brazilian Aid Service for Micro and Small Firms (SEBRAE) in the area of supplier assistance and development.

former employee in starting his new venture. This is the case of SF8 where the large firm, where the owners worked, assured the necessary demand for the firm's initial operation. With the exception of SF1 (80 per cent of its production is directed to LF2) and SF3 (works only for LF2) all other small firms have many clients. What seems to have changed since our earlier study is the presence of a more explicit and active outsourcing policy by the large firms.

**Table 10: Year of Foundation, Activity and Origin of Owners**

	Year of Foundation	Activity	Origin of Owners
SF1	1991	Shaving, painting and welding	The owner worked for thirty years in LF2. He was responsible for quality guarantee in his section.
SF2	1957	Die-making and machining services.	The founder was a Spanish immigrant with previous experience (in Spain) at a metalworking firm.
SF3	1986	Metal polishing.	The owner was an experienced polisher in LF2.
SF4	1987	Die-making	Three brothers. All had previous experience as workers in metalworking firms in the region.
SF5	1991	Die-making.	The three owners worked in a local car component firm. One was chief of the die making section, and the others were die makers.
SF6	1990	Drawing	One of the owners was an experienced metallurgical Engineer with previous experience in large steel plants. The other was a successful steel sales representative. They own another small firm in São Paulo.
SF7	1973	Machining services.	Family enterprise. The father and two sons came from the rural area. They had sold a small property and did not know how to invest the money. They had no previous knowledge of mechanics. One of the sons studied with a friend who as an engineer and thus learned the basics about milling.
SF8	1974	Die-making and machining services.	The two owners worked in large local firms as die-makers (one in a major car component manufacturer and the other an important engineering firm). It was these two large firms that guaranteed the initial demand for SF8.
SF9	1986	Machining services in automatic lattices.	The owner was production manager in a small machining services firm of the region. He came directly from the countryside to this first job.
SF10	1986	Die-making and machining services.	The owner had worked in many large metal working firms of the region. He acquired considerable experience before establishing SF10. Besides SF10 he owns another small firm. The business is managed by the owner, his wife and a manager.

Regarding the introduction of new technologies and work methods in the small firms, it is interesting to observe that this is partly connected to the experience acquired by the owner while working in large firms. SF1, for example, has a quality program inspired by what its owner learned as quality chief in LF2.

Table 11 list the more modern equipment acquired by the small firms. We can see that six of them employ microelectronics based automation equipment (CNC lathes and milling machines, digital electric erosion machines). Quality programs are still in its beginnings in all of these firms, but all of them are taking part in a joint effort by UNICAMP/SEBRAE and the large firms directed to the development of micro and small suppliers.

**Table 11: More advanced Production Equipment in Small Firms**

SF1	No microelectronics-based production equipment.
SF2	1988: CNC lathe: Romi Centur/30. 1992: Universal cylindrical grinding machine.
SF3	1 lathe Joinville TM150, acquired in 1987.
SF4	Milling machine Sanchez Blanes – digital 3 axes (bought in 1993 second hand form a large firm for US\$13,000). Tool electric erosion machine, digital 2 axes; manual electric erosion. Plans to acquire a CNC milling machine.
SF5	1991: 1 tool electric erosion machine (IBH, mod master 60 A); 1991: 1 horizontal grinding machine FERDIMAT 360x 640 mm; 1991: 1 lathe NARDINI ND 325 (capacity 650 x 2.200 mm) 1991: 1 lathe Parmo (from Argentine) Mod P 180 (capacity 360 x 1000 mm); 1992: 1 tool milling machine INFRESA FTV4CA, digital , 2 axes.
SF6	Has no microelectronics based automation equipment. Last purchases were a magnaflux device and mechanical cutters.
SF7	1987: 1 Romi Centur (CNC lathe) 130 1988 e 1990: 2 Nardini-Nodus (lathes) 1 lathe Nardini e 1 grinding machine centerless.
SF8	1988: Tool electric erosion machine (Engemaq EDM 200) 1988: Milling machine Romi U30 1987: CNC lathe/Nardini Sagaz GPR.
SF9	Firm has 25 automatic lathes and has no plan to buy a CNC one.
SF10	The more modern lathes are two ROMIs bought in 1988 and 1989. In 1993 bought a horizontal grinding machine, has 2 Grinding Center, 1 CNC lathe.

Quality programs are still incipient in the small firms. These firms however were very concerned in being able to rapidly attend to the quality standards demanded by their clients. Most owners were effectively engaged in the quality enhancement effort undertaken by all these firms (Table 12)<sup>12</sup>.

