Patterns of Accumulation of Knowledge and Innovation in the Brazilian Textile-Garment Complex

ABSTRACT

This paper explores the patterns of technological knowledge accumulation of the textile-garment complex in Brazil in order to suggest industrial policies to reinforce the firms' competitiveness. The paper is based on micro-data from the Technological Innovation Survey (Pintec) and the Yearly Industrial Survey (PIA) of the Brazilian Institute for Geography and Statistics (IBGE) in 2005, through which Brazilian firms were classified as leaders, followers, fragiles and emerging companies. The results show the presence of strong inter and intra-sectorial heterogeneity and suggest that measures for technological policies should obey the different patterns of technological knowledge accumulation in each of these firm's categories.

KEY WORDS:

Knowledge Accumulation. Innovation. Textile-Garment Complex. Technological Policies. Brazil.

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1 – INTRODUCTION

The pattern of technological innovation in the textile-garment complex has its own traits, which may be understood through different theoretical and empirical perspectives: the intensity of Research and Development (R&D) costs (OECD), sources of innovation and appropriation mechanisms (PAVITT, 1984; LEVIN et al., 1987), accumulation regimes (NELSON; WNTER, 1982), inter-sectorial flows of technology (SCHERER, 1982; ROBSON, TOWNSEND; PAVITT, 1988), sectorial innovation systems (MALERBA, 2005) and specific forms of innovation in the so-called low technology sectors (HIRSCH-KREINSEN; HAHN; JACOBSON, 2008).

Based on these diverse theoretical approaches the textile-garment complex may be characterized as a dependent exogenous technical development, especially in the chemical and capital goods industry, characterized by the dominance of suppliers, according to Pavitt's (1984) taxonomy. Scherer (1982) identifies the textile-garment complex as a net user of technology, especially in those sectors which Robson, Townsend and Pavitt (1988) classify as "central" to the generation of technology, that is: electronics, machinery, instruments and chemicals.

Contrary to what may seem, the association between low levels of R&D and the absence of sectorial technological dynamism does not correspond to the reality of the complex (HIRSCH-KREINSEN; HAHN; JACOBSON, 2008). The excessive emphasis on studies of high technology activities may actually divert the focus from those which really account for most of the indicators of economic activity in any country. According to the authors, the study of the innovation patterns of low-tech sectors is justified for several reasons, given that these sectors: (1) show a considerable increase in productivity, (2) interact with high-tech sectors, depending on the technology process, (3) generate internal innovation, which may not be accurately captured by R&D statistics, and (4) constitute a key element of the capacity for innovation and the effectiveness of the industrial value chain in regions and countries. Some aspects of this dynamism can be found in the transformations that the textile-garment complex has undergone in recent decades. Globally, there has been a sectorial process of reorganization that has multiple dimensions, which can be summarized as technological, organizational and regional.[1]

In technological terms, there was the incorporation of machines and equipment with microelectronic components and advances in the chemical industry in terms of dyes and paints, or petrochemical as in the case of synthetic fibers. In this sense, the emergence of alternatives to cotton fibers is noteworthy; these are being increasingly incorporated into the manufacture of textiles and clothing, either replacing natural fibers or blending them. More recently, segments further up the chain, especially in the production of chemical fibers, show significant opportunities for the sector through the incorporation of scientific knowledge to the products, as in cases of applying nanotechnology to the properties of fibers such as strength, comfort, anti-odor effects, antibacterial, moisturizing and UV protection.

In organizational terms, there has been valuation and specialization in some corporate functions by large companies in the chain, such as global brands, marketing, product development, design, marketing channels, the ability coordinate the chain, management of suppliers and financial supports. These functions favor the textile-garment command chain and ensure higher earnings and appropriateness. In a parallel fashion, the tendency has been to transfer the productive activities themselves to third parties. In fact, a triangular production scheme has become common, where the large buyer places orders with suppliers, who in turn have several affiliate factories. There has also been a clear segmentation of the market so that the high priced, creative and quality markets coexist with low priced and standard goods markets.

In regional terms, there has been the displacement of productive activities through direct investment or outsourcing/subcontracting to regions or countries where labor costs are low. Strategies for subcontracting productive activities have stretched to Asia, Central America and the Caribbean, countries in North Africa

1 The information is based on the following studies: Lupatini (2004); Pio et al. (2003); Garcia et al. (2005); Monteiro Filho and Santos (2002); Antero (2006); Prochnik (2002); Serra and Carvalho (1999); Campos and Paula (2006); Garcia (2008) e Hiratuka et al. (2008).

and Eastern Europe. In Brazil, the reflections of these transformations have been noted, as various national companies have started to import articles such as synthetic jackets and Bermuda shorts from China. In addition, large weaving companies have transferred production units to the Northeast region in search of lower labor costs and fiscal and credit benefits.

Many of the transformations cited above are ways which the textile-garment complex has developed to aggregate knowledge to their products and increase the degree of appropriation of returns on investment in the face of the intensification of the competitive process in the industry. This shows that even a sector with relatively low R&D can create specific forms of innovation, provided this is defined as the implementation of new economic ideas, the exploration and understanding of markets and the use of market information to outline the creation of new products, principally because innovation is based on learning and not on findings. (ROBERTSON; SMITH, 2008).

The objective of this article is to identify patterns of accumulation of technical knowledge in the textile-garment complex in Brazil. This could be important to define technological policy measures to increase the competitiveness of Brazilian companies. The hypothesis of this article is that technological opportunities differ in inter-sectorial and intra-sectorial terms, when the textile industry is evaluated according to its different sectorial segments and the leaders-followers-fragile-emerging typology. (DE NEGRI et al., 2007). When focusing on the internal heterogeneity of the industrial complex, this article follows the theoretical perspectives that suggest the existence of different bases of knowledge, the actors involved in innovation, the interrelations between actors and relevant institutions, in addition to specific ways to innovate depending on the sector under consideration. (MALERBA, 2005; HIRSCH-KREINSEN; HAHN; JACOBSON, 2008).

The article has additionally three sections. In the second, the methodological aspects are presented. In the third, the importance of the textile-garment complex and the pattern of technological innovation among its companies are shown. The last section makes final considerations, associating the technological dynamic of the complex to the corresponding technological policy.

2 – METHODOLOGICAL ASPECTS

In order to identify which Brazilian companies are capable of the endogenous generation of technology and how they are organized to qualify themselves, De Negri *et al*. (2007), based on earlier work by De Negri and Salerno (2005), created the leaders-followers-fragile-emerging typology to differentiate between Brazilian industrial companies in terms of their ability to differentiate products and the way in which they accumulate knowledge to innovate. The database was organized by the Institute of Applied Economic Research (IPEA), with firms with more than 30 employees representing the totality of these companies in the Annual Industrial Survey (PIA), that is, the correct stratum of the PIA. In all, 25 thousand Brazilian industrial companies were counted between 1996 and 2006, representing more than 95% of the industrial added value. Information relating to technological innovation in firms comes from the sample expansion of the Survey on Technological Innovation in Brazilian Industry (Pintec). Both databases were provided by the Brazilian Institute of Geography and Statistics (IBGE). The database also includes information on exports and imports from the Foreign Trade Secretariat (Secex).

