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[Aller au sommaire du numéro](#)

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# **Multinational Enterprise (MNE) Supplier Networks: Organizational Innovation or Innovation Policy?**

*The case of Brazilian and Chilean networks*

By

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*In the context of Brazil/Chile, this article examines ways in which innovation policy can enhance the competitiveness of developing countries while building on organizational innovations which benefit multinational enterprises (MNEs). After a survey of Brazilian/Chilean innovation policy, we conclude that it has failed to bring about linkages between firms. One exception is provided by a Brazilian supplier network programme - an initiative which helps generate links between large and small firms. However, there is no Brazilian or Chilean programme designed to create linkages between MNEs and local firms. We argue that if the supplier network were modified to do just this, increases in MNE and national competitiveness would ensue.*

## **INTRODUCTION**

In this paper we investigate how innovation policy can promote the creation and diffusion of competitiveness in the context of less developed countries (LDCs). We describe the range of available instruments for implementing an innovation policy for LDCs, and we focus on a key area for innovation pol-

icy, that of network formation. We investigate through fieldwork the nature of Brazilian and Chilean innovation policies and we point to the insufficiencies of these policies. We emphasize the absence of Brazilian and Chilean innovation policies that encourage the formation of networks between firms. In particular, we argue that Brazilian and Chilean multinational enterprises (MNEs) can contribute to the diffusion of competitiveness from MNEs to their suppliers through networks monitored by innovation policy. We suggest that Brazilian/Chilean innovation policy has a crucial role in ensuring that these networks are not simply profit-maximizing organizational innovations from the perspective of the MNE, but also genuine mechanisms for competitiveness diffusion.

We test two interrelated hypotheses. The first hypothesis is that Brazilian/Chilean innovation policy does not succeed in increasing national competitiveness; the second, that it does not make use of MNEs in its attempt to increase national competitiveness. Following the testing of these hypotheses through an empirical investigation of innovation policy programmes in the context of 17 public and private Brazilian/Chilean innovation institutes, we conclude by suggesting that Brazilian/Chilean innovation policy tap into Brazilian and Chilean MNEs as engines of Brazilian/Chilean competitiveness. We put forward a supplier network programme as a mechanism to facilitate this process.

## **INSTRUMENTS OF INNOVATION POLICY**

Innovation and competitiveness are concepts that apply both to the nation and the firm. In this paper, we seek to emphasize the overlaps between the objectives of public policy-makers and those of firm managers in relation to these concepts. We first define the two sets of objectives and we then identify their overlaps. Part of the objectives of public policy-makers is articulated through innovation policy, whose aim is the acquisition of national competitiveness. While d'Andrea Tyson (1992) defines national competitiveness as a nation's ability to produce goods and services that meet the test of international competition and to ensure that its citizens enjoy a standard of living that is both rising and sustainable, Krugman (1994:7) shows that both in an economy with very little international trade and one with high levels of trade, "the growth rate of living standards equals the growth rate of domestic productivity—not productivity relative to competitors, but simply domestic productivity" ". We follow Krugman's logic and equate the competitiveness of a nation with its productivity. In turn, the determinants of national productivity and competitiveness are technological and organizational innovation. Lucas (1998) and Romer (1986) present economic models of competitiveness that are based on technological innovation while Best (1999), Porter (1990) and Pitelis (1998) accentuate the role of managerial, resource-based and organizational innovation in competitiveness. This is not the place to present these models in full (see

Beausang (2003:99-106)) for such coverage), but the key point is that national competitiveness is largely a result of national technological and organizational innovative efforts.

Similarly, the objective of firm managers is to increase their firm's competitiveness. Some traditional indicators of firm competitiveness include the difference between average cost and the market price of the firm's product offering, the growth of sales, the profit/sales ratio and the profit growth/turnover ratio. Yet a more dynamic vision of firm competitiveness emerges if we concentrate on the anticipated future profits of a firm: they depend on the firm's relative productivity and input costs and the relative attractiveness of its product offering over time. In this case, "the future profitability of a firm may be a function of its current spending on R&D, its patenting activity, or many other facets of the firm's strategy" (McFetridge, 1995, p. 6). It is precisely this dynamic/strategic vision of profits and competitiveness that we emphasize here. In particular, we highlight the role of internal and external organizational innovation in increasing firm productivity and competitiveness. For a theoretical analysis of the relationship between internal/external organizational innovation and firm competitiveness, see Schumpeter (1955), Penrose (1959) and for a joint analysis of their approaches, see Beausang (2003, pps. 64-66). The key point here is that an important objective of firm managers is to innovate in order to compete.

Then what is the relationship between the objectives of public policy-makers and firm managers? On the one hand, an important objective of policy-makers is the acquisition of national competitiveness<sup>1</sup>. On the other hand, firm managers seek to increase firm competitiveness and productivity, partly through internal and external organizational innovation. Now it is obvious that firms cannot be innovative in the organization of their relationship with other firms/institutions unless these firms and institutions have the minimal innovative capacity that is required to engage in an innovative effort, i.e. unless the national innovative environment is strong. In other words, firm innovation is enhanced by national innovation because innovation breeds innovation. This is due to what William Easterly (2001) calls the agglomeration economies of innovation: a firm located in an environment devoid of innovation is unlikely to innovate. Consequently, the objectives of policy-makers and firm managers coincide in the sense that both gain from increases in national innovation and competitiveness.

### **A Survey of Existing Instruments**

Now that we have outlined the framework that binds competitiveness and innovation policy, we can specify the various innovation policy instruments and the ways in which innovation policy can best be applied in an LDC context. There are many possible instruments that can further innovative development

in an LDC. Macroeconomic policies affect innovative capabilities through interest rates, price changes, exchange rates, fiscal and monetary policies, and foreign exchange restrictions. The trade regime also has an impact on innovative development, since world competition improves quality, introduces new products, forces LDCs to keep up with technological progress, and offers economies of scale. Indeed, “industrial efficiency is a function of the efficiency with which countries have utilised technologies and of the high rates of productivity growth they have enjoyed. Boosting capabilities implies a dynamic technical efficiency as opposed to a static allocative efficiency. However, outward orientation does not mean the absence of selective trade and other interventions in strategic sectors for the development of an industrial base, quite the contrary; and strategic industrial policy requires time, investment and effort” (Lall, 1996, p. 37)<sup>2</sup>.

Another instrument of innovation policy is skills development. The link between innovation policy and skill acquisition is clear: “more advanced technical training becomes critical as the industrial structure develops... The educational system has to match the skill needs of the industrial structure” (Lall, 1996:42). Skills must be tailored to the specific needs of industry.

Technical information and support services are other instruments of innovation policy. They exist under different forms. Information can be gathered through journals, contacts with capital goods suppliers, buyers of export products, and interactions with subcontractors. Public infrastructure for science and technology is the most prominent policy area concerned with the diffusion of information. The need for information and technical support grows with the level of technological capability development but strengthening of the information structure can greatly help the technological development process.