**Table 12: Quality Indicators in Small Firms**

	Quality Manual	Owners involved with quality management	Internal audits	Inspection plan for received materials	Registers exams of received material	Evaluates suppliers	Process capability studies	SPC
SF1	no	yes	no	no	no	no	no	no
SF2	yes	yes	no	no	no	no	no	no
SF3	being written	yes	no	no	no	no	no	no
SF4	no	yes	no	no	no	no	yes	no
SF5	no	yes	no	no	no	no	yes	no
SF6	no	yes	no	yes	no	no	no	no
SF7	being written	yes	no	no	no	no	yes	Introducing
SF8	no	yes	no	no	no	no	no	no
SF9	being written	yes	no	no	no	no	no	no
SF10	no	yes	no	no	no	no	yes	no

<sup>12</sup> Quality indicators used to build Table 12 are based on the evaluation criteria employed by the large clients when auditing their suppliers.

**Table 12: Quality Indicators in Small Firms (cont)**

	Quality indicators are generated	Preventive maintenance	Efforts to motivate employees	Training	Participative programs	Sheduling for checking equipments	Preventive actions to attend clients	Cooperation with clients in Quality area
SF1	no	yes	informal	little emphasis	yes	no	no	no
SF2	no	no	Informal	idem	no	yes	no	yes
SF3	no	no	no	idem	no	no	no	no
SF4	no	no	Informal	idem	no	no	no	yes
SF5	no	yes	Informal	idem	no	yes	no	yes
SF6	no	partial	Informal	idem	no	no	no	yes
SF7	yes	no	Informal	idem	no	no	no	yes
SF8	no	no	no	idem	no	no	no	no
SF9	no	no	no	idem	no	no	no	yes
SF10	no	yes	informal	idem	no	yes	no	yes

### Skills and training in the sample firms

As regards work force skills, one of the main problems faced by the sample firms in their restructuring processes is the overall low level of schooling (Gitahy and Rabelo, 1988 and 1992; Gitahy, 1990 and Carvalho, 1992). In a research undertaken in 1991 among 18 large and medium-sized firms of the autoparts sector, Gitahy and Rabelo (1992) observed that in some of these firms the implications of this low level of formal schooling was only acknowledged after the failure to introduce some quality control techniques, such as SPC, due to the inability of shop floor personnel to perform basic mathematics operation and even to read the requirements written in the charts. Even though a higher level of schooling was beginning to be required as a selection issue by some firms (Gitahy and Rabelo, 1988; Peliano et al., 1987; Gitahy, 1990) it is only when firms start to introduce more systematic restructuring programs, involving quality management, that they demonstrate an increased concern with providing workers with enlarged training and educational opportunities.

This movement towards work force re-skilling is associated with the passage from a fordist/taylorist production efficiency model, based on the intensive use of semi-skilled workers, to a new model where high worker skills are essential for the firm's efficiency. An aspect of this trend is the diffusion of production systems based on the use of multifunctional workers. The raise in the level of formal schooling observed by Gitahy and Rabelo (1992) also reflects a selective dismissal policy adopted by most firms, where the less skilled workers are the first to be laid-off.

Table 13 compares the schooling level in the three large sample firms with that of the work force employed in the formal sector of the Brazilian economy<sup>13</sup> in all sectors, in the transformation industry and in the automobile-industry. As we can see schooling levels are significantly higher in the sample firms, specially if compared with those of the automobile sector, to which LF1 and LF3 belong<sup>14</sup>. The low level (LF1) and the higher (LF3) reflects the different stages in the introduction of organizational changes in the firms.

<sup>13</sup> RAIS data is collected from firms and refers only to formally registered employees of the formal sector.

<sup>14</sup> The engineering industry, specially the machine tool sector, traditionally has employed a more skilled and schooled work force than the auto assemblers and auto parts manufacturers.

**Table 13: Schooling level of Brazilian Workforce (Brazil, Transformation industry, Automobile Industry, Large Firms of the Sample) in % of Employment**

	Brazilian workforce* 1985	Transformation industry* 1985	Automobile industry* 1986	LF1 1993	LF2 1993	LF3 1993
Until 4 <sup>th</sup> grade complete	38,0%	49,7%	nd	33,5%	35,0%	30,1%
Until 8 <sup>th</sup> grade incomplete	51,5%	58,9%	69,3%	58,3%	49,8%	48,1%
Until 8 <sup>th</sup> grade complete	63,7%	80,3%	Nd	72,8%	60,6%	65,9%
Until secondary school incomplete	70,8%	86,4%	91,1%	82,3%	67,8%	69,1%
secondary school complete	15,4%	7,4%	5,5%	10,0%	17,2%	13,2%
Superior (complete and incomplete)	12,7%	5,7%	4,0%	7,6%	15,3%	17,6%

RAIS/MTB, author's tabulation for the automobile industry, in Carvalho (1992).

Nd: Data is not available.

Tables 14 and 15 allow us to compare schooling between large and small sample firms. With the exception of firms SF1 and SF6, whose activities requires lower skills and schooling levels, in all other small firms we have schooling levels similar to those of the large ones for workers in the same job classification. What is rare in the small firms is the presence of personnel with an University degree. In another research being carried out by the authors we have identified some medium-sized firms, with a similar history to the small one of this study, that are now hiring employees with college level (specially for quality management and sales)<sup>15</sup>.