The categorization of firms starts with the concept that innovation is a strategy that allows companies to reap greater gains, particularly if there is product differentiation that allows premium prices to be obtained by the company. Such a view was disseminated by Porter (1980), featuring three different business strategies for companies: i) competition through differentiation, ii) price competition, in which there are homogeneous products and cost differentiation, iii) competition for niches. Among these, the first strategy, product differentiation, would be less subject to price fluctuations and competition by reducing costs, making it the most promising strategy

Based on these concepts, the typology adopted in this study comes from the notion that leadership is associated with the firm's participation in the market as an innovator, its consequent greater accumulation of capital and its ability to conquer international markets. There are two types of leadership that a firm can exercise in the market: i) leadership in product differentiation,

Table 1 – Leader, Following, Fragile and Emerging Companies in Brazilian Industry. Firms with 30 or More Employees (2005)

Type of Company	Number of Companies (Nº)	Annual Invoiced Revenue (average) (in million R$)	Employed People (average)(Nº)	Participation in Invoiced Revenue (%)	Participation in Job (%)
Leaders	1.114	501	978	43,3	21,0
Followers	10.105	63,1	253	49,4	49,4
Fragile	20.028	4,3	73	6,6	28,2
Emerging	469	17,9	149	0,6	1,4
Total of industry	31.716	40,7	163	100	100

Source: Taken from De Negri et al. (2007).

similar to what Porter (1980) called competition for differentiation, and ii) cost leadership, or, again in the words of Porter (1980), competition for price. In the first case, the company differentiates its product by associating it with desirable attributes to the consumer, which are not available from competitors. Thus they can charge higher prices and obtain a premium price. In the second case, technological leadership comes from the production of homogeneous products that cost less in comparison to its competitors.

The category of followers describes companies "with a large capacity to follow technological changes in their sector and consequently differentiate their products or carry out changes to reduce production costs", always following the technological leaders. The leaders and most of the followers can be considered the "nucleus generating new knowledge in Brazilian industry".

From a methodological point of view, the classification of the companies into each category is based on some indicators, summarized below:[2]

> *Leader Companies:* innovators of new products for the market and that export at premium prices or innovators of new processes for the market, exporters and low (lower quartile) cost/income ratios within their industrial sector (National Classification of Economic Activities Group (NCEA) to 3-digits);
>
> *Follower Companies:* other non-leader exporters or companies that have a work productivity equal to or above the non-leader exporters in its industrial sector (NCEA Group to 3 digits);
>
> *Emerging Companies:* companies that are not classified as either leaders or followers but that invest continually in R&D or innovate new products for the global market or have R&D laboratories (R&D departments that have Master's or PhD graduates engaged in R&D activities);
>
> *Fragile Companies:* all other companies serving the domestic market that in general do not innovate and have higher operating costs.

Table 1 shows the results of this processes classification of Brazilian industries. Note that in Brazil there are 1,114 companies (3.5% of the total) that were classified as technological leaders in their industries, accounting for 43.3% of revenues and 21% of the workforce of the Brazilian industry. Measured by average revenue, the scale of operation of the leaders is almost eight times higher than the followers, with almost 1,000 workers per company. The latter number is about 3.9 times that of the indicator for followers and 13 times higher than that of fragile companies.

3 – THE TEXTILE-GARMENT COMPLEX IN THE BRAZILIAN TRANSFORMATION INDUSTRY

The textile-garment complex represents 3.63% of Brazil's industrial transformation, 2.50% of employment and 2.20% of Brazilian exports. In particular, the textile industry represents 0.93% of employment and 0.79% of Brazilian exports, while the garment industry represents 1.57% of employment and 1.41% of Brazilian exports.

2 The validation of the classification was obtained through statistical procedures that identified whether the companies formed differentiated groups among themselves and by a discriminant analysis. See De Negri et al. (2007) for more details.

When weighing up the importance of the complex, the recent tendency of shrinkage in the sector must be emphasized, when the significant reduction of participation in these indicators since the mid-1990s is observed (Table 2).

By way of illustration, it can be seen that in 1996, the manufacture of textile products represented 3.42% of the Industrial Transformation Value (ITV) of the transformation industry. However, in 2006, this participation had fallen to 2%, representing a 42% fall in the aggregated value of the national industry. It can be observed that this result occurred in general in all the subsectors, especially in the spinning segment, which fell 60% in 10 years (from 0.72% to 0.29%). In the case of the garment industry there was a fall of 32% in the participation in the industrial aggregate value.

Regarding the indicator of net sales in the period 1996-2006 of the Annual Industrial Survey (PIA), there was a decrease of approximately 27% for the textile industry and 25% for garments. These percentages represent a loss of R$10 billion in the textile industry and R$6 billion in garments over the 10 year period (Table 3).

It is only from 2005, that an interruption in the downward trend in net revenue can be noted for both industries. In the case of textiles, revenue stabilized at around R$25 billion, whilst for garments there was a return to a growth in sales from 2004. The indicators for the gross production value and industrial processing also confirm the performance of net sales.

All these decreases reflect the low growth rates of the domestic economy until 2003 and the consequent stagnation of the levels of income and employment for most of the period under consideration. However, the increase in competition with imported products seems to have been decisive for this result.

The picture of weakening and loss of competitiveness of the entire system is reinforced by looking at data on foreign trade of the industrial complex. After successive growth since 2001, the trade balance of the textile-garment industry complex began to decline sharply after 2005 because of the higher growth in imports relative to exports (Graph 1). The behavior of the trajectories of imports and exports of the textile-garment complex is linked to macroeconomic factors and the competitiveness of the chain, such as currency fluctuations, domestic economic growth and the intensification of international competition, mainly from Asian products.

The problem is more chronic in relation to the segment of chemical fibers and threads, which are

Table 2 – Participation of the Textile-Garment Chain in the Industrial Transformation Value in Brazilian Industry (1996-2006)

	1996	2006
Manufacture of textile products	3,42%	2,05%
Processing of textile fibers	0,06%	0,03%
Spinning	0,72%	0,29%
Weaving	1,03%	0,60%
Manufacture of textile goods	0,41%	0,24%
Finishing services of threads and cloth	0,22%	0,15%
Manufacturing of textile goods from cloth – exclusive clothing	0,68%	0,54%
Manufacturing of cloth and knitwear articles	0,30%	0,20%
Production of clothing and accessory articles	2,32%	1,58%
Production of articles of clothing	2,20%	1,49%
Production of clothing accessories.	0,12%	0,09%
Total	5,75%	3,63%

Source: IBGE (2005).

Table 3 – Net Revenue from Industrial Sales, the Gross Production Value (GPV), Industrial Transformation Value (ITV) of the Textile-Garment Complex (R$ Billion)

Year	Net Revenue from industrial sales		GVP		ITV	
	Textile	Garment	Textile	Garment	Textile	Garment
1996	36,60	24,70	37,50	24,97	16,33	11,08
1997	32,70	23,20	34,14	23,47	14,20	10,14
1998	32,70	24,00	33,27	23,83	14,38	9,99
1999	33,80	20,90	34,91	21,12	15,52	9,32
2000	32,50	19,60	33,70	19,70	14,21	8,85
2001	30,80	18,90	32,04	18,82	13,07	8,65
2002	29,30	16,50	30,15	16,48	12,37	7,54
2003	27,00	14,40	27,72	14,30	10,43	6,49
2004	28,30	14,60	28,76	14,63	11,09	6,74
2005	25,60	16,60	26,18	16,73	10,41	7,02
2006	26,70	18,60	27,42	18,50	10,94	8,42

Source: Prepared by the Authors using the IBGE Automatic Recuperation System (SIDRA) and PIA.