Unfortunately, in many cases, there is no proper linkage between the promotion work of institutions involved in information and technical support and the technological needs of industry. This is why the role of technological parks is key to bridge these two areas. These parks provide necessary governmental support for industrial and communications infrastructure, and for labor training. The experience of East Asian countries with these parks is particularly enlightening. In South Korea, the Electronics and Telecommunications Research Institute (ETRI), which is a technological park and one of the four subsidiaries of the Ministry of Information and Communication, has contributed to Korea’s industrial development through the early transfer of research and development (R&D) results. It runs the Industrial Technology Enhancement Centre, whose main goal is to contribute to the improvement of technology standards and to the “Koreanization” of strategic high technology. The flaw of the Centre’s programmes is their poor local synergy: the Centre usually has a strong tendency to focus on national priorities in R&D instead of private company interests. Another subsidiary of the Ministry of Information and Communication called the Industrial Technology Research Institute has a major role in technology

transfer. It maintains a close relationship with private firms in its park and carries out joint research projects with them. Many of its research projects stem from consultations with firms. Similarly, the Technological Innovation Centre at the Korean Advanced Institute of Science and Technology carries out industry-oriented projects and facilitates technological developments in the industrial sector.

Alternatively, the Taiwanese government-led Hsinchu Science-Based Industrial Park is based on another model, whereby the government only provides 50% of the park's budget, in order to maintain a stable linkage between its Electronics Research and Service Organization and private companies. The other 50% is met through service contracts and sales of technology to private companies, as a way of contributing to the upgrading of the technological level of Taiwan's electronics industry. The benefits to attract investors include a flexible tax-free period of 5 years, a tax levy maximum of 22%, low interest loans, duty-free imports of machinery, raw materials, fuels, services or semi-finished products, and capitalization of the investors' patent rights.

Finally, because a great part of innovative capability development is based on formal technological effort, involving long-term experimentation and introduction of new processes that face considerable market risk, finance is another important innovation policy instrument. Innovation requires loans at concessional rates, and equity participation by the lender.

All of the above instruments help create an innovation-friendly environment, however they do not promote innovation as such. We now turn to more "direct" innovation policy instruments. The main types of direct innovation policy instruments are financial incentives, procurement, regulations on imports of foreign technologies and foreign direct investment (FDI) (including regulations on linkages between MNEs and local firms), and direct targeting of specific technologies for research by the public sector. The two essential pillars are regulations on imports of technologies and FDI, and the direct targeting of specific technologies for research. We will concentrate on them.

As far as control of technology imports is concerned, regulations on the content and terms of technology transfer in developing countries have often reduced the output of technology inflows to the detriment of the buying country, and hence hampered the growth of technological capabilities. As Lall claims, "firms should be left to make their own decisions on where and what to buy in the technology market...what is critical is to get the larger policy and incentive framework right" (Lall, 1996:47). Regarding the technological impact of FDI, although investors can provide access to the most modern technologies, they will only actually transfer those technologies that the host country can absorb, with its skills and capabilities. Technological diffusion through inward FDI is by no means a substitute for indigenous capability development. FDI is a means of transferring the results of innovation but not necessarily the

innovation capability itself. Newly industrialized economies need to deepen their technological capabilities to undertake more advanced design and development tasks.

A policy option therefore becomes to require of foreign investors that a local firm have the majority or full ownership of the affiliate. This requirement can be backed by measures to ensure that enterprises invest in technological capabilities and achieve international competitiveness quickly. Another possibility is to induce MNEs to shift some of their design and development work to LDC affiliates. The LDC itself must concentrate its efforts on making underlying investments in education, local science and technology infrastructures, and on adopting a strong export orientation (Lall, 1996). The government has to coordinate and promote local learning in joint ventures with MNEs, as the deliberate policy of encouraging domestic know-how with selective entry of foreign investors can yield significant dividends for industrial development.

Beyond the promotion of joint ventures between large local firms and MNEs, part of the government's innovation policy mandate is to encourage the creation of linkages between small and medium-sized enterprises (SMEs) and MNEs, which may enhance national technological capability. It sometimes occurs that MNE activity has spontaneous spillover effects on SMEs, particularly human capital spillovers: for instance, employees may leave an MNE affiliate or an SME related to it and set up new SMEs. Best (1999:25) suggests that MNEs contribute to skill formation in Malaysia through such spillovers<sup>3</sup>. However, these spillovers do not always take place spontaneously, and there is a role for the creation of linkages between MNEs and SMEs. Indeed, on the one hand, many SMEs, particularly in LDCs, are not able to meet the criteria to embark on a "high road" strategy of technological upgrading, which would turn them into attractive linkage partners for MNEs (UNCTAD, 2000:15). On the other hand, the external forces driving FDI determine to a large extent the limits of technology diffusion through the creation of linkages: Best (1999:35) mentions that "Singapore's investment is heavily concentrated and in third and fourth tier supplier firms in the Johor region with minimal technology management capabilities; its growth is associated with the transition of the Singapore manufacturing capabilities from mass production to automated production." Therefore, special government measures are required to shape the linkages between MNEs and SMEs.

The Malaysian government has been very effective in promoting and shaping these linkages. The Penang Development Corporation initiated "small partnerships" in manufacturing among MNEs, SMEs, and government. A case in point is the Penang Skills Development Centre (PSDC) which is the result of a strategic alliance between the State Government of Penang, industry members (i.e. MNEs and local firms), and academia. "PSDC is a one-stop human resource development centre established in 1989 to address the shortage of sufficiently skilled manpower" (UNCTAD, 2000:16). PSDC's training reflects the

needs of the industry and its courses are able to figure prominently in member companies' annual training plans. The PSDC bridges the gap between skills taught in public institutions and skills required on the job. "Such tailored skills development training is an important factor in an SME's ability to absorb technology and engage in continuous innovation" (UNCTAD, 2000:16). One of the PSDC's most innovative programmes is the global supplier programme (GSP), which consists of two initiatives: basic training in critical skills and linkages with MNEs. The Centre has developed specific programmes for getting SMEs prepared for partnerships and MNEs have nurtured and mentored SMEs in the GSP. Lessons learned, according to UNCTAD (2000:17) are that the conditions for success are the following:

- governments must act as catalysts by providing and continuously improving logistics and educational infrastructure, particularly for the development of engineering and management skills;
- the public and private sectors, as well as academia, must work together to create "meso" institutions, such as skill training centres, to facilitate the transfer of technology and to achieve the capacity for continuous innovation.