**Table 14: Schooling in Large Firms**

Years of schooling	LF1		LF2		LF3	
	No emp.	%	No emp.	%	No emp.	%
illiterate	4	0.4	5	0.3	---	---
1 to 3 years	107	11.9	133	8.6	21	6.5
4 years	190	21.2	403	26.1	82	24.0
5-7 years	222	24.8	224	14.5	62	18.1
8 years	130	14.5	166	10.8	61	17.8
9 to 10 years	85	9.5	112	7.2	11	3.2
11 years	90	10.0	265	17.2	45	13.2
Superior incomplete	34	3.8	83	5.4	---	---
Superior complete	34	3.8	152	9.9	60	
Total	896	100.0	1543	100.0	342	100.0

<sup>15</sup> The owner of small firm employing around 100 workers mentioned that when he published a vacancy for someone with a University degree for metrology they received 250 curriculums. This gives a picture of the difficult situation of skilled professionals today.

**Table 15: Schooling in Small Firms**

SF1	Most have only up to 4 years ( <i>Primário</i> ).
SF2	Does not consider schooling an important factor. requires only experience. No idea of employees formal schooling.
SF3	Only one employee, who has a SENAI course.
SF4	Two die-makers with 2 <sup>nd</sup> degree and SENAI, two other employees have 1 <sup>o</sup> Grau.
SF5	All employees have 2 <sup>nd</sup> degree and SENAI.
SF6	Owner considers schooling level very low. There are many illiterate employees.
SF7	The majority has between 4 to 8 years of schooling. One has 2 <sup>nd</sup> degree (technician), and only other 5 employees have above 8 years schooling.
SF8	Majority has 2 <sup>nd</sup> degree (technicians). All are die-makers.
SF9	Shop floor personnel have only <i>Primário</i> (up to 4 years). Two setters have up to 8 years. Quality foreman has 2 <sup>nd</sup> degree (technician).
S10	Majority has at least 1 <sup>st</sup> degree (8 years schooling) and SENAI courses.

As for training programs the three large sample firms are in different development stages. LF2 has a long tradition in this area, having even created a Foundation that cooperates with SENAI in the technical training field. In the 1970s it sponsored a technical school in the field of electronics from where it hired its personnel for the CNC manufacturing unit. It also helped train their clients work force in the use of basic CNC techniques. LF3 has an intensive training program for its employees that is now tied to a new multifunctional career structure, where workers have to complete a series of pre-established courses in order to change levels. In firm LF1 a training program is now being organized as part of its overall quality enhancement effort. Presently it investing more heavily in managerial training in order to facilitate the introduction of the new quality techniques and gain cooperation from middle management. Training for shop floor personnel is too going to be provided, but presently it is not intensive.

**Table 16: Training Activities in Small Firms**

SF1	There is only one initial week of training, during work time. This training involves basic notions of security, quality control and equipment handling. Afterwards there are weekly meetings with employees, where they are asked to give suggestions.
SF2	No training is given. Until the machining foreman left they had weekly meetings to discuss quality related problems. Firm intends to promote this again.
SF3	Only one employee. No training.
SF4	The owner intends to use SENAI to train employees in quality techniques.
SF5	There is no planing, but they regularly take part in courses and lectures promoted by SEBRAE, clients and Industry Associations.
SF6	Only on-the-job training is provided. Worker requires one week to learn to operate machines, and up to 4 months are need to be a good worker. Has used SENAI for training.
SF7	There is no planing. Firm has used SENAI and SEBRAE for training. SPC was taught on-the-job.
SF8	There is no training program. Interviewee considers training, specially in quality area, to be too costly for small firms.
SF9	Firm intends to initiate a training program in the weekend dealing use of instruments, maintenance and blueprint reading.
SF10	Considers most employees to be already sufficiently trained. Rarely makes use of external courses (to reinforce some specific area). The employer's union plan to begin a series of training courses.

Table 16 describes training activities, still very incipient, in the small sample firms. What is mostly valued in these firms is the workers' previous experience, specially that obtained in the large firms.

Based on this perception one of the interviewees regarded the SENAI courses as unsatisfactory and another sought that most courses on quality were too expensive for small firms. Training, when considered necessary, is on-the-job, although some small firms do take part in events promoted by regional institutions (SENAI, SEBRAE, Employer's Associations, etc.). In the case of firm SF1 the owner organized a internal training course based on his experience in quality management while an employee at LF2. Another practice observed in the small firms was formal or informal meetings where employees are stimulated to discuss problems, mostly those related to quality, and present suggestions on possible improvements (Table 17).

## **Wages, Social Benefits and Industrial Relations**

One of the major problems Brazilian firms have faced when trying to introduce new forms of work organization is the reigning atmosphere of micro-conflictuality within the shop floor. This climate is a heritage from the labor management practices associated to the boom period of the Brazilian economy (1968-73), where the premises of a taylorist/fordist production system were aggravated by an authoritarian management style and difficulties in dealing with trade unions (Gitahy, Leite and Rabelo, 1993).