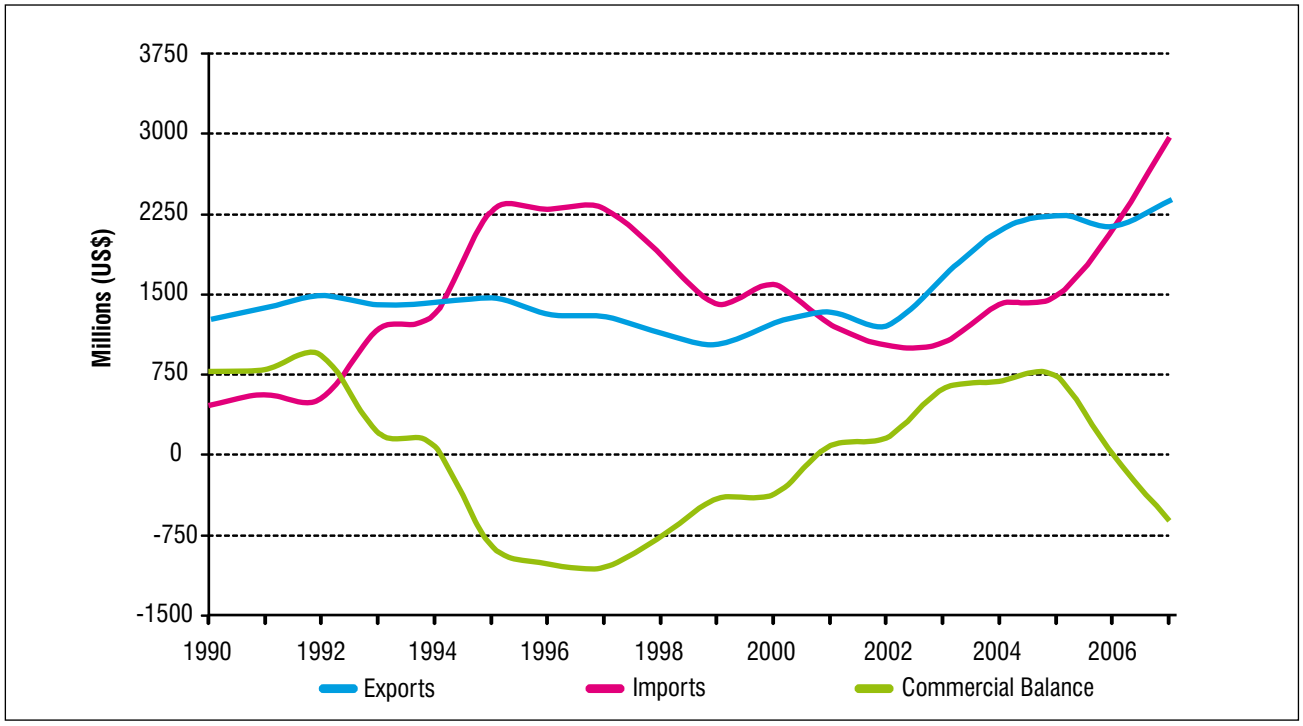
Notes: Values deflated using the Wholesale Price Index – Global Offer (IPA-OG).

lacking in Brazil to supply the internal chain of the textile-garment industry. This creates a demand for growing volumes of imports over time, especially from 2003 onwards, bearing in mind the increased use of these fibers globally due to their advantages, vis-à-vis natural fibers.[3] Although the Brazilian production of blended fibers mainly from natural fibers (cotton) is strongly competitive due to high productivity and low production costs, it is not possible to observe the trade surplus in the total trade balance of fibers from 2006, according to data from the Bureau of Foreign Trade (Secex).

Excluding fibers, fabrics and garments are the items with the highest average share in total imports of textiles, with respectively 59% and 32% in the period 1990-2007, based on information from Secex. However, the share of imports of textiles declined from 57% in 2000 to 40% in 2007, while the share of garments in total imports of textile products rose 28% to 40% over the same period. In the period 2000-2007, imports of textiles rose 71%, while garments rose by 242%. The data shows the chronic lack of competitiveness of the garment segment, which is precisely the link with the highest added value and that is potentially the most dynamic in the textile-garment chain.

Regarding exports, fibers had an increase of 195% in the period 2000-2007, thanks to the performance of natural fibers that rose 290%, as seen above. The exports of textile products, excluding fibers, were mainly due to garments and fabric, with average participations in textile exports of 60% and 30%, respectively, in the period 1990-2007. Two indicators reveal that exports of garments have been losing importance in relation to the exports of fabrics in the period 2000-2007. The first is the participation of garment in textile exports, which fell 62% to 49%, while in the case of fabrics the indicator rose from 32% to 44%. The second indicator is the growth rate of exports in the period 2000-2007, which increased 108% for fabrics and only 18% for garments. The modest result for garments contrasts with the global tendency, where this segment has had the biggest growth. The low representation of Brazilian garment exports is traditionally attributed to the large domestic market and the low competitiveness of the Brazilian textile productive chain.

3 Fleury et al. (2001) highlight that clothes with chemical fibers that are similar to those made with natural fibers in terms of comfort and have better usage characteristics (less ironing, better dirt repellence, less domestic laundry requirements), durability and have a competitive price. Viana; Rocha and Nunes (2008) highlight that these fibers are more resistant to wear and tear, increasing the productivity of the looms.



Graph 1 – Exports, Imports and Commercial Balance of Products of the Textile-Garment Chain, in U$D Millions (1990-2007)

Source: Prepared by the Authors using Data from Secex/Ministry for Industrial Development and Foreign Trade (MDIC).

The exports of the textile-garment chain have a large participation of products with a low aggregate value, bearing in mind that the natural fibers segment was the item with the highest value of exports in 2007, reaching US$ 651 million, whilst fabrics and garments reached US$ 564 million and US$ 631 million, respectively

4 – THE STRUCTURE AND PATTERN OF TECHNOLOGICAL INNOVATION OF THE TEXTILE-GARMENT COMPLEX

4.1 – Technological Opportunities in the Textile-Garment Complex

Based on data from Pintec for 2005, it was observed that the intensity of R&D in the textile industry, measured as the proportion of R&D costs of revenue as a whole is 0.22%, well below the average of the transformation industry (0.66%). This indicates that the possibility of innovation due to search activities is small, showing that the sector has low technological opportunities and reduced cumulativeness, as the purchase of knowledge incorporated in inputs and machinery tends to prevail over the acquisition of intangible knowledge.

Table 4 shows that the technological effort of the textile industry is highly dependent of the acquisition of knowledge embodied in tangible goods. Spending on machinery and equipment accounted for 75% of all resources allocated to innovation by companies in the sector in 2005 (US$ 746 million). Spending on more abstract forms of technological knowledge represented 10% of the total, such as internal R&D (7.9%), purchase of R&D (0.5%) and acquisition of external knowledge (1.7%).