Innovation policy instruments are prolific. Overall, it is the interaction of various factors that determines the final outcome of innovation policy, not any particular set of factors by itself. Getting the correct incentive structure would be of little use if the national capacity to respond to incentives were deficient. Investing in education and technology support systems would be worthless if the incentive structure misguided the alternative decisions of firms. Yet, in all aspects of technological capability development, there is a constructive role for government policies, as we will try to show within the context of Brazil and Chile.

### **Recommendations for LDC innovation policy**

In order to select priority policy instruments that can promote innovation in LDCs, we must first learn from the evolving use of instruments through time in developed countries. In these countries, amongst the varied innovation policy instruments described above, traditional instruments such as R&D institutions and all basic research efforts have become side-lined by new instruments in the search to stimulate the creation of efficient innovative capabilities. Indeed, after the Second World War, "the R&D system was seen as the source of innovations" (Freeman, 1997:29); this belief constituted the cornerstone of the traditional approach to innovation policy, which was called the linear model of science and technology "push". However, "as empirical evidence and analysis began to accumulate about industrial R&D and about innovation, both in Japan and in the United States and Europe, it became increasingly evident that the success of innovations, their rate of diffusion and the associated productiv-



ity gains depended on a wide variety of other influences as well as formal R&D” (Freeman, 1997:31). Amongst these, Freeman mentions the innovations of the shop-floor, the improvements to products coming from interaction between a firm and related firms, and between a firm and the narrower professional science-technology system. Based on this developed country experience, an important characteristic of innovation policy in developing countries should be that it involve a network building strategy. As Meyer-Stamer (1997a) stresses, “soft” factors have to be promoted by the diffusion of information on new organizational concepts, and by network building both across firms and between firms and government. Foray and Freeman also call for a policy of networks, based on the current production system: “in an information-intensive production system with a multiplicity of micro markets,...the only possible access to...diversity is through cooperation with other producers” (Foray & Freeman, 1993:72). With this model of innovation, the firm can access the know-how of firms in connected areas, which increases the value of its own human capital.

The implications drawn from this innovation policy focus are the following: significant public research programmes aimed at substituting for private research must be replaced by a more catalytic type of state intervention, which facilitates the conditions of the research learning process. Technological partnership must be promoted so that each individual trajectory of specialization becomes less risky. On the basis of the focus of network formation, we argue that it is possible to design effective innovation policies in developing countries. We now explore Brazilian/Chilean innovation policy to assess how realistic our project is in the context of Latin American developing countries.

## **BRAZILIAN/CHILEAN INNOVATION POLICY**

In order to gain an insight into the main innovation policies in Brazil and Chile, we draw from the interview answers of 17 representatives of public and private technology institutes (see tables 1 and 2 for a list of the institutes)<sup>4</sup>. Their comments were gathered during fieldwork carried out in 1999. For the full text of the interview questions and their answers, please see Beausang (2003:179-183). After synthesizing interview responses, we consider their implications for the theory of innovation policy.

### **Activities covered by technology institutions**

In this subsection, based on interview answers, we examine the goals of a broad set of Brazilian and Chilean innovation institutions, from programmes of technological innovation of Ministries of the Economy to private technology consultancies. We then unveil the identity of their preferred funding recipients.

**Table 1: List of selected Brazilian technology institutions**

<b>Name</b>	<b>Type of institute</b>	<b>Interviewee (s)</b>
Banco Regional de Desenvolvimento do Rio Grande do Sul	Regional development bank in Rio Grande do Sul	Director
Fundo de Amparo a Pesquisa do Rio Grande do Sul (FAPERGS)	Public institute for the promotion of research in Rio Grande do Sul	Director
Federacao de Industrias do Rio Grande do Sul (FIERGS) <sup>20</sup>	Industrial federation of Rio Grande do Sul	President
Servico Brasileiro de Apoio a Empresas do Rio Grande do Sul (SEBRAE RS) <sup>21</sup>	Public institute for the promotion of small and medium enterprises in Rio Grande do Sul	Director
Incubadora de Empresas Tecnologicas (IETEC) <sup>22</sup>	Municipal incubator	Assistant to the president
Unisinos <sup>23</sup>	University	Professor
Secretaria da C&T do Rio Grande do Sul <sup>24</sup>	Science and technology secretariat of Rio Grande do Sul	Director
Polo informatico da Unisinos <sup>25</sup>	Technology centre	Project manager

**Table 2: List of selected Chilean technology institutions**

Name	Type of institute	Interviewee (s)
Parque Valle de lo Aguirre	Technological park	Director
Programa de Innovacion Tecnologica (PIT) <sup>26</sup>	Technological innovation programme of the Chilean Ministry of the Economy	Executive director
INVERTEC <sup>27</sup>	Private consultancy in technology management	Main consultant
Corporación de la Madera (CORMA)	Sectoral association of pulp and paper producers	Vice-president
Fundacion Chile <sup>28</sup>	Technology institute	Project consultant; director of wood sector projects
Centro de Investigaciones Mineras y Metallurgicas (CIMM) <sup>29</sup>	Centre for research and innovations in mining technologies	Executive director
Corporacion de Fomento a la Producción (CORFO) <sup>30</sup>	National programme for promoting manufacturing	Coordinator of supplier networks programme; chief of operations department of the National Fund for Technological and Productive Development; manager of the Fund for the Development of Innovation.

### ***The main problems to be addressed by innovation policy***

One of the main goals of the institutions in our sample was the promotion of technological diffusion between firms. Many Chilean institutions did not consider the lack of technological innovation in their country as a problem in itself. Some asserted that there was more need for diffusion than innovation, given that the linear model of innovation had proven faulty. It was stated that knowledge increase via foreign technology transfer rather than indigenous technological innovation could be an efficient means of diffusion and acquisition of technological capability.

However, a second preoccupation was to promote the transition from development to research within firms. In Chile, the lack of research in firms was seen as a problem by the INVERTEC consultancy<sup>5</sup>. In 1995 a survey on industrial technological innovation was administered to 541 Chilean firms. Only one third of them reported that they made a strong effort to engage in research (Instituto Nacional de Estadísticas & PIT del Ministerio de la Economía, 1995). Based on the results of this survey, the PIT identified the following shortcomings in the Chilean innovation system: the current inadequacy of the financial system given the necessities of technological innovation projects, the poor development of cooperation between firms in innovative projects, and the difficulties in the transition from the phase of R&D to its productive applications.

### ***The reasons behind low levels of innovation***

While some policy-makers deplored the low levels of innovation of firms, many of them were also quite aware of the roots of the problem. In Brazil, we were told that there was no entrepreneurial culture of research because of its high cost (IETEC interview, 1999). The research deficit was also seen as a remainder of the 1970s' policy of import substitution industrialization, which induced Brazilian firms to copy technology, with the result that entrepreneurs only engaged in technological investment for a specific project, without being aware of the need for continuous R&D (Ibid.).