Recently the large firms of our sample have been trying to improve this situation through the introduction of participative schemes, employment stabilization (reduction in turn-over rates) and use of new job and wage structures, among other things. The strong economic recession, with high unemployment rates, has acted in the meantime as a disciplining factor on organized labor. Innovations are being introduced in the region practically without any negotiation with trade unions<sup>16</sup>. In this particular area both union and management have shown a strongly anti-negotiation tendency.

In the small firms industrial relations are less antagonistic in part due to the owners origins and to a more personalized relationship with workers. In many of these firms there are no unionized workers, and when owners complain of trade unions it is mostly to say that they do not distinguish the small firms from the large ones. Table 17 shows the existence of periodical meetings with workers, low turn-over rates and a high degree of formal employment. Temporary labor, even in periods of high production, was only found in one firm, while the others considered this practice incompatible with a quality service, since no commitment could be obtained from a temporary worker.

The costs associated with formal labor (social costs) seemed to be a hard burden for some of the small firms. Firm SF8 encountered, during a difficult period in 1992, a "creative" solution to this problem: all employment relations were abolished. Shop floor personnel and foremen divided themselves in groups giving origin to four new firms, that worked in a subcontracting basis for SF8. Generally these new firms provide services only for SF8<sup>17</sup>, which agrees in its turn not to hire outside services. Receipts are divided according to a fixed rule: 50 per cent goes to SF8 and the other half to the subcontracted firms involved in the particular service. Expenses with tools, raw materials are equally divided. This stimulates workers to take greater care for quality control since losses are also divided. More than attend to some kind of accounting principles, the purpose of this rule, according to one of the founders, is to establish a sense of justice among all participants, leaving it clear that no one is being exploited. They are now creating a maintenance scheme where every worker becomes responsible for the machine he operates. The interviewees mentioned a sensible improvement in quality and productivity since this new employment arrangement was established (a fact confirmed by personnel of LF1's purchasing department). Three factors seemed to have helped the success of this venture: (a) workers who created the four subcontracted firms had

---

<sup>16</sup> Trade unions have demonstrated a great development however in São Bernardo do Campo, where the large automobile assemblers are located.

<sup>17</sup> Occasionally the subcontracted firms get an outside job, paying then a rent to SF8 for the use of equipment.

been in SF8 for a long time (average of eight years); (b) the remuneration system pleased all those involved, besides the fact that the new arrangement provided greater time flexibility (no fixed working hours, only delivery dates); and (c) the owners' social origin (all die-makers) contributed to a better relationship with former employees. Besides reducing social labor costs, this new form of organization stimulated greater employee involvement and motivation. We do not know however how representative of a general tendency this case can be<sup>18</sup>.

**Table 17: Industrial Relations in Small Firms**

	Regular meetings with employees	Suggestion schemes	Conflicts with trade union reported	Turnover rate	Use of temporary labour
SF1	yes	yes <sup>1</sup>	No	low	no
SF2	yes <sup>2</sup>	no	Has good relations with the trade union, which is a member of CUT.	low	no
SF3	nd	nd	No unionized employees	nd	no
SF4	no	no	No unionized employees	Practically zero	no
SF5	no	no	Has some unionized employees <sup>3</sup>	Low, practically zero	Uses in an informal (illegal) basis
SF6	no	no	yes <sup>4</sup>	nd	no <sup>5</sup>
SF7	no	no	yes <sup>6</sup>	low	no
SF8	nd	nd	nd	nd	no
SF9	no	no	No unionized employees	Less than 2%.	no
SF10	yes	yes	nd	low <sup>7</sup>	no

<sup>1</sup> The owner had previous experience with QCs in LF2. He now tries to adopt this approach in his firm.

<sup>2</sup> Temporarily interrupted. The relation with employees is said to be good, many have been with the firm for a long time (starting as apprentices and becoming then die makers). Traditionally the firm has paid wages equivalent to those of large firms, but recently it has not been able to keep up with this practice.

<sup>3</sup> There are unionized workers; good relations with Trade Union reported.

<sup>4</sup> In part this is due to the fact that these are the only one firm located in the city of Campinas, were the metalworkers Union is most active. This does not mean that the others firms have cooperative relations with the Union, simply there is no unionization within them.

<sup>5</sup> Some experiences were made, but results did not please owners ("you can not demand much, neither invest in a temporary worker").

<sup>6</sup> There are unionized workers. Trade Union belongs to CUT. The firm had one strike, but it was interrupted through talks with employees.

<sup>7</sup> For two years no one left the firm.

Nd: Data is not available

We find significant differences in employment conditions when large and small firms are compared (tables 18 and 19). One of the main advantages of employment in large firms are the social benefits provided, especially important in a country where the State health system collapsed some years ago, public transport is expensive and unreliable, and the leisure options are limited and mostly

<sup>18</sup> In a sample of 40 small and medium-sized firms recently studied by the authors this was the only case with such characteristics. The owners of SF8 mentioned though that many other small firms were visiting them to emulate the experience.

inaccessible to workers. In Table 18 we observe that all large firms provide private medical aid, transport and meals, while others offer some leisure activities (a country club for employees). Small firms are far behind in this field, since their financial conditions restrict their capacity in this area. Table 19, however, shows that six of them provide some form of assistance and three others help with transport.