Investments in capital goods are necessary to build an up-to-date production line in terms of machinery and equipment for large scale production and high productivity. On the other hand, even in an organization characterized by low technological opportunities, investments in R&D are required to enable dialogue with suppliers of inputs, as in the case of spinning, to follow the launches of new products by big global producers of chemical fibers such as Dow Chemical,

Rhodia and Dupont. The leaders-followers-fragile-emerging typology shows that these investments are predominantly among the leaders, as the distribution of spending with innovation between R&D and machinery and equipment are less unequal in this category of companies. Table 4 shows that while the leaders allocated 47% of spending on machinery and equipment and 26% with internal R%D, the followers allocated sums of 80% and 5%, respectively.

In the case of the garment industry, the technological opportunities are even less, as shown by the intensity of R&D of 0.18%. The opportunities are especially dependent on inputs supplied by the textile industry, such as more technologically sophisticated fabrics, and the industry of capital goods, such as sewing machines. In Table 5, it can be verified that spending with innovation is concentrated in machines and equipment (59.3%) and industrial projects (15.1%).

As in the textile industry, it is worth noting the strong differentiation between leaders and followers in terms of the distribution of spending on innovative activities. While the leaders designated 32% of their spending to R&D, the followers only allocated 6.9%. The acquisition of machinery and equipment accounts for 40% of the leaders' innovation costs and 58% of followers' costs. The greater weight of R&D among the leaders is necessary because these companies need to engage with suppliers of fibers and chemical inputs to achieve the correct specification for the finished product (MONTEIRO FILHA; SANTOS, 2002).

On the other hand, comparisons between Tables 4 and 5 show that the total spending on innovation in the garment industry accounts for only R$ 197.6 million compared to R$ 746.1 in the textile industry. The different proportions allocated to machinery and equipment and industrial projects demonstrate that the garment industry is not very capital intensive and is geared to the more creative stages of the complex's innovation cycle.

Since the barriers to entry are low, due to the existence of companies with a low intensity of capital, the competitiveness and the level of appropriation on the return of investments depend on a strategy of differentiation or fashion, with investment in brands, product conception, design, quality and distribution and commercialization channels. These intangible

Table 4 – Percentage Distribution of Spending on Innovative Activities in the Textile Industry, by Category of Company. Year: 2005 (R$ Million)

Indicator	Leaders	Followers	Fragile	Emerging	Total
Spending on innovative activities	99,2 (100%)	586,0 (100%)	44,7 (100%)	16,2 (100%)	746,1 (100%)
Spending on internal R&D	26,3 (26,5%)	30,0 (5,1%)	-	2,7 (16,7%)	59,0 (7,9%)
Spending on external R&D	1,1 (1,1%)	2,3 (0,4%)	-	-	3,4 (0,5%)
Acquisition of other knowledge	0,9 (0,9%)	7,6 (1,3%)	2,6 (5,8%)	1,5 (9,3%)	12,6 (1,7%)
Acquisition of machinery and equipment	46,3 (46,7%)	470,4 (80,3%)	41,8 (93,5%)	3,4 (21,0%)	561,9 (75,3%)
Training	3,0 (3,0%)	6,6 (1,1%)	0,3 (0,7%)	0 (0%)	9,91 (1,3%)
Spending on introducing innovations	13,0 (13,1%)	14,1 (2,4%)	0 (0%)	2,5 (15,4%)	29,6 (4,0%)
Industrial Innovation	8,6 (8,7%)	55,0 (9,4%)	-	6,1 (37,6%)	69,7 (9,3%)

Source: Prepared by the Authors using Technological Innovation Research (Pintec).

Table 5 – Percentage Distribution of Spending on Innovative Activities in the Garment Industry, by Category of Companies. Year: 2005 (R$ Million)

Indicator	Leaders	Followers	Fragile	Emerging	Total
Spending on innovative activities	42,8 (100%)	108,9 (100%)	43,4 (100%)	2,6 (100%)	197,6 (100%)
Spending on internal R&D	13,7 (32,0%)	7,5 (6,9%)	0,6 (1,5%)	0,6 (22,8%)	22,4 (11,3%)
Spending on external R&D	0,9 (2,0%)	0,1 (0,1%)	0,1 (0,2%)	0 (0%)	1,1 (0,6%)
Acquisition of other knowledge	1,3 (3,1%)	2,0 (1,8%)	1,1 (2,4%)	0 (0%)	4,4 (2,2%)
Acquisition of machinery and equipment	17,1 (39,9%)	63,4 (58,2%)	35,1 (80,9%)	1,6 (61,4%)	117,2 (59,3%)
Training	1,6 (3,8%)	2,6 (2,4%)	3,6 (8,2%)	0,1 (4,2%)	7,9 (4,0%)
Spending on introducing innovations	5,7 (13,4%)	8,0 (7,3%)	1,0 (2,3%)	0,2 (7,9%)	14,9 (7,5%)
Industrial Innovation	2,4 (5,7%)	25,3 (23,2%)	1,9 (4,4%)	0,1 (3,7%)	29,8 (15,1%)

Source: Produced by the Authors using Pintec.

investments are specific ways of incorporating knowledge to the product, increasing its aggregate value. The speed of the company's response to market signals is a way of anticipating competitors and increasing market participation. The shortening of products' life cycles is a way of dealing with the absence of effective appropriation mechanisms of benefits from investments in the creation of new products.

In the garment sector there are companies that attempt to differentiate as much as possible those products with the highest aggregate value, based on fashion design, made in small lots. Sales are done through brand name shops, often using franchising. Others however, have neither brand names nor the capacity to carry out R&D to differentiate products and are subcontractors. Some have economies of scale to produce large volumes at low prices, whilst others are small enterprises that are contracted through outsourcing.[4]

Outsourcing or subcontracting begins with companies in the sector that have brands or traders or retailers with brands.[5] In the case of producers with brands the focus is completely on design and retailing, with no involvement in production.[6] Monteiro Filho and Santos (2002) highlight that these companies need training in brand management, distribution and trading channels and the operation of points of sale; the development of R&D to interact with fiber and chemical inputs to ensure a finished product with the correct specifications; and dominate the concepts of management practices so they can outsource production and logistics. Large retailers that have invested heavily in brands also have a role in coordinating the garment chain because of their big purchasing power. Supermarkets, hypermarkets and retail chains favor large volumes and low prices, thus

4 In general, service providers do not have their own production line and work under contract for third parties. These companies only have buildings, equipment and labor of their own. The contracting company will guide them regarding raw material, inputs and the fabrication. This type of operation is very common in the sewing phase.

5 This typology of organizational models was carried out by Fleury et al. (2001).

6 This category of companies includes *Nike*, *Donna Karan*, *Ralph Lauren*; the cases of *Levi Strauss & Co*. and Benetton are emblematic.

becoming an option for companies with economies of scale to manufacture standardized low-priced goods.[7]

The next section shows the economic and technological innovation indicators in subsectors of the textile-garment complex to evaluate the existence of different patterns of accumulation of technological knowledge by the typology of leaders-followers-fragile-emerging companies.