Other institutions, both in Brazil and Chile, emphasized the fact that in order to be innovative, firms needed to have a pre-existing capability in technological infrastructure, equipment and human resources (IETEC interview, 1999). These minimal conditions must already exist before firms can start innovating; of course, these conditions do not exist in most Brazilian and Chilean firms. Consequently, the IETEC incubator in Brazil provided most of its grants to projects in product development, marketing and commercialization, rather than to projects in more basic innovation, because it considered the former projects to constitute a funding priority<sup>6</sup>.

Yet, the project coordinator of the Fundación Chile (Moreno interview, 1999), which is a technology transfer agency, suggested a potential remedy to the low levels of innovation. He called for the creation of mechanisms that generate and diffuse information between agents of innovation. One such mechanism consists in “soft guidance instruments”. By soft instruments, he meant flows of information, pooling of know-how of various actors, integration of interests, and adoption of procedures. These instruments involve the participation of employers’ organizations, trade unions, associations, local administration, technology institutes, and universities. For Fundación Chile’s project coordinator, the active shaping of “soft” structures to improve Chile’s competitiveness is in infancy. The only recent improvement in this respect has been the creation of joint marketing channels between firms. For example, enterprises from the wood industry have begun to create networks for joint marketing (see Meyer-Stamer, 1997a).

The project coordinator insisted that these forms of cooperation among enterprises could be cemented by institutional networks. For example, the Fundación Chile has recently created “sectoral working parties” for “dynamic enterprises”, to induce some enterprises to exchange engineers and inspect each others’ plants in competitive cooperative structures (see also Esser & Meyer-Stamer, 1993). The Fundación Chile has consolidated communication and information structures among enterprises and between employers and experts (through seminars on new production technologies, “round tables” for employers on technical and organizational problems at the subsectoral level, and continuous management training). The Fundación promotes cooperation in R&D, specifies quality standards, and organizes joint seminars on technological problems. According to its project coordinator, the Fundación Chile proves how important institutions are in the process of developing competitiveness. Via its arbitration, enterprises form networks with technologically innovative services, institutions, and universities. Unfortunately, the coordinator noted that institutions such as the Fundación Chile were very rare in Chile.

### **Individual targets of innovation policy**

Given the low levels of innovation, the recipients of innovation policy funding had to be selected all the more carefully. Ideally, large firms were the preferred targets of both Brazilian and Chilean policy-makers, as they had the most resources to devote to innovation. An INVERTEC consultant claimed that projects developed by large firms produced three times as many benefits as those developed by small ones in terms of output per peso invested (INVERTEC interview, 1999). For this consultant, the ideal innovative firm employed four hundred people: with this number of employees, the firm did not experience organizational inertia and carried sufficient financial weight to engage in innovation. The same was concluded in Brazil (IETEC interview, 1999). The FIERGS representative, in Brazil, noticed that large firms had a

role to play as industrial leaders, particularly in a globalized world (FIERGS interview, 1999). According to him, when Brazilian SMEs attempt to sell their products to the US, for instance, they do not have the means to commercialize or compete; hence the need for them to rely on larger firms for commercialization. Therefore, he found that large firms had to be key policy targets, on the basis of their spillover to the rest of the economy.

Whereas large firms were often identified, at least in principle, as key policy targets, MNEs in particular were not drawn into the national innovation project: the representatives of CORFO (Silva interview, 1999) and the Brazilian Rio Grande do Sul Bank for Regional Development (Bonzoni interview, 1999) mentioned that their institutions did not want to place any limitations on the free agency of MNEs, by forcing them to diffuse their innovative capabilities to other firms. They argued that such requirements would “distort” investment decisions. Indeed, this prevailing attitude in the sphere of Brazilian and Chilean innovation policy is consistent with the nature of these countries’ investment policy. As argued by Chudnovsky & Lopez (2000a, p. 18), the Brazilian and Chilean governments have been so keen to attract MNEs at all costs that they have rarely placed any requirements or set up incentives towards their contribution to local innovative capability. They argue that the structure of investment incentives implemented in these countries has not reflected the possibility that, in addition to benefiting from the investments themselves, host countries could benefit more directly from externalities and spillovers via local subsidiaries’ undertaking of innovative activities, training of human resources, or supplier development. This is all the more surprising given that the World Trade Organization does not prohibit the application of incentives destined to R&D activities or personnel training. Although on the one hand, some incentives have been granted to investments which were meant to lead to significant export flows, on the other hand, competitiveness improvement and restructuring of local suppliers have not been consistent policy objectives. The absence of such objectives has limited the generation of backward linkages from promoted investments in Brazil and Chile.

In fact, the representative of the Brazilian Rio Grande do Sul Bank for Regional Development (Bonzoni interview, 1999) noted that the current recipients of its funding were neither large firms, nor MNEs, but SMEs, supposedly because of the difficulties involved in influencing the strategies of the other two categories of firms. In addition, for the IETEC representatives (IETEC interview, 1999), large Brazilian firms do research in-house, as opposed to US ones, which subcontract SMEs to make technological breakthroughs for them. For these representatives, the in-house technological activity of large Brazilian firms does not allow any scope for technological diffusion. Nonetheless, because IETEC does not have an important capacity for product commercialization, its director is attempting to form alliances between its incubated firms and large firms by advertising them as an inexpensive source of technological

development for large firms. The *Conselho Regional de Engenharia e Agronomia* or Regional Council of Engineering and Agronomy informs engineers from large firms of the existence of incubator SME services. Both parties share an interest in cooperation: the large firm can specialize in its core competencies, the small one can access the market and commercialize its innovations via the large firm. However, to date, IETEC's success in appealing to large firms has been limited.

So far, we have examined innovation policies which focus on particular actors, such as single firms. However, some of the most interesting innovation policy programmes in Brazil and Chile at the moment are the few programmes which attempt to build on external networks between firms. We now turn to an investigation of these programmes.

### **A recent initiative in Brazilian and Chilean innovation policy: the supplier network programme**

One such programme is the Programa de Desarrollo de Proveedores (in Chile)/Programa de Capacitacao de Fornecedores (in Brazil), or Supplier Network Programme. Henceforth we will refer to it as PDP. A PDP is a programme in which a supplier is subcontracted by a core firm for an extended period of time (from two to three years) under the direct supervision of a governmental agency (Servico Brasileiro de Apoio a Empresas or Brazilian Service of Support to Firms (SEBRAE) in Brazil and Corporacion de Fomento a la Produccion (CORFO) in Chile). The purpose of the PDP is to monitor the core firm's transfer of technology and management practices to the suppliers. From our viewpoint, PDPs are interesting because they contribute to the objective of competitiveness diffusion between firms. As we mentioned, these programmes have been a feature of East Asian innovation policies for some time, but are a very recent addition to Latin American innovation policy.