**Table 18: Social Benefits provided by Large Firms**

	Medical aid	Dental aid	Transport	Basic needs package	Others
LF1	yes	no	Yes	no	yes*
LF2	yes	yes	Yes	no	yes**
LF3	yes	no	Yes	yes	yes***

\* Scholarships, agreements with drugstores and supermarkets.

\*\* Country club, agreement with supermarket

\*\*\* Group life insurance, credit cooperative.

**Table 19: Social Benefits provided by Small Firms**

	Medical aid	Dental aid	Transport	Basic needs package	Others
SF1	no	no	no	yes	no
SF2	yes	no	no	no	no
SF3	no	no	no	no	no
SF4	no*	no	yes	yes	yes**
SF5	no	yes	no	no	no
SF6	no	no	yes	no	yes**
SF7	yes	no	yes	yes	yes**
SF8	yes	no	no	no	no
SF9	yes	no	no	no	no
SF10	yes	no	no	yes	no

\* The firm intends to establish a medical aid program in a 50/50% basis

\*\* Meals are provided

In Tables 20 and 21 we find comparison between wages paid in the sample firms for the same jobs. The differences observed are not only from small to large firms, but within firms of similar size. Wage differentials reflect both distinct labor costs among the various cities and the stage the firm has reached in its restructuring process. In firm LF3, for example, higher wages result from a new job structure, whose aim is to stabilize the labor force and develop multifunctional, cooperative employees.

**Table 20: Wages at Large Firms (june/93 in US\$)**

	Die- maker	Production machinist	Polishing machine operator	CNC lathe ma-chinist	Automatic lathe machi-nist	Metal-shaver	Grinding machine operator
LF1	665	nd	nd	nd	604	nd	nd
LF2	nd	nd	nd	525,6	nd	372	532,8
LF3	883	nd	nd	654,5	529,3	nd	605,8

nd: Data is not available

**Table 21: Wages at Small Firms (june/93 in US\$)**

	Die-maker	Production machinist	Polishing machine operator	CNC lathe machinist	Automatic lathe machinist	Shaver	Grinding machine operator
SF1	NA	NA	NA	NA	NA	240	NA
SF2 <sup>1</sup>	452-668	213-316	NA	NA	296-465	NA	NA
SF3	NA	NA	240	NA	NA	NA	NA
SF4	480	NA	NA	NA	NA	NA	NA
SF5	430-540	NA	NA	NA	380	NA	NA
SF6 <sup>2</sup>	NA	145	NA	NA	NA	NA	305
SF7	325-433	195-238	NA	238-347	282	NA	NA
SF8	470-940	NA	NA	NA	NA	NA	NA
SF9 <sup>3</sup>	NA	137	NA	NA	184	NA	NA
SF10	481	NA	NA	NA	251-481 <sup>4</sup>	NA	359-442

<sup>1</sup> General services and cleaning: 151 e 220 respectively. Foremen varies from 404 to 737 (production and die-making).

<sup>2</sup> Machine setter from 434 to 477. Recently all employees became salaried with a 10% linear increase when the change occurred.

<sup>3</sup> Production machinists and automatic lathe machinists respectively. Production foremen 369, and general services 128. Manager: 1085.

<sup>4</sup> Machinists (A, B e C) 481,418 e 251 respectively. Lower wages are for cleaners (149). Production foremen and machining programmer: 689. Spidle Machine Operator 502 to 558, and manager, 760.

Note: Wages refer to May 1993, and were received in the beginning of June US\$ 1 = Cr\$ 46.100,00.

na: Question does not apply.

Many of the small firms had previously paid wages similar to those of their large clients, but , according to their owners, the present economic situation no longer allowed them to follow this practice. The economic crisis, characterized by high unemployment rates, has made the simple factor of having a job already a very important asset, reducing wage demands in the small firms.

What we see then is a work force with similar characteristics, in terms of skill and experience, to those employed in large firms, in the small ones, with the difference that in the latter they receive lower wages, have fewer training opportunities and enjoy much less social benefits.

## Cooperation and competition within the cluster

The only experiences of inter-firm cooperation identified in this cluster were between the large firms and their small suppliers. No form of cooperation whatsoever was detected among the small firms. There is a total lack of associative practices among them. Events like borrowing tool, sharing a large order in peak times, exchange of technical/commercial information, frequently mentioned in the literature on industrial districts were not present among our sample of small firms. Rather we find fierce competition. It was, and in some instances still is, a common practice of the large firms to put a great number of small suppliers to bid for a service, inviting them to a virtual price war. As a result one had very unstable client-supplier relationships and an atmosphere of strong competition among the small service firms. Some of our small sample firms complained that clients were constantly demanding higher quality, but that the deciding factor when contracting a service was always price. This meant that they could loose a job to a competitor with much less quality but willing to offer greater price reduction. As we can see from Table 22, half of the small firms mentioned difficulties in price negotiation with their clients (which were not necessarily the large sample firms).

