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The Role and Development of Technology-Intensive Suppliers in Resource-Based Economies: A Literature Review

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Abstract

Although primary industries are important to developing countries, they have been largely unable to contribute to rapid growth. Systematically strengthening the development of local technology-intensive suppliers (t-suppliers), however, may contribute to both reinforcing the industrial base and supporting the competitiveness of primary production. Indeed, the development of t-suppliers has been common in those resource-based economies which achieved a high level of development (Scandinavia, Canada, Australia). This paper explores the role of t-suppliers in natural resource-based economies. It outlines a theoretical framework for the analysis of the factors which foster or constrain their development and defines areas for an effective promotion of t-suppliers. The proposed model of analysis distinguishes between factors influencing the development of t-suppliers on the level of the main industry (MI), the level of supplier firms or firm-level and the level of external determinants with special reference to industrial policy factors.

JEL classification: O14, Q22, R11

Key words: Technology-intensive suppliers, resource-based economies, developing countries, SME promotion, economic growth

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Zusammenfassung

Die Rolle und Entwicklung von technologieintensiven Zulieferern in Rohstoffökonomien: Ein Literaturüberblick

Primärindustrien sind in vielen Entwicklungsländern von großer Bedeutung, haben in der Vergangenheit jedoch in der Regel nicht zu hohem Wachstum beitragen können. Eine systematische Förderung lokaler technologieintensiver Zulieferer kann nicht nur dazu verhelfen, die industrielle Basis des Landes zu stärken, sondern auch die Wettbewerbsfähigkeit der Rohstoffproduktion zu erhöhen. Tatsächlich stellt die Entwicklung von technologieintensiven Zulieferindustrien ein gemeinsames Charakteristikum der ressourcenbasierten hoch entwickelten Länder Skandinaviens (Finnland, Schweden, Norwegen) sowie Kanadas und Australiens dar. Der Autor dieser Studie untersucht die Rolle der technologieintensiven Zulieferer in ressourcenbasierten Entwicklungsländern. Er entwirft einen theoretischen Rahmen für die Analyse der Faktoren, die ihre Entwicklung fördern oder behindern und definiert Bereiche für eine effektive Förderung von technologieintensiven Zulieferindustrien. Das vorgeschlagene Analysemodell unterscheidet zwischen Faktoren auf der Ebene der Hauptindustrie, der Ebene der Zulieferindustrien oder Firmenebene und der Ebene externer Determinanten mit speziellem Bezug auf industriepolitische Faktoren.

The Role and Development of Technology-Intensive Suppliers in Resource-Based Economies: A Literature Review

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Article Outline

1. Introduction
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1. Introduction

The share of primary commodities as a percentage of total exports from developing countries (DCs) has decreased in recent years. A vast number of countries, however, are still depending on this kind of exports. Latin American and African exports rely to more than 50% on natural resource-based industries (NRIs) (UNCTAD 2003). Common sense suggests that an abundance of natural resources should generate wealth but a look at the poor economic performance of Latin America and Africa alludes to the contrary.

The resource curse theory argues that natural resource abundance may negatively impact on the development of a society through various channels. On the cultural level natural resource abundance could induce rent-seeking behavior and the level of trade it might lead to

declining terms of trade, instability of returns and an overvalued real exchange rate. Furthermore, natural resource abundance could on the industrial level inhibit the formation of a solid industrial base e.g. by a premature de-industrialization and on the social level spur unequal distribution of income. On the political level, finally, resource abundance might provoke postponement of political changes, pursuit/adoption of inadequate policies and territorial conflicts (Auty 1994, Auty 2000, Sachs/Warner 1995, Stevens 2003).

The lack of developing a diversified industrial base is linked to what has been called Dutch disease reminding of the concentration of the Netherlands' investment in gas exploitation during the 70s (Stevens 2003). The Dutch disease model suggests that the increasing profitability in the primary sector induces a flow of resources into it (and into the services sector), which negatively affects the development of the secondary sector (Martin 2002, Matsuyama 1992).

The linkage theory and the recent value chain theory have been pessimistic regarding the potential of NRIs building linkages with further local industries. Most NRIs in DCs have taken the form of enclaves that export the whole production and import a large part of their inputs, capital goods and specialized services (Cramer 1999, Hirschman 1958, Lall 1992, Porter 1990, Stevens 2003).