The PDP is not a spontaneous development but rather an artificial, policy-induced creation of relationships between a core firm and SME suppliers. Hence, it requires the intervention of a third actor, i.e. a government agency, whose role is to monitor the competitiveness spillovers of the core firm. This intervention can be crucial because the core firm often conducts most stages of its production process in-house or buys services in the market—therefore it must be induced by a governmental agency to delegate particular production activities to its suppliers.

But what profit can the core firm derive from the PDP? A core firm requires constant supply and competitive prices from its suppliers. Its goal is to improve efficiency, decrease defect rates, increase quality control, and optimize productive processes. Towards this goal, the core firm can transfer its managerial practices so that the small one can produce a higher quantity of output per unit, or transfer its technology so that the small one can produce at a

lower cost via the reduction of its labor force<sup>7</sup>. Therefore, the main interest of the PDP for the core firm is that with improved quality from suppliers, it can reduce the costs of its operational and productive processes (SEBRAE, 1999). The result of the programme for the core firm is more competitiveness, economies of scale, bigger negotiation power, and more information for decision-making.

Moreover, to understand the appeal of the PDP, we have to consider the alternative options available to the core firm. Assuming that a core firm has decided to externalize part of its production<sup>8</sup>, there are two ways for it to organize its supplier relations: either the core firm and its suppliers are integrated by a policy partnership via the PDP (whereby the core firm buys from a small number of suppliers, and builds long-term, cooperative relationships with those few suppliers) or they are involved in subcontracting arm's length relationships through the market (whereby the core firm buys inputs from outside using a number of short-term suppliers and shops for the best price each time it requires an input).

To understand why a core firm prefers PDP partnership supplier relations, we first need to examine why some firms resort to arm's length subcontracting relations. Dyer (2000) notes that when inputs are highly standardized, or do not involve transaction-specific assets, firms use subcontracting arm's length relationships with outside suppliers who can specialize and achieve economies of scale. For him, arm's length relationships have appeal because they are simple and easily managed: they only involve minimal information exchange, the levels of interdependence between the technological and functional systems within each firm are low, and the need for trust is also low because neither party is vulnerable and switching costs are low. All these characteristics imply that a consumer's relationship with his set of suppliers can be replicated easily with any other set of suppliers.

Then what determines a firm's choice between arm's length subcontracting and PDP partnerships? As it happens, the strength of arm's length relationships, i.e. their simplicity, is also their major weakness: they are "incapable of generating [competitive] advantage because there is nothing idiosyncratic about the exchange relationship that enables the two parties to generate profits above and beyond what other seller-buyer combinations can generate" (Dyer, 2000, p. 37). Hence, when transactors choose to create value and competitive advantage through investments enhancing the productivity both of the consumer and of a set of long-term suppliers, i.e. investments in dedicated assets<sup>9</sup>, partnerships are preferable to arm's length relationships, as the latter do not even consider a particular consumer-supplier combination as the source of competitive advantage. As explained by Dyer (2000), "when deciding [between organizational forms], managers must wrestle with a fundamental dilemma: productivity grows with the division of labor, thereby creating an



incentive to outsource activities to more specialized firms, but specialization increases the costs of communication and coordination of activities, thereby creating an incentive to bring activities in-house to manage under a common hierarchical structure” (p. 25). To a large extent, partnerships offer a moderate compromise between specialization and coordination. In particular, it was clear from our fieldwork interviews in Brazil that the PDP was preferred for this reason. We were told that it allowed for the maintenance of specialized yet stable relations, which therefore facilitated their coordination, while arm’s length subcontracting was perceived as a temporary means of specialization without coordination.

To examine the extent of stability and coordination provided by PDPs, we now turn to the case study of a Brazilian PDP.

### ***Case study of a Brazilian PDP***

At the SEBRAE, an agency which is represented both at the national and the local levels, a PDP was designed in 1993<sup>10</sup>. The PDP process is divided in the following stages. The SEBRAE finds a core firm, verifies its interest in the programme, investigates whether it has a series of existing suppliers or not, and encourages it to select the firms it would be willing to train. The demanding entity must be the core firm. Training revolves around issues of quality, productivity, management, technology, and human resource (HR) management<sup>11</sup>. The SEBRAE has implemented PDPs in the shoe, metal and furniture sectors.

Two PDPs have been carried out in the shoe sector of the Vale dos Sinos in Rio Grande do Sul (RS), where fieldwork was conducted; the two demanding firms were Artecola and Simpatia. One of the Sinos programmes was set up by the SEBRAE of RS in conjunction with the Associacao Comercial Industrial e de Servicos de Novo Hamburgo (ACI-NH) or Commercial, Industrial and Service Association of Novo Hamburgo, the Centro Tecnologico de Couro, Calcados e Afins (CTCCA) or Technological Centre for Leather, Shoes and Components, and Artecola Industrias Quimicas as the demanding firm (the second programme involved the same actors and workings, except that the demanding firm was called Simpatia). The SEBRAE supported the demanding firm in the execution of projects and training of suppliers, with an emphasis on total quality management. The ACI-NH promoted the linkages between the SEBRAE and the leather-shoe complex. The CTCCA carried out the technical coordination of the project and contributed to its development with technical resources. It participated in the project through monthly hours of technical training and through its labs. In conjunction with the other participants, Artecola chose its supplier firms, and elaborated a programme of subcontracting and development of suppliers, establishing priorities as to products and services to be delivered. It stimulated the adoption of modern management methods by small suppliers, promoted their technological upgrading, and estab-

lished long-term contracts with them. Artecola supported training activities via its consulting services, HR and materials. 60% of project expenses were financed by the National SEBRAE, 10% by the regional RS SEBRAE, 20% by Artecola, 5% by the SMEs, and 5% by the ACI-NH (SEBRAE, 1999).

Sixtythree SMEs received management and technology training from Artecola. The sequence of the programme was as follows: definition of policies with suppliers, visit of consultants to Artecola, visit of Artecola to suppliers, seminars with suppliers, visits of suppliers to Artecola by group and division, diagnosis of suppliers and compilation of performance indicators, elaboration of plan of action, courses, consulting, technical training, and final diagnosis. There were 15 hours of seminars, 536 hours of classes, 298 hours of training and 800 hours of consulting. Courses included the following: introductory seminar to total quality management, five senses course, analysis methodology, statistical processing, production planning, participatory groups, leadership, just-in-time (JIT) and cost analysis for SMEs.

### ***The managerial profile of supplier firms***

Having explained the functioning of the programme, we need to describe the nature of the supplier firms participating in it, and their initial managerial profile. We gained an insight into their profile by accessing data from the Simpatia PDP record held by SEBRAE (which involved 51 SMEs). The consultants' initial assessment of the suppliers was rather negative. 80.4% of the supplier firms did not possess an organization chart (SEBRAE, 1999). 19.6% of them declared they had a strategic plan, which was not confirmed in 5 cases by other SEBRAE questionnaire responses. In financial terms, 43.1% of the firms declared they were in an unstable position. 56.9% of the firms did not possess a structure or system of cost analysis. Only 6 firms had an activity oriented towards quality systems. Only one firm was implementing JIT. 82.3% of the firms did not have a clearly defined HR policy.