This situation is slowly changing, for as we can also observe from Table 22, six of the small firms already had some more stable supplying contracts with their clients. Firms, like LF3, were selecting

their best quality suppliers and establishing longer period business contracts with them, as long as they kept up to required quality standards. This provided the small client with a more stable demand forecast, facilitating an investment policy. Firms SF1 and SF3 had a special relationship with LF2, where their owners came from. LF2 had helped them to get started and assured both of them a minimum amount of work every month as long as they gave priority to its orders. LF2 even provided some of the necessary equipment for the founding of SF1, which were later paid in services.

Finally we should mention the consultancy provided by the small firms as an important cooperative arrangement. These small firms, specially those dedicated to die-making, have acquired a technical expertise that frequently allows them to give suggestion for the improvement of clients projects. SF6, for example, was providential in helping a large aeronautics firm in developing a project part, which many other suppliers did not consider feasible. Only two of the small firms did not mention any past experience in terms of consultancy for the large clients (Table 22).

**Table 22: Relations with Clients**

	Capable of providing consultancy.	Has a more stable supplying agreement with clients.	Difficulties in price negotiation reported.
SF1	yes	yes	no
SF2	yes	no	no
SF3	no	yes	no
SF4	yes	yes	yes
SF5	no	yes	no
SF6	yes	no	yes
SF7	yes	yes	yes
SF8	yes	no	yes
SF9	yes	yes	no
SF10	yes	no	yes

### **Flexible specialization and collective efficiency in the two cluster**

Diffusion of innovations associated to the flexible specialization model in these two clusters has followed distinct patterns and affect in different ways employment conditions and inter-firm relations. These differences result, to a large degree, from the diverse competitive strategies that dominate each cluster. In the shoe manufacturing cluster of Rio Grande do Sul competition is largely based on the ability to reduce prices, while in the metal-working cluster of Campinas product quality has a larger weight as a competitive advantage. The study has showed that quality is gaining ground among shoe producers in RS, but that price is still the dominant concern. Pressure from automobile assemblers, partly traduced in the need to comply to ISO 9000 standards, has changed the status of price competition in the sample firms of Campinas, and placed quality a major managerial issue. The "high road" approach, therefore, is much more clear among the firms investigated in the interior of São Paulo state.

Employment is growing in the shoe manufacturing cluster, where the core-periphery phenomena (under subcontracting arrangements) is quite clear and where the predominant form of flexibility is the numerical one. In the metal-working cluster of Campinas, employment is decreasing, but the trend is to constitute a more stable and better paid work force. In this latter case employment conditions in the small firms do not differ much from those prevailing in larger ones. Of course small firms lack conditions to provide similar training and social benefits, but the gap is much more narrow than the one observed in Rio Grande do Sul.

Geographical proximity has favored in both regions a close interaction between firms and teaching/research institutions, and the demand for training courses is increasing. Cooperation between large and small firms in the quality area is more intense in the Campinas region. These cooperative efforts are still hindered however by an environment of strong competition and by the

lack of any previous associative experiences within the prevailing taylorist/fordist model of the past. Economic instability that has characterized the Brazilian economy since the early 1980s is also an important obstacle to the establishment of new production methods, since it is difficult to undertake strategic planning in such an unstable climate.

It is our belief however that there is fertile ground for the development of cooperative experiences, involving large and small firms, public and private institutions, in both clusters, given the necessary stimulus from local authorities. If such policies are vigorously embraced by the main actors it is possible to reproduce both in Rio Grande do Sul and the Campinas region success histories (both in the economic and social sense) mentioned in the literature on industrial districts.

## Post-face

During the '90s, the transformations in the national and international scenario and the opening up of the Brazilian market affected the two clusters studied in different ways.

Even though the activities of the footwear enterprises continue to be concentrated on production, a stage in the chain in which the value added is relatively low (around 20%) and its main competitive strategy continues to be based on the reduction of the labour costs, these transformations led to important changes in the configuration of the RS cluster. For example, the consolidation of the opening up of the Brazilian market engendered an intensification of the relationship between the cluster producers and the suppliers and external producers, leading to difficulties at the level of internal cohesion.

Two examples are paradigmatic with regard to this new situation: in the cluster, the footwear producers' preference for imported machinery (that has caused a serious crisis for the local machine producers) and the massive exports of semi-treated leather - the wet-blue - which, in turn, has established a supply difficulty for the local producers. Besides these two examples, there is no doubt that the possibility of having the use, both rapidly and at a low cost, of the supply from suppliers located in other countries can cause a serious threat, as it precisely hits the key element of the cohesion of the cluster, that is, the facilities arising from geographical proximity.