In contrast to most of resource-abundant economies, countries such as Canada, New Zealand, Australia and the Nordic Countries have been able to achieve high levels of economic development. Empirical studies show that the strength of local technology-intensive suppliers and the specialized services represents a common characteristic of the Northern European countries (Finland, Sweden, and Norway) and Canada (Bigsten 2001, Herniesnemi et al. 1996, Porter 1990, Ramos 2001). A similar situation can be seen in the development of Australian mining machinery and equipments, whose exports were more than two billion dollars in 2002 (Maloney 2002). These suppliers do not only show high growth rates, but are also enhancing the productivity of their customers in the primary industry. From these suppliers, two different groups can be distinguished: labor-intensive and technology-intensive suppliers (t-suppliers). The former are mostly services with low skills requirements and producers of undifferentiated goods. The second group is characterized by more skilled activities such as manufacturers of specialized machinery and production inputs, and knowledge-intensive services.

However, not only natural resource-based industries in the industrialized countries, but also the aquaculture sector in Chile and the vegetable oil industry in Argentina provide evidence that these industries can contribute to extend industrialization through the development of local t-suppliers (De Obschatko 1997, Montero 2004). The objective of this literature review is

to explore the role of t-suppliers in natural resource-based economies and to outline a theoretical framework for the analysis of the factors which foster or constrain their development.[1]
The paper is organized as follows. Chapter 2 explores the role of technology-intensive suppliers, explains the linkages between t-suppliers and primary value chains and highlights the importance of t-suppliers in the economy. In Chapter 3 the model of analysis is presented followed by an in-depth explanation of the factors that determine the development potential of t-suppliers in developing economies. In addition, Chapter 3 outlines areas for an effective promotion of t-suppliers. Chapter 4 resumes the main conclusions.

2. The Role of Technology-Intensive Suppliers

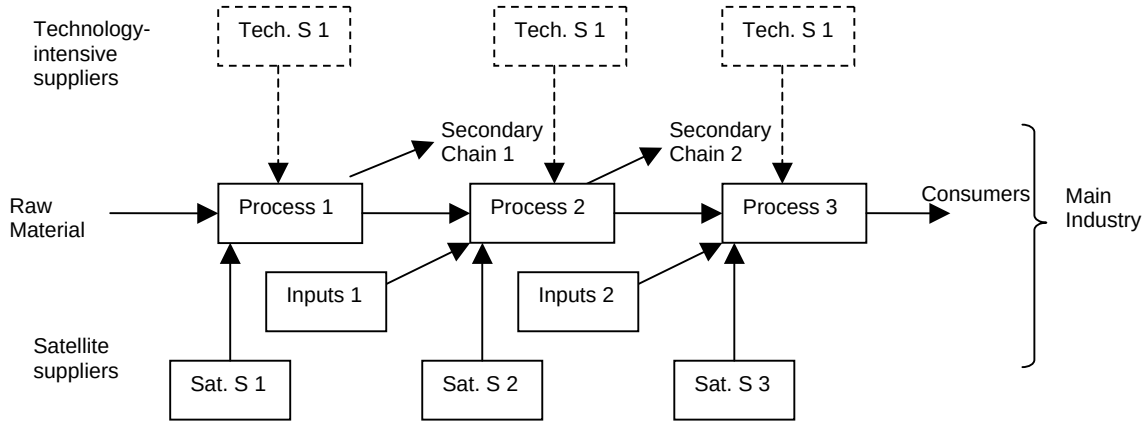
2.1. Local Suppliers in Global Value Chains

In his insightful book 'The Strategy of Economic Development' (1958), Hirschman argues industrialization is produced by the generation of inter-industry linkages. The expression 'linkage' refers to the economic relationship between two or more industrial[2] sectors due to the demand-supply effect i.e. an industrial activity can generate forward linkages if its production output is used as input of further industries whereas it generates backward linkages if its requirement of production inputs induces the setup of other supplying industries. Each industry, called by Hirschman Main Industry (MI), has a different potential to stimulate the development of further industries, which is defined as linkage effect. Moreover, the linkage effect of more than one industry must be cumulative.
How supplier firms are connected to the main industry is illustrated in *Figure 1*. The Main Industry is placed on the central axis and includes the central production activities, whether it is a resource processing or manufacturing industry, suppliers of direct inputs and services that depend totally on the central activity (called also satellite or peripherical firms). Many other secondary chains can be found alongside the central axis that make use of intermediate outputs from the central activity or deliver intermediate inputs to the central activity. *Figure 1* shows also the t-suppliers, often firms from other industries that partially or completely participate along the chain but are not directly involved in the physical process. They are suppliers of capital goods, manufactured production inputs and technology-intensive services such as brokers, consulting and biotechnological services.