These data (which are representative of the majority of Sinos shoe sector SMEs, according to SEBRAE) explain why the priority of PDPs in Brazil so far has not been technological training, but other areas such as management, commercialization and finance. It does seem logical to address basic problems before complex ones<sup>12</sup>.

### ***What were the core firms expecting from the programme?***

Given the poor performance of supplier SMEs, one might wonder why core firms would want to engage in a network with them. The motivations of the two demanding firms involved in PDPs in the Vale dos Sinos were varied. Artecola, for instance, was "hoping to stimulate the practice of industrial subcontracting through the creation of conditions for the establishment of a tech-

nical and management standard that would be common to [its] small-sized suppliers” (SEBRAE, 1999, p. 15). Homogeneity and stability in supply were therefore important advantages offered by the programme. The viewpoint of the manager of Simpatia, which was the other firm involved in a PDP in the Vale, was different. He was more interested in strengthening his firm’s core competencies: “the global economy is moving towards the fragmentation of mega-industries into large and medium-sized ones and this tendency causes large firms to stimulate small ones, and the specialization of business is part of this market rule” (SEBRAE, 1999, p. 13).

### ***How did the participants evaluate the programme?***

Now that we have clarified the expectations of demanding firms before they became involved in PDPs, the next issue we need to address is how they subsequently evaluated these programmes. The director of Arteccla stated that the PDP considerably improved the process of evaluation and certification of suppliers, the quality of their supply in terms of delivery and quality, as well as their services and defect resolution. The manager of Simpatia cast the following judgment on the PDP: through the creation of a network between Simpatia and its suppliers of sole components, the suppliers’ sequential production structure became organized into cells, the management skills of suppliers improved, more supplier flexibility allowed for a quicker change of models within Simpatia, controls became less necessary, the indirect labor force used to control defects was reduced, and so were stocks (SEBRAE, 1999). These judgments point to the fact that both small and core firms derived benefits from PDPs. On the whole, they can be grouped under the category of “stability benefits”, as suggested by the literature.

### **Conclusion**

Based on the above panorama of Brazilian and Chilean innovation policies, it is clear that even if policy-makers are increasingly acknowledging the importance of linkages between different firms, they ignore the linkages of MNEs in particular and focus their attention on those of indigenous core firms in general. We would like to make a case for national innovation policies to stimulate the creation of networks centred around MNEs, yet this requires a complete rethinking of the Brazilian and Chilean national systems of innovation (NSIs)<sup>13</sup>. Below, we suggest reasons why national innovation policy could gain from targeting MNEs as opposed to indigenous core firms in general, and we examine the specificities of MNE-led supplier networks.

## **BRIDGING MNE AND POLICY STRATEGIES: SUGGESTIONS FOR AN IMPROVED SUPPLIER NETWORK PROGRAMME**

We argue that for Brazilian and Chilean PDPs to achieve their full potential, they would have to make use of MNEs instead of indigenous core firms, which are currently at the centre of PDPs. On the one hand, we have already reviewed the evidence on Brazilian PDPs organized around indigenous core firms, and we concluded that they had succeeded in diffusing competitiveness. On the other hand, there is ample evidence in the literature, and we will show below that most MNEs are competitive firms, given their privileged access to two key sources of competitiveness, i.e. technological and organizational innovation<sup>14</sup>. Therefore, we suggest that Brazilian and Chilean PDPs could use MNEs and diffuse their competitiveness.

This usage of MNEs would be a novelty in the Brazilian and Chilean context. Indeed, MNEs are not targeted by current Brazilian or Chilean innovation policies, including PDPs. But we do not consider this to be a problem for our research: while the absence of MNEs from existing PDPs is unfortunate, it only reinforces our point that Brazilian and Chilean innovation policy ignores the potential of MNEs. We suggest that this is a mistake. However, we still have a lot to learn from existing PDPs between indigenous core firms and their suppliers. A priori, there is no reason why the beneficial results of these PDPs should not apply to PDPs involving a multinational core firm. In other words, we suggest that the MNE is a good candidate to undertake a PDP, but we make use of the PDP evidence that exists, which only involves indigenous core firms, to evaluate the performance of this kind of programme in the transfer of technology and best practice management.

There are two advantages in an innovation policy of supplier networks creation involving MNEs in particular. On the one hand it builds upon an MNE strategy: indeed, one of the sources of competitiveness of the MNE is a strong external network<sup>15</sup>. On the other hand, as we showed above, network-building has become a key aspect of innovation policy. Therefore, an external network (such as the supplier network) can be the meeting point between an MNE strategy and a policy strategy. External networks can be shaped both by MNEs and innovation policy. Hence our double goal of identifying the conditions under which an external network between an MNE and its suppliers benefits first the MNE, and second some targets of innovation policy, i.e. suppliers.

### **The rationale of PDPs for MNEs**

While we covered the benefits of PDPs for core firms in general in the preceding section, we now focus on the conditions under which PDPs benefit MNEs in particular and on the attributes that MNEs must possess to engage in

such networks. Regarding the above-mentioned conditions, it is interesting that some researchers have suggested that MNEs would prefer to retain linkages overseas (with their parent or globally), rather than undertake the extra costs of developing local suppliers (Hill, 1985). Thee (1985) goes so far as to argue that MNEs subcontract locally only under government pressure. In practice, however, an MNE's decision to set up a supplier network is determined by the existence/capability of local suppliers and the capability of the MNE to maintain overseas networks. We choose to concentrate on the MNE's capability to maintain overseas networks, as we are particularly interested in the attributes of the MNE itself in this section, as opposed to those of its suppliers<sup>16</sup>.

The capability of the MNE to maintain an overseas network is itself related to the trade potential between the MNE's home and host countries as well as the MNE's size. Together, these two factors constitute the MNE's "economic base" for networking. Let us begin with trade potential. For a full *expose* of the relationship between trade potential and supplier networks, see Markusen (1983). In a nutshell, there are two sides to this relationship. One aspect of the relationship has to do with the MNE's specific level of export-intensity: the more export-intensive the MNE, the higher the quality and the more specialized the inputs required to be competitive in world markets, the lower the MNE's reliance on local suppliers. The other aspect of the relationship is related to national trade flows: the more trade potential there is between an MNE's home and host countries, the more justification there is for the establishment of a supplier network.