Other issues related to the globalisation of the markets also seem to threaten to the continuity of the RS cluster. It is worthwhile highlighting the "Chinese phenomenon" that, in little more than five years, took up a priority role in the international footwear market, practically outdoing almost all the footwear producers of a low or medium-low price range on the North-American market. On the crest of this wave, many enterprises of the cluster under study were directly (among those that traded with the American market) or indirectly (those that were sub-contracted by export enterprises) jettisoned from the market. In this context, the shutting down of many enterprises and the dismissal of thousands of employees was observed.

Among the outcomes of this process, it is possible to highlight some movements that concern the configuration of the cluster. In the scope of industrial organization, a kind of centralisation of the sub-contracting process was noticed, through the consolidation of the *facção* as a transaction emerging from this type of relation. By means of the *facção*, the hiring enterprises increased the demand for sub-contracting of the finished shoe and reduced the demand for the sub-contracting of parts, that was predominantly carried out by workshops. In this new format, the relation between the enterprises and the workshops was weakened and the workshops started to give preference to the relationship with the "facções". On the other hand, the growth of unemployment triggered off the constitution of some workers' co-operatives. Some of these co-operatives, that at the beginning of their creation were stimulated by some entrepreneurs and representatives of the municipal town halls, had their production practically all dedicated to one or few enterprises. The production of these co-operatives is also oriented towards finished products, especially intensive labour and low price products.

Regarding the labour profile, a greater demand for schooling of the workers has been observed among the larger enterprises. This change in the criteria of selection, reflect, in most cases, demands for a more committed attitude towards the enterprise and the new procedures related to the quality of products and processes, i.e., that is, a new attitude among labourers.

With regard to the cluster studied in the Campinas region, from the mid '90s onwards, the upturn in the growth of the Brazilian automotive complex and the intensification of the competition at a national and international level violently accelerated the re-structuring process of the enterprises from this production chain. During this period, the diffusion of technological and organizational innovations appears associated with the increase in investments and a sustained movement of increase in productivity and the re-location of industrial plants that are translated in the reduction of volume and the re-location of employment.

Even though the Campinas region is one of the privileged areas in the location of new investments, the intensification of the process of reorganization of this production chain, in an environment of increasingly fierce competition and the increase in imports (global sourcing strategies) has provoked an intense concentration movement, through fusions/acquisitions or even closing down of enterprises.

Under these conditions, the process of restructuring along the production chain will intensify two tendencies observed in this study: on the one hand, the externalisation /internalisation of activities associated with focusing processes and, on the other hand, the tendency towards the reduction in the number of suppliers associated with the enormous pressure towards the formalisation of quality, flexibility and cost reduction (Abreu et alii, 1997). Thus, from the point of view of the vertical relations, we will see significant transformations in the division of labour between the enterprises and changes in the nature of the relation between clients and suppliers. So as to survive in this environment, the surviving small enterprises have strongly invested not only in machines and equipment, but also in quality and re-training programs for their workers.

This scenario has, to a certain extent, altered the configuration of the horizontal relations and increased the enterprises' relationship with different institutions located in the region, so as to amplify their possibilities of access to resources and knowledge that cannot be produced internally. Thus, the enterprises have aimed at participating and at establishing relationships with diverse types of institutions (trade unions and employers' associations, universities, professional training systems, consultancies etc.) so as to raise financial resources, have access to recent information and to solve urgent problems, but also because this relationship/participation is primordial for the diffusion of knowledge on the adequate forms of organization and for the subsequent legitimisation and institutionalisation of the new practices.

This process has important consequences not only for the employment structure (labour division among enterprises) but also for labour profile. The increase in productivity appears clearly associated with the introduction of technological and organizational innovations, linked to the concept of flexible specialisation and has involved the intensification of labour and greater demands of schooling for the hiring of labour, but in a context in which the labour market is extremely unfavourable to the workers and in which the workers' unions find themselves considerably weakened.