4.2 – Economic and Innovation Indicators in Subsectors of the Textile-garment Complex

4.2.1 – Processing of natural fibers

The sector of processing natural fibers is the smallest in the textile industry in terms of the number of companies, employees, revenue and exports (Table 6). This sector is also the less technologically vigorous in terms of leader companies (only three) and does not stand out in terms of the intensity of capital or knowledge. Only 1% of the total investment made in the textile industry is attributable to this sector, neither does it have a relevant amount of R&D.[8] These companies' best technology, when it exists, is due to the purchase of knowledge incorporated in capital goods.

4.2.2 – Spinning and weaving

The spinning and weaving industry has 473 companies, which account for 29% of the number of companies in the textile industry (Table 6). Other indicators also show the relative weight of the sector such as employees (41%), revenue (46%) and exports (43%). In this sector, 21 companies were identified as leaders, 227 as followers, 221 as fragile and four as emerging. Of all the sectors in the textile industry, it is the leader in terms of research that leads to new products and processes, as it accounts for 68% of spending on R&D in the textile industry. This is partly due to its role as a producer of inputs for the textile-garment chain, such as yarns and fabrics for the other industries further along the productive chain, ultimately determining the possibility of competitive insertion in the domestic and international markets.

All the product leaders are product innovators and 86% are innovators of processes. It is noteworthy that in the spinning and weaving segment, product innovations are incremental, involving mainly the development of new threads and the constant improvement of their quality.

In the case of process innovations, the introduction of faster automated machines occurs, which makes the segment especially dependent on the suppliers of capital goods and is capital intensive vis-à-vis those sectors further along the productive chain, such as clothing. In the spinning sector, for example, the development of processes aims to speed up production and increase quality control of the product. (MELO; CAVALCANTI; GONÇALVES, 2007).

The spinning and weaving leader companies are large, with on average 719 employees, which is twice the size of the followers and seven times the size of the fragile companies (Table 6). Their larger size explains their capacity to support high fixed R&D costs and a greater ability to innovate products and processes. The intra-group industrial heterogeneity in terms of size is reflected in heterogeneity with respect to technological development, as process innovation is the ability to modernize the plant, which extends the capability to provide standardized products. At the same time, the tendency to innovate in products means the ability to differentiate and segment the market.

Therefore, although they are only 4% of the total number of companies, the leaders of spinning and weaving are responsible for 13% of employees, 23% of revenue and 33% of exports. This last fact confirms a structural characteristic of the spinning and weaving sector, with a high concentration of exports in a reduced number of large, efficient companies. Information in the literature on the sector, from the start of the decade, reveals that the three biggest business groups in the sector (Vicunha, Santista and Coteminas) accounted for around one third of the textile-garment exports (PROCHNIK, 2002).

In the case of the followers, the two innovation tendencies cited above are not as frequent. A smaller part of the followers innovate, more often in process (45%) than in products (31%) – Table 7. On the other

7 The *Gap, C&A and Marks & Spencer* are examples of this category of company;

8 Data on the R&D of leaders are not available to avoid the individualization of the information. This does not alter the nature of the conclusions drawn.

Table 6 – Economic Indicators of Sub-sectors of the Textile and Garment Industry (2005)

Sector	Indicators	Leaders	Followers	Fragile	Emerging	Total
Processing of Natural Fibers	Companies	3 (7,5%)	7 (17,5%)	30 (75,0%)	-	40 (100%)
	Employees	234 (6,9%)	622 (18,3%)	2546 (74,8%)	-	3402 (100%)
	Revenue*	-	362,5 (80,1%)	90,0 (19,9%)	-	452,5 (100%)
	Exports*	0,2 (0,5%)	54,8 (99,5%)	0,0 (0,0%)	-	55 (100%)
Spinning and Weaving	Companies	21 (4,4%)	227 (47,9%)	221 (46,7%)	4 (0,9%)	473 (100%)
	Employees	15101 (12,9%)	77494 (66,5%)	22428 (19,3%)	1455 (1,3%)	116478 (100%)
	Revenue*	3058,7 (23,1%)	9336,7 (70,4%)	745,2 (5,6%)	127,6 (1%)	13268,2 (100%)
	Exports*	179,7 (32,6%)	371,2 (67,4%)	0,00 (0%)	0,00 (0%)	550,9 (100%)
Textile Goods	Companies	36 (3,9%)	274 (29,6%)	616 (66,5%)	-	926 (100%)
	Employees	17805 (12,9%)	76833 (55,6%)	43570 (31,5%)	-	138208 (100%)
	Revenue*	2494,3 (20,6%)	8344,2 (68,9%)	1272,5 (10,5%)	-	12111 (100%)
	Exports*	208,6 (32,9%)	424,97 (67,1%)	0,00 (0%)	-	633,57 (100%)
Cloth and Jersey Articles	Companies	4 (1,9%)	59 (27,3%)	153 (70,8%)	-	216 (100%)
	Employees	6246 (22,7%)	12005 (43,7%)	9228 (33,6%)	-	27479 (100%)
	Revenue*	728,4 (26,9%)	1529,5 (56,5%)	450,9 (16,6%)	-	2708,8 (100%)
	Exports*	29,2 (74,1%)	10,2 (25,9%)	0,0 (0%)	-	39,4 (100%)
Clothing	Companies	12 (0,3%)	623 (17,1%)	3000 (82,3%)	12 (0,3%)	3647 (100%)
	Employees	14395 (4,6%)	109055 (34,63%)	189874 (60,2%)	2083 (0,7%)	315407 (100%)
	Revenue*	1049,9 (8,3%)	8195,6 (64,4%)	3414,7 (26,8%)	62,0 (0,5%)	12722 (100%)
	Exports*	29,3 (17,3%)	140,3 (82,7%)	0,0 (0%)	0,0 (0%)	170 (100%)

Source: Prepared by the Authors from the IBGE (2005) and Pintec.

***** Revenue and Exports in R$ Millions

hand, these companies are an important weight in the textile industrial structure, as they represent 48% of all the companies, 67% of employees, 70% of revenue and 67% of exports (Table 6). Although exports represent 4% of revenue and not 5.9% as for the leaders, there is a big capacity for external insertion, guaranteed by the existence of relatively up-to-date plants from the productive point of view, which allows them to achieve productivity gains and low production costs.

It should be noted that the four emerging companies in the sector have average revenue nine times greater than that of the fragile companies (Table 6), as well as an investment/revenue ratio larger than the actual leader companies (Table 7). The emerging companies are a dynamic niche in the sector, as they have a high intensity of R&D by the standards of the textile sector, given that they spend more than 2% of their revenue on R&D, vis-à-vis the 0,5% spent by the leaders.