How does this apply to our context of analysis? On the first aspect, Chudnovsky & Lopez (1999) show that Brazilian/Chilean MNEs are not highly export-intensive, as they seek primarily to compete in their host countries, hence the justification for the establishment of networks. On the second aspect, it has been shown elsewhere (Beausang, 2003) that Brazilian/Chilean foreign direct investment is not a substitute for trade; in fact, Chudnovsky & Lopez (1999) have argued that such capital flows emerged as a response to the opportunity opened up by the creation of the Mercosur trading block between Brazil, Argentina, Paraguay and Uruguay (plus Chile, Bolivia and Peru), and has ended up complementing the trade flows between Mercosur members. Hence the rationale for supplier network creation.

A second determinant of an MNE's capability to maintain overseas networks is its size, as it influences the MNE's competitive advantage. In the context of Taiwanese host country supplier networks, Chen (1998) shows that the impact of firm size on the capability to maintain an overseas network varies across time. He compares the sourcing strategies of Taiwanese affiliates established before 1990 with those established after 1990 and he finds that in the long-run, affiliates of small and medium-sized MNEs offer a stronger local linkage because of what he calls the pressure to localize. Such pressure comes from the MNE's inability to tap into international resources and from a gradual

reduction in the support it receives from its parent firm. However, in the short-run, he finds that affiliates of large MNEs source more materials locally because of economies of scale in local procurement. Yet in the long-run, these affiliates use standardized components and parts that enable alternative sourcing from the outside world: therefore, they pursue a globalization strategy with worldwide suppliers. That is, they engage in global, not local sourcing.

Although Chen's findings are specific to the context he is looking at, there is a lot to be learned from them in terms of the attributes required of MNEs considering an involvement in local supplier networks. In fact, the part of his findings that is generalizable is their implication for the attributes that are not required. Indeed, the interesting point about Chen's small and medium-sized MNEs is that they are weak organizations from the perspective of a firm-specific advantage but they are linked by strong networks<sup>17</sup>. From this perspective, there does not have to be a strong competitive advantage to justify the creation of local supplier networks, in fact, it is the weakening of an MNE's competitive advantage that justifies their creation, as an opportunity to take advantage of assets accumulated locally<sup>18</sup>.

At this point, we must introduce a note of caution: "competitive disadvantage", as Porter would call it, can only take an MNE so far. Realistically, it cannot be seen as a sufficient base to justify the creation of a local supplier network. Chen's small and medium-sized MNEs were largely able to develop local supplier networks because they possessed a "cultural base" for networking, which offset their insufficient "economic base" or more precisely their insufficient competitive advantage. This cultural base consisted in the pre-existing ethnic linkages between Taiwanese entrepreneurs and the Chinese diaspora present in host countries. It is in this respect that Chen's findings on Taiwanese MNEs are very context-specific.

Yet while we need to keep Taiwanese idiosyncrasies in mind, Chen's data does provide us with some evidence that a strong competitive advantage is not a pre-requisite for an MNE's involvement with supplier networks. Furthermore, in the case of MNEs with a weak advantage that are willing to establish a network, it makes all the more sense for the state to facilitate the process in the context of a PDP by providing the necessary training and monitoring facilities. Overall, our main point remains that the dynamics of competitiveness articulate MNEs and supplier firms through the innovation system. This articulation can take place through a two-phased mechanism:

- A/Accelerated rate of innovation of MNEs via multinationalization
- B/Diffusion of innovation from MNEs to suppliers and integration of the MNE into the NSI.

It is not because the MNE has subsidiaries that transcend the national that the NSI should not profit from the feedback of the MNE's enlarged scale of operation. It makes sense to diffuse the benefits of multinationalization

throughout the value chain. Suppliers do not benefit at the expense of the MNE; rather, the PDP is best seen as an exchange between reduced costs to the MNE and a “backward” technology and/or management transfer to suppliers. The objective is technology and/or management diffusion versus cost reduction<sup>19</sup>.

### **Why is the MNE an ideal target for policy?**

We have already shown why the absence of involvement of MNEs in PDPs could be detrimental to the MNE. But exactly why should policy-makers choose the MNE as a vehicle for the PDP? One of the basic flaws of PDPs so far is that they have not really incorporated a technology dimension, particularly in Brazil. The MNE is precisely amongst the most dynamic technology actors in developing country economies, therefore if it were to be included in the PDP, it would be a useful source of technology and hence competitiveness. Moreover, the particularity of the MNE is that it is located in different countries, once again taking advantage of different NSIs and, through a feedback mechanism, integrating them into its innovation capability. This particular characteristic of the MNE gives it a crucial role in the NSI, it places it at the avant-garde of technology at the national level, since it has access to more knowledge than an indigenous firm does. By exposure to this cross-border technological pool, an MNE that is involved in a PDP could give its suppliers access to the most dynamic and developed aspects of technology, in addition to those of organizational innovation.

In light of the positive impact of supplier networks on the NSI as well as on the MNE itself, the first task of policy-makers is to awaken MNEs to the benefits that can be gained from PDPs. A lot of work needs to be done in this area, probably more so in Chile than in Brazil. Although we have argued that MNEs have a lot to gain from a PDP, MNEs are still inclined to ignore its virtues and focus on its disadvantages. As suggested by transaction costs theory, the presence of environmental and human factors, such as uncertainty, limited rationality and opportunism, renders rather unattractive the investments that an MNE would have to make to construct and consolidate a trustworthy supplier network that complements its specific competitive advantage (Peres Nunes, 1998). In fact, in normal conditions, such investments are costly, have a high probability of failure and are scarcely appropriate. In such a context, the action of public policies that try to eliminate the inertia of conduct based on distrust is justified (but currently still at the stage of infancy), in order to diminish the risks of opportunism and consolidate new work practices that support the profitability of efficient productive articulations.

Various measures can be taken by policy-makers to induce MNEs to participate in a PDP. These measures strive to increase the efficiency of the PDP, and thereby render it “attractive” to MNEs. The following elements could be useful in attaining this objective:

- i) Reform of legal and administrative aspects that regulate supplier and technical assistance contracts between firms. Legal instruments must be adequate for the promotion and regulation of subcontracting mechanisms.
- ii) Constitution of a network of private institutions which would promote articulations between suppliers and MNEs, with public support. The strategic orientation of MNEs would be to strengthen and develop firm networks as a key element for competitiveness increases. As far as public support is concerned, SEBRAE and CORFO (particularly SEBRAE) need to establish a new focus on technology transfer in addition to their present focus on management transfer.
- iii) Creation of adequate instruments to take these programmes to their term, with due consideration of the contexts of technical assistance, technology transfer, training, and financing. Sectoral associations like the ACI/NH in the Vale dos Sinos and the CTCCA could have a key role in monitoring these activities.

Besides awakening MNEs to the benefits of PDPs, the second task of policy-makers is to ensure that these benefits do not solely flow to MNEs with high market and bargaining power: even if MNEs were convinced of the merits of supplier networks, they might attempt to draw all the benefits of the network, i.e. quality increases and cost savings, without providing equal benefits to suppliers. There is no certainty that suppliers will receive an equitable transfer of technology and managerial best practices from MNEs, if policy is not monitoring the transfer process. The role of policy is to ensure that the benefits of the network are distributed equally between the MNEs and their suppliers.