## References

- Abreu, A.; Gitahy, L.; Ramalho, J.R. e Ruas, R. (1997) "Produção flexível e relações inter-firmas: a indústria de autopeças em três regiões do Brasil", paper presented at Workshop "Produção Flexível e Novas Institucionalidades na América Latina", 18-20 de setembro, Rio de Janeiro.
- Antunes, E.D.D. (1993) "Treinamento ou Desenvolvimento de RH?" em *Caderno de Recursos Humanos, Programa de Eficácia Gerencial*, Ed. Ortiz, Porto Alegre.
- Azevedo, B. (1993) "A Pequena Produção Manufatureira: uma Interpretação à Luz de uma Nova Problemática do Desenvolvimento", *Ensaio FEE* (14), Porto Alegre.
- Brannen, P. (1983) *Authority and Participation in Industry*, Batsford Academic and Education Ltd., London.
- Brusco, S. (1982) "The Emilian model: productive decentralisation and social integration" in *Cambridge Journal of Economics*, nr 6, p.167-184.
- Carvalho, R.Q. (1992) "Projeto de Primeiro Mundo com Conhecimento e Trabalho de Terceiro?" em *Textos para Discussão* nr 12, DPCT/IG/UNICAMP, Campinas.
- EXAME (1990), *Melhores e Maiores*, agosto 1990, Ed. Abril, São Paulo.
- Gitahy, L. (1990) "Educação e Desenvolvimento Tecnológico: O Caso da Informatização da Indústria no Brasil", DPCT/IG/UNICAMP-IEP/UNESCO, apoio IDRC, mimeo, Campinas.
- Gitahy, L. and Bresciani, L.P. (1997) "Reestruturação Produtiva e Trabalho na Indústria Automobilística Brasileira", mimeo, DPCT/IG/UNICAMP, Campinas.
- Gitahy, L.; Leite, M. and Rabelo, F. (1993) *Reestruturação produtiva e a Empresa: Programas de Qualidade, Políticas de Gestão de Recursos Humanos e Relações Industriais*, Projeto: Estudo da competitividade da Indústria Brasileira, Bloco Temático V, Tema 3, IE/UNICAMP-IEI/UFRJ, mimeo, Campinas.
- Gitahy, L. and Rabelo, F. (1988) "Os Efeitos Sociais da Microeletrônica na Indústria Metal Mecânica Brasileira: o caso da Indústria de Informática" em *Anais do Seminário Padrões Tecnológicos e Políticas de Gestão: Processos de Trabalho na Indústria Brasileira*, DPCT/IG/UNICAMP, Depto de Sociologia/FFLC/USP, FEA/USP, São Paulo
- Gitahy, L. and Rabelo, F. (1992) "Educacion y desarrollo tecnológico: el caso de la industria de autopartes" in Gallart, M.A. (Org.) *Educacion y Trabajo - Desafios y Perspectivas de Investigacion y Políticas para la Década de los Noventa*, Red Latinoamericana de Educacion y Trabajo CIID-CENEP/CINTERFOR, Montevideo.
- Gitahy, L.; Rabelo, F. and Costa, M.C. (1988) "Inovação Tecnológica e Políticas de Gestão: Difusão de Novas tecnologias e Subcontratação em Empresas Metal-Mecânicas de São Paulo" trabalho apresentado no XII Encontro Anual da ANPOCS, outubro, Águas de São Pedro.
- Gitahy, L.; Rabelo, F. and Costa, M.C. (1990) "Technological innovation, industrial relations and subcontracting", paper presented to the I Symposium on "New technological and Societal Trends" (Session IV) at the XII World Sociological Congress, Madrid.
- Negri, B. (1990) *Diagnóstico Setorial: A Indústria de Transformação no Estado de São Paulo 1970-1990*, mimeo, Relatório de Pesquisa, IE/UNICAMP, Campinas.
- Peliano, J; Gitahy, L.; Cassiolato, M.; Bicalho de Souza, N.; Neder, R and Carvalho, R. (1987) *Automação e Trabalho na Indústria Automobilística*, Ed. UnB, Brasília.
- Piore, M. and Sabel, C. (1984) *The Second Industrial Divide - possibilities for prosperity*, Basic Boks, New York.
- Rabelo, F. and Costa, M. C. (1989) "Redes de subcontratação e novas tecnologias", paper presented at the Seminário Padrões Tecnológicos e Políticas de Gestão, USP/UNICAMP, São Paulo.
- Rabelo, F. (1989) *Automação, Estrutura Industrial e Gestão da Mão-de-Obra: O caso da Introdução das Máquinas-Ferramentas com Comando Numérico na Indústria Metal-Mecânica*, dissertação de mestrado IE/UNICAMP, Campinas.
- Ruas, R. (1985) *Efeitos da Modernização sobre o Processo de Trabalho*, FEE, Porto Alegre.

- Ruas, R. (1989) "Difusão de Novos Paradigmas da Produção Industrial: Convergência e Especificidades em Dois Segmentos Industriais" em *Anais do Seminário Internacional Padrões Tecnológicos e Políticas de Gestão*, BID, CNPq, USP, São Paulo.
- Ruas, R. and Antunes, J.R (1992) "Novas Formas de Gestão em Indústrias Tradicionais" em *Ciências Sociais Hoje*, Riofundo Ed., Rio de Janeiro.
- Schmitz, H. (1992) "On the clustering of small firms" in *IDS Bulletin*, Vol. 23, n. 3, July, Brighton.
- SCT (1992) "Tecnologia e Competitividade: Análise e Perspectiva da Indústria Calcadista do RS", mimeo 168 p., Secretaria de Ciência e Tecnologia, Porto Alegre.
- Segenberger, W. and Pyke, F. (1990) "Industrial districts and local economic regeneration: Research and policy issues" in Pyke, F. and Segenberger (eds) *Industrial districts and local economic regeneration*, International Labour Office, ILO Publications, Geneva.
- SINDIPEÇAS (1991 and 1996), *Desempenho do setor de Autopeças*, São Paulo.
- Tauile, J.R. (1984) "Employment Effects of Microeletronic Equipment in the Brazilian Automobile Industry", mimeo, ILO, Rio de Janeiro.