Table 7 – Indicators of Innovation, Investment and R&D of the Textile-Garment Industry (2005)

Sector	Indicators	Leaders	Followers	Fragile	Emerging
Processing of Natural Fibers	Number of Companies	3	7	30	-
	Product Innovators (%)	100%	57%	0%	-
	Process Innovators (%)	100%	100%	67%	-
	Participation in Investments (%)	-	-	-	-
	Participation in R&D (%)	-	-	-	-
	Investment/Revenue (%)	-	3,90%	4,50%	-
	R&D/Revenue (%)	-	0,00%	0,00%	-
Spinning and Weaving	Number of Companies	21	227	221	4
	Product Innovators (%)	100%	31%	10%	100%
	Process Innovators (%)	86%	45%	13%	100%
	Participation in Investments (%)	23%	73%	3%	1%
	Participation in R&D (%)	40%	54%	0%	6%
	Investment/Revenue (%)	5,80%	6,00%	2,70%	7,50%
	R&D/Revenue (%)	0,50%	0,20%	0,00%	2,10%
Textile Goods	Number of Companies	36	274	616	-
	Product Innovators (%)	86%	27%	16%	-
	Process Innovators (%)	69%	36%	32%	-
	Participation in Investments (%)	17%	77%	6%	-
	Participation in R&D (%)	54%	46%	0%	-
	Investment/Revenue (%)	4,30%	5,90%	3,20%	-
	R&D/Revenue (%)	0,40%	0,10%	0,00%	-
Cloth and Jersey Articles	Number of Companies	4	59	153	-
	Product Innovators (%)	75%	29%	5%	-
	Process Innovators (%)	75%	53%	19%	-
	Participation in Investments (%)	15%	74%	11%	-
	Participation in R&D (%)	9%	91%	0%	-
	Investment/Revenue (%)	2,20%	5,10%	2,50%	-
	R&D/Revenue (%)	0,00%	0,00%	0,00%	-
Garments	Number of Companies	12	623	3000	12
	Product Innovators (%)	92%	18%	15%	100%
	Process Innovators (%)	83%	36%	29%	50%
	Participation in Investments (%)	8%	72%	20%	0%
	Participation in R&D (%)	45%	49%	0,2%	5,50%
	Investment/Revenue (%)	2,60%	3,00%	2,00%	0,30%
	R&D/Revenue (%)	1,00%	0,10%	0,00%	2,10%

Source: Produced by the Authors using IBGE (2005) and Pintec.

The fragile companies only serve the domestic market and are responsible for small amounts of revenue and total and technological investment of the sector. Only 10% and 13% claim to be innovators of products and process respectively. This highlights the intra-group technological heterogeneity of the spinning and weaving sector, where no less than 221 companies (around 47% of the sector) do not have effective conditions to insert themselves into the external market or even protect themselves from the fierce international competition, given the 71% increase in Brazilian imports of fabrics in the period 2000-2007.

4.2.3 – Textile goods

The manufacturing of textile goods is the largest sector of the textile industry, with 56% of the number of companies, 48% of employees, 42% of revenue and 50% of the textile industry's exports (Table 6). The intensity of the R&D of the leaders in textile goods (0.4%) is 300% bigger than that of the followers (0.1%) – Table 7. The followers make 77% of investments, whilst the fragile companies invest only 6% of the total. Regarding efforts in R&D, the followers account for 46% of spending and the fragile companies have no strategy to accumulate knowledge to innovate. Table 7 also shows that all the leader companies are innovators, as 86% innovate products and 69% innovate processes. Conversely, the followers innovate more in process (36%) than in product (27%).

4.2.4 – Fabrics and knitwear articles

The fabrics and knitwear share of the industry is more modest, with only 9% of revenues, 13% of the number of companies and 10% of employed persons (Table 6). Investments in R&D are almost inexistent (1%), external insertion is very low, measured by the participation in exports (3%). There are four leader companies in this sector, 59 followers and 153 fragile companies.

Even though they have a small participation in total investments (15%) and spending on R&D (9%) – Table 7, the four leaders of the sector are responsible for 74% of exports, 23% of jobs and 27% of the sector's revenue (Table 6). Indicators of size, such as revenue per company, show an intra-sectorial disparity, as the leaders are seven times larger than the followers and 60 times the size of the fragile companies.

It is also noted that the sector has an intensity of R&D close to zero, although the intensity of investment of the followers (5.1%) is very similar to that of companies of the same category in the sectors of spinning and weaving (6%) and textile goods(5.9%). On the other hand, in this sector the leaders have an intensity of investment of (2.2%), significantly less than the followers (5.1%) and even the indicator of the fragile companies (2.5%).

In the case of the fragile companies, there is minimal involvement in innovation, with around 5% of companies implementing innovations of products and 19% of processes (Table 7). In this industrial segment the fragile companies are numerous, accounting for 71% of the total companies and employing one third of employees, although they are not exporters.

4.2.5 – Garments

The garment industry has a large amount of companies, even when examining a certain PIA stratum, which is restricted to companies with more than 30 employees (3,647). Most of them are small, employing on average 86 employees per company and are not very capital intensive. Of these 3,647 companies, 12 leaders were identified, 623 followers, 3,000 fragile and 12 emerging companies. The high proportion of companies in this industry that are classified as fragile (82%) is noteworthy, when contrasted with only 0.3% of companies considered leaders, 17% followers and 0.3% emerging.

The leaders are mainly innovators of products and processes. Innovation among followers and fragile companies is more infrequent, as 40% of the followers and 31% of fragile companies are innovators. The followers innovate processes more than products and the same occurs in fragile companies. It is interesting that all the emerging companies are product innovators.

When comparing leaders and followers, the latter have a 6.6 times greater revenue. The external insertion of the leaders is greater than the followers and absent in fragile companies, as evidenced by the ratio between exports and revenue. Regarding this aspect, it is interesting to note the leader's ability to generate foreign exchange, as the twelve leading companies export

17% of the total, while 623 followers export 83%. The export pattern of the followers is of standardized goods, competing by price with a low involvement in R&D. Due to their export capacity, both leaders and followers deserve differentiated attention in industrial policies.

4.2.6 – In conclusion

Unlike the processing of natural fiber sector the spinning and weaving sector has the greatest technological opportunity in the textile sector and shelters large and efficient companies with vertical integration and a good external insertion. It is possible that they combine economies of scale and the capacity to differentiate products, whilst the larger followers in the sector are capable of exporting standardized goods on a large scale, produced in operationally up-to-date plants as demonstrated by the investment/revenue indicator (6%). Although they have on average an intensity of R&D of only 0.2% they carry out 37% of R&D in the textile industry as a whole, whilst the leaders account for 27%. In fact, leaders and followers do not distinguish themselves in relation to investment and external insertion indicators, even if the intensity of R&D has a more significant difference. This indicates that both categories follow the same technological management strategy, with a greater homogeneity between the companies.

In the textile goods sector there are two different technological management patterns. The leader companies, with 17% of spending on R&D and 7% of the total investments in the textile industry are more intensive in knowledge and less in capital when compared to the followers who have 14% and 32% for the same indicators, respectively. This is reflected in a ratio of R&D over investment of 9.8% for the leaders and 1.8% for the followers. Therefore, it is noted that the leaders have a greater opportunity, accumulation and appropriation strategies, and exploring niche markets with high added value, given their export performance

The fabrics and knitwear sector has a lower level of intra-sectorial heterogeneity. The pattern of the subsector is low technological opportunities, little accumulation of knowledge embodied in the product and a low level of ownership. The low rates of investment by leaders (2.2%) indicate that they operate with low levels of economies of scale and a low R&D intensity, which does not reach 0.01%, signaling that they operate in the markets for standardized goods, competing on price. Although the four leaders export a lot in relation to their sub-sector (74%), their exports account for only 2% of total exports by the textile industry. Thus, the companies exploit the internal market and basically do not have significant external competitiveness

This sector is more vulnerable to external competition, especially if the amount of imports of knitwear in the recent period (2005-2007) is taken into account.[9] Therefore, as the sector has little representation in terms of added value, sales and employees in relation to other subsectors of the textile chain, there is a risk of de-industrialization. Brazil is not competitive in the so-called “technological fabrics”, which involve blends such as cotton with inox and linen. The best performance of Brazilian fabric weaving, in terms of adopting innovations and export capacity, are in clothing integrated with knitwear, as in the case of beachwear and sports clothes.