## **CONCLUSION**

The empirical evidence provided by 17 public and private Brazilian/Chilean innovation institutes formed the basis in this article for an attempt to define and extend the scope of innovation policy theory in a Brazilian/Chilean context. This institutional evidence provided support for both the hypotheses that Brazilian/Chilean innovation policy does not succeed in enhancing Brazilian/Chilean competitiveness and that MNEs are not included in current innovation policies.

In focusing on this approach, consideration was given to detailing the crucial role of networks as a common factor in possible corporate and innovation policy initiatives. As an example of external network promotion by innovation policy, we considered the case of the supplier network programme (PDP). To date, in Brazil and Chile, this programme has incorporated indigenous core firms and the evidence on existing PDPs involving such firms sup-



ports the hypothesis that PDPs generate national competitiveness increases through the transfer of technology and management from core firms to their suppliers.

Yet because the overall argument for redefining and improving innovation policy was pursued in conjunction with a concentration on the links between MNEs in particular and competitiveness, this led us to consider whether MNEs could play a major role in raising competitiveness levels in both Brazil/Chile and how innovation policy could facilitate this process. In this perspective, we suggested that MNE-led PDPs could be a useful policy innovation. We analyzed the case for MNE-led PDPs and our conclusion was that they could be catalysts of technology and management transfer from MNEs to their suppliers.

While this paper has focused on the effects of innovation policy programmes in the particular case of supplier networks, further research could examine other types of inter-firm network promotion. Brazilian and Chilean innovation policy bodies are creating funding opportunities for general inter-firm agreements as well. It would be of interest to research the local competitiveness effects of promoting inter-firm agreements between Brazilian/Chilean MNEs and other firms, as opposed to just analyzing those of supplier networks in particular.

## NOTES

- 1 Interestingly, it is clear that the major constraint on national competitiveness consists in the limits of territoriality: national competitiveness is constrained by the nation's single pool of concentrated resources. Yet nations could overcome this constraint if they could draw from the expanded resources of firms that are not restricted to the national territory, thereby enhancing national competitiveness. More on this later.
- 2 Indeed, economic development requires a coherent set of different policies, all informed by the continuity of one focused strategy oriented towards the development goal. Ideally, one should be able to see the common thread of development policy cutting across industrial, competition, and innovation policies. Of course, this implies previous agreement on the essence of the development goal. We argue that the acquisition of competitiveness could be a good proxy of the development goal.
- 3 "Many of the large American and Japanese companies invest continuously in shop-floor skills. In fact, the "invisible college" of company skill formation is considerable in Penang" (ibid., p. 25). Best mentions the case of Hitachi's use of small group activity in Penang which has facilitated the "transfer" of skills to the local industry .
- 4 In Chile, all of the interviews were conducted in national level public institutes and private institutes. In Brazil, problems of access forced us to concentrate on state level institutes for our interviews, which we conducted in the state of Rio Grande do Sul (RS). Together with the state of Sao Paulo, RS is the manufacturing and business centre of Brazil. It is mainly peopled by Brazilians of German descent. Local industries include

- wine, ladies' shoes, textiles, steel, electronics and electric goods.
- 5 For one of its consultants, the most innovative sectors in Chile were telecommunications, mining, genetics, fisheries, biotechnology, while according to the Chilean programme of technological innovation (PIT), these were forestry for pine and eucalyptus, microelectronics, and fruit.
  - 6 However, the IETEC constitutes an exception with respect to the profile of its firms in that the entrepreneurs that apply to participate in the incubator already have a high degree of scientific and technological knowledge, come from scientific university departments and hence need commercialization rather than innovation opportunities.
  - 7 Indeed, technology is at least as important as organizational innovations for the success of the PDP (Eduardo Silva interview, 1999).
  - 8 That is, it has rejected the option of vertical integration/hierarchy, whereby the firm produces the required input in-house and maintains control over both the sourcing unit and the buying unit. Vertical integration is preferred when inputs must be highly customized because the buyer reduces the transaction costs associated with bargaining over the profits generated in a customized exchange.
  - 9 "Dedicated assets are investments in factories, equipment, processes, and people that are customized to a particular customer or supplier. These investments improve the productivity of the network and the speed with which the network can coordinate in developing unique products" (Dyer, 2000:37).
  - 10 In this section, we focus on evidence on the Brazilian PDP. However, there also exists a PDP in Chile. In Chile, the PDP is only a three-year-old pilot programme. Over the years, the programme has slightly changed. When the programme was set up, all firms were from the agro-industrial sector. In 2000, 700 Million pesos went to the agro-industry, and 200 Million were allocated to manufacturing. While only 18 core firms participated in the programme in 1999, it now involves 16 core firms with 1688 SMEs. Only 2 firms have asked for contract renewal. Indeed, the relationship with suppliers often proceeds spontaneously after the first year of the programme, without the need for a policy push. In Chile, the PDP functions through agents, i.e. non-profit organizations, or sectoral associations. The PDP funds are sent to them. The agents structure the plan of the programme and present it to CORFO. The SMEs make their interest in the PDP known to the agents but at the same time, the agents try to stimulate the core firms. There is no direct relationship between the SMEs and the core firms; they both have to go through the agents.
  - 11 In the Brazilian programme, technology and product innovation are not the main foci. The programme mainly concerns management innovation, which according to many is the urgent problem faced by Brazilian firms.
  - 12 Moreover, on the supply side, "[core firms] are more willing to transfer knowledge about management than about technology" (UNCTAD, 2000, p. 8).
  - 13 Innovation systems can be defined as networks of agents and sets of policies and institutions that affect the introduction of new technology to the economy, sets of public and private institutions and organizations that fund and perform R&D, translate results of such activities into commercial innovations, and affect the diffusion of technologies within the economy.
  - 14 See for instance Hedlund (1986) and Dunning (1995).
  - 15 See Dunning (1995), Hedlund (1986), and Zanfei (2000).
  - 16 For a token description of the capability of local suppliers, see section 3.3.2.
  - 17 This is all the more relevant to our analysis because Chilean MNEs tend to be medium-

sized.

- 18 This approach is rooted in a particular conception of foreign direct investment, whereby it is motivated by the quest for a specific advantage instead of being the result of the possession of such advantages (Chen, 1998, p. 6).
- 19 Interview with Mr. Klauch, export agent, Novo Hamburgo, 1999.
- 20 [www.poa.fiergs.org.br](http://www.poa.fiergs.org.br)
- 21 [www.sebrae-rs.com.br](http://www.sebrae-rs.com.br)
- 22 [www.prefpoa.com.br](http://www.prefpoa.com.br)
- 23 [www.unisinos.tche.br](http://www.unisinos.tche.br)
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