In the garment industry, using the indicators of follower companies as a reference, it can be established that some of these companies are able to focus on strategies to aggregate value, such as export/revenue (1.7%) e R&D/revenue (0.1%). This involves a change of focus on the part of the companies that would have to relinquish their usual strategy, which is the production of standardized goods and price competition.

5 – FINAL CONSIDERATIONS

There is significant technological heterogeneity in the textile-garment complex. Technological opportunities differ in inter-sectorial and intra-sectorial terms, when the textile industry is evaluated according to its various industry segments and in the leader-follower- fragile-emerging typology.

Considering the four industry groups (CNEA) evaluated in the textile industry, there is the coexistence of 64 leader companies, 630 followers, 1020 fragile and four emerging. In the case of the garment industry, of

9 In the period 2005-2007, there was an increase of 628% in the import of knitwear. However, it is noteworthy that the imports of this product have always been very low.

a total of 3647 companies, 12 leaders were identified, 623 followers, 3000 fragile and 12 emerging. That is, of a total of 1,718 textile companies, only 3.7% have productive efficiency, innovating processes and with a good capacity to develop products. In the garment sector the situation is worse as these companies correspond to only 0.3% of the leader companies.

The capacity to innovate products and processes is a prerequisite for a competitive presence in the international market, finding the best niches in the market. In turn, reaching goods markets with a higher aggregate value does not mean losing the focus on international markets where standardized goods prevail. This is because there are leaders, and especially followers who have the technological capacity for large scale production and low costs. This capacity is due to advantages associated with the pay level of the "factory floor" workers, as in manufacturing plants that have moved to the Northeast region, or competitive factors related to blends of natural fibers (cotton) or chemical fibers (polyester).

Some measures, involving investment both in intangible and tangible assets, could be suggested to achieve greater competitiveness in high aggregate value niches and commodities. For example: internal R&D capacity, distribution channels, brands and certifications, machinery and equipment, suppliers of raw materials for the textile chain, vertical coordination in the textile-garment chain, vertical integration and financial instruments and credit, in addition to reciprocity rules for meeting deadlines. However, these measures depend on the pattern of accumulation of technological knowledge followed by companies in each industry group of the textile-garment complex.

Both leaders and followers of the spinning and weaving and textile goods sectors should be the focus of public policy, such as policies for technological training that includes the modernization of capital goods, investment in R&D and vertical integration policies. This focus is justified because in addition to the arguments above, these sectors together represent 85% of companies in the textile industry, accounting for 89% of employees, 89% of revenue, 92% of investment and 93% of exports. However, the participation of the fragile companies is worrying, as they are 51% of the total companies and have 23% of employees, but they account for only 4% of total investment and 7% of revenue.

There are national groups that act in several sectors of the textile chain and are competitive abroad in home ware and fabrics (denim and drill). The entry of Brazilian companies into segments with a high aggregated value, such as fabrics in the “Premium” line, is seen as an alternative to the commodities sector, which is highly competitive globally. However, penetration of these segments requires an internal technological capacity, a propensity to interact with companies in the chemical industry, like Basf and Clariant, and a concern with certification and seals of quality. Achieving external competitiveness also requires an increased productive capacity of chemical fibers, of which the country has a structural deficit. Associations between the State and private business groups can contribute to this, by building new plants for this purpose.

In the case of the spinning and weaving sector the measures of intensity of R&D of 0.5% for leader companies and 0.2% for followers is below the average for the transformation industry and there are reduced proportions for the assimilation of new technological tendencies for fiber reduction. This is justified because, in recent decades, the analysis of the competitive standard in this sector shows that the fibers and fabrics have become increasingly standardized. Thus, the competitiveness of companies lies in their ability to manufacture large volumes of products with high flexibility.

Given this perspective, it would be interesting to explore market niches with higher added value, which require investment in nanotechnology in order to increase the possibilities of producing fabrics with threads with nanoparticles. Such threads alter the properties of the fiber such as strength, comfort, anti-odor effect, bactericides, hydration and UV protection.

Greater investment in R&D for spinning and weaving companies means trying to consolidate a more knowledge intensive pattern of knowledge in leader and follower companies. Other intangible assets may be necessary to consolidate this pattern, depending on the specifications of each link in the textile-garment chain. The strategy of increasing the efforts for the internalization of R&D in companies requires the creation of R&D centers of excellence in Brazil, in addition to stimulating cooperation between

research institutions and companies.[10] Cooperation with Brazilian research centers, such as the Brazilian Enterprise for Agricultural Research (Embrapa) and the Agronomical Institute of Campinas (IAC), could allow the use of know-how of genetic improvements and the development of new varieties of cotton.[11]

To increase the creative capacity of the garment industry there must be investment in the training and qualification of human resources, such as seamstresses, fashion designers, stylists, designers and vendors, increasing the capacity of national education and training in design, with the creation of new courses in federal schools and institutions to support the industry. With a greater absorption of professionals in these areas, the most dynamic companies in the sector would increase their pattern of accumulation of knowledge and, in turn, their chances of integration in markets with higher added value.

The external competitiveness of the sector seems to favor large national groups, considering the evidence demonstrated that the ability to export, purchase new machinery, invest in R&D and intangible assets favors large companies, both leaders or followers, depending on the sector in question. This means that horizontal mergers between domestic firms and between them and foreign companies can promote the emergence of large national groups that are more able to internationalize. Internationalization through direct foreign investment, either through the installation of industrial plants (green field) or by acquiring companies abroad, gives privileged access to large consumer markets.

Vertical mergers may also be an alternative, considering that the vertical integration of companies with expertise in an industrial segment can reduce transaction costs, dominate other industrial processes, add value to products, promote technological learning, increase economies of scale along the chain and create conditions for a greater ownership of investments and returns from innovation.

The internalization of production stages involving key technologies in the manufacture of fabrics can increase the competitiveness of the complex. This means that processes of vertical integration in the chain, that internalize intensive R&D steps, such as the production of fiber up to the manufacturing stage, should be encouraged to explore better opportunities in the technology sector.[12] In the field of jeans manufacture, for example, there is a trend among customers to require not only the weaving of the fabric but also the manufacture of the jeans themselves.

If, in addition to leadership, the company is vertically integrated, one can add the benefits associated with the production of their own fabrics with special fibers to produce garments that can be launched on the market using technology push strategies. Moreover, there are advantages of being able to respond quickly to changing market signals, such as changing tastes, habits and fashion trends. However, even large companies can benefit themselves of the transfer of routine productive activities to companies that operate under outsourcing systems to seek lower labor costs. Do not forget that the choice of vertical coordination of a subcontracting network may be the most attractive alternative for the simplest functions in the production process, since the economies of scale are focused on the distribution network and the scope of the design capacity.

When companies are not vertically integrated, transaction costs and the disadvantages associated with the distance from end users can be mitigated by investing in information technology. This seems to be the case for companies that invest in sophisticated information systems, which include forecasting and capacity management across the supply chain to meet the rapid changes in consumption patterns. That is, investments in supply chain management techniques combined with information technology (Electronic Data Interchange and Efficient Consumer Response). In addition to these investments, transaction costs are reduced when companies that coordinate the chain

10 Actions like these are demanded by industries in the sector. The focus of this policy may be in creating a R&D capacity for the textile industry, as according to business men in the sector there is a lack of centers of excellence in the textile industry when compared to other countries (RAUH NETO, 2006).

11 Accordingly, "colored cotton" can be cited, which can encourage differentiated products and dispense with the use of dyes, with benefits linked to the reduction of toxic chemical effluents into the environment.

12 The successful growth of Coteminas was due to a strategy of vertical integration, which happens in other parts of the world, starting at the end of the 1990s, which has made it the largest textile industry in the Common Market of the South (Mercosur), with a leadership position in the segment of articles for the home and jerseys (polo shirts, T-Shirts and socks) according to Herrmann and Nassar (2011).

vertically impose the mold from the design on the outsourced producer and provide all the materials. In this way, there are few specific assets, making transaction costs relatively low.

In fact, the coordination above in the chain and the specialization of functions related to design, the consolidation of distribution networks and the valuing of own brands are consolidated international trends in the chain. As the Brazilian textile chain is poorly integrated in terms of vertical coordination between suppliers and users and in terms of the integration of capital further down the chain, it is necessary to articulate instruments to incentivize action throughout the chain, in order to strengthen its links and reduce the disadvantage in relation to the textile chain of Asian competitors. The competitiveness of the textile industry depends on all the links in the chain and not just one company or group of companies. To this end, measures to promote courses on supply chain management in institutions supporting companies, would allow the tracking of global trends in the industry and disseminate the use of this management technique in Brazil so that the exchange of information between customers and suppliers could be expanded .

Emerging companies need specific policies because they have a high potential for success in the strategy of exploiting differentiated market niches. Their technological potential justifies such measures as their R&D/revenue ratio is 2.1% in the textile industry and 2.1% in the garment industry. Although the number of emerging companies is small (16), they should receive greater contributions or more favorable conditions in the structuring programs for emerging companies of the National Bank for Social Development (BNDES). Another proposal that could reach small emerging companies would be the subsidy of innovation projects, rather than financing, in which the risks would be shared with the BNDES and part of the royalties would be used to finance of other projects (ASSOCIAÇÃO..., 2008).

In the case of the garment industry, leaders and emerging companies appear to follow the same pattern of accumulation of technological knowledge, centered on the capacity to carry out R&D and the concern about differentiating products based on design. On the other hand, the followers and the fragile companies appear to follow a different pattern, in which there is no internal structure of R&D or valuing of internal sources of accumulation of technical knowledge. Although there is this similarity, the larger followers cannot be compared with the fragile companies, which are "production companies", possibly locally, whereas the followers are "distribution companies"; essentially large scale traders. The fact that the average revenue of the followers is 13 times greater than that of the fragile companies helps support this argument.

Regarding the fragile companies in the garment industry, which constitute a large majority of the sector (82%), they can hardly adhere to an individual strategy of adding value, given that companies are generally small, family businesses providing services to the larger enterprises by outsourcing and belong to the informal sector. With an average annual profit of R$70,000 and an absence of external insertion and internal R&D structure, it is very unlikely that they could withstand the costs of implementing an in-house design nucleus, especially for those who are sub-contractors, given the absence of autonomy, skilled human resources and the limited production structure. For others, there remains the option of a consortium of companies in which several small companies can coalesce to share design costs, an export structure and participation in national and international fairs with the support of institutions like Sebrae and local authorities. In this way, even though their technological dynamism is not very expressive, policy measures for such companies should be implemented in light of their important role in generating income and employment. Accordingly, programs for the dissemination of technical management and production control can be quite effective in improving the competitiveness of these companies.

The strategy of developing own brands in market niches that are not in competition with Asian products seems to be the best alternative to avoid the fierce competition in the segment of the market of standardized, low-cost products, even for small fragile companies, as long as there is adequate institutional support - National Industrial Training Service (Senai) and the Brazilian Service to Support Micro and Small Enterprises (Sebrae). In this case, partnerships between local institutions and business, with a

consortium of companies, can stimulate an increased degree of formalization of enterprises and the creation of brands, investments in designer clothing made from denim, quality and environmental certifications, and promotional events and trade fairs for the sector. To facilitate entry into international markets the creation of environmental certifications should be stimulated as there are international organizations that have created a "green seal" for textile products that meet ecological and toxicological criteria.[13]

Support for fragile companies is justified because their disadvantages in terms of lack of financial and human resources make it difficult to have any strategy for escaping the power of coordination exercised by large retail chains. Besides the power they have to dictate the prices for items of clothing and choose the inputs to be used, large retailers may also shift their orders to other countries, as they have a wide range of suppliers, because there are manufacturers that have cheap labor in various parts of the globe. Consequently, participating in a network of global suppliers may be a dangerous strategy, in addition to limiting economic and technological autonomy. In addition to intangible assets, industrial policy provisions cannot dispense with improving the system of public financing for the purchase of machinery and equipment, given that much of the competitiveness also depends on investments in material assets. This becomes more important when it is found that in the case of the clothing industry only 36% of the followers and 29% of the fragile companies innovate in process, and 38% and 27%, respectively, in the textile industry.

Other measures, also involving institutional support, are linked to the expansion of efforts to promote Brazilian fashion abroad through institutions in the sector such as the Brazilian Textile Industry Association (Abit), Brazilian Agency for Export Promotion and Investment (Apexbrasil) and the Brazilian Association of Fashion Designers (Abest). Actions like these can help producers with their own brands to strengthen commercial representation abroad, in view of the high cost of setting up their own distribution network. In addition, policies to encourage the export industry, such as the modalities of the Export Financing Program (Proex), which are: Proex-Financing and Proex -Equalization and the New Export Revitalization, could strengthen follower companies to reach goals for the acceleration of the growth of its exports. Also in relation to foreign policy, agreements should be sought for preferential access to markets in the United States and the European Union.

As measures of public policy, many of the propositions suggested above require tax cuts or increases to the limit of federal government loans. However, such measures should be conditional to a rise in spending on R&D, the exportation performance of followers and the internationalization of the leaders, as rules of reciprocity for credit and tributary support from public policy. Other measures are associated with the determinants of political-institutional competitiveness, such as the use of the State's purchasing power for products with higher technological aggregation levels and macroeconomic conditions, such as avoiding excessive overvaluation of the exchange rate in times of increased international liquidity

Such measures are conditions for Brazil to add more value to the products of the textile-garment complex, especially in garments, which is the most dynamic in global terms and where the country is less competitive, with a low international insertion in terms of sales, quality and product differentiation. To this end, more financial, credit and fiscal support to the sector, especially the larger firms (leaders and followers), should be associated with targets linked to the construction of own brands, in-house design capacity and the incorporation of inputs with greater technological content.

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13 Initiatives such as the certification of environmentally sustainable cotton in their production cycle, led by Coteminas, Marisol, Santista Têxtil/Tavex and Springs Global, inspire measures such as these.

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