1 The article focuses on suppliers of manufactures (capital goods and production inputs) for non-exhaustive industries (e.g. agriculture, aquaculture and forestry).

2 In fact, Hirschman also identifies other types of linkages ('consumption linkages' and 'fiscal linkages'), but in this paper I will only deal with 'production linkages' which played the central role in the development theory he proposed in the late 1950s.

Figure 1: T-suppliers within a Primary Value Chain



Source: Own compilation

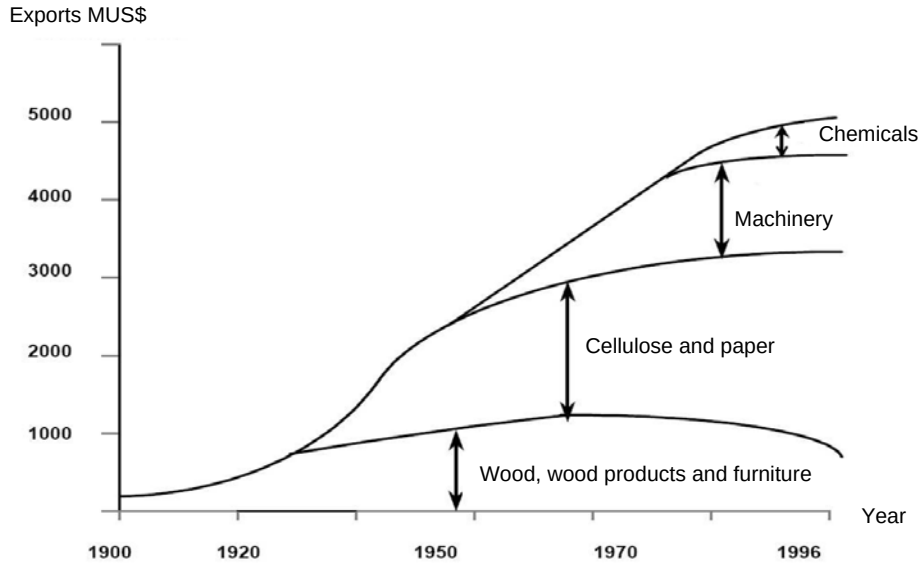
The linkages among suppliers and buyers in value chains are characterized by different degrees of intensity. Whereas labor-intensive suppliers are often totally dependent from one industry and are located close to it, the setting-up of specialized input producers needs more than the simple linkage effect of a single industry. It means that the demand of the industry, whose linkage effect is not enough for the setting-up of new supplier firms, will be supplied either by imports or suppliers from other sectors if the technology is compatible. This is the case of t-suppliers; they attend diverse industries but they have a weak position within the value chain. Their links are represented in *Figure 1* by dotted lines that symbolize that precisely these suppliers have a weak link with the industry.

Whereas there is enough empirical evidence that shows the successful development of linkages among local t-suppliers and global manufacturing chains in Asia (Altenburg 1999, Battat 1996, Meyanthan/Munter 1994), resource-intensive chains remain widely neglected (Cramer 1999). It seems that in DCs local suppliers have participated as satellite firms characterized by low absorptive capabilities providing only labor services and less differentiated products. As opposed to this, today's industrialized countries extended the linkages to domestic t-suppliers in advanced stages of the MI's development. The example of the Finnish wood and paper industry shown in *Figure 2* presents a good example to closely study the linkage effects in the industrialization process. During the first development phase (approximately to the mid 1950's), native wood was only minimally processed before being exported and the large majority of required capital goods and production inputs were imported. During a second phase, which lasted until 1970, processing of wood into cellulose, paper and cardboard was established. All the engineering services required in the value chains were provided by local companies and the first local technology-intensive suppliers came into being

and developed rapidly. The development after 1970 is characterized by increasing exports of high-valued wood, paper, and chemical products as well as machinery and equipments (Herniesnemi et al. 1996, Ramos 2001).

Similar development processes can also be found in the Argentinean vegetable oil industry, which in the 1990's began to develop backward linkages to local t-suppliers. Today 95% of machinery and equipment are supplied by local companies. These suppliers are expanding their production capacities according to the growth of the vegetable oil industry and are currently attempting to develop export markets to reach a diversification of customer portfolios (De Obschatko 1997).

Figure 2: Development of the Forest Industry and Linkages in Finland



Source: Hernesniemi et al. (1996)

2.2. The Importance of T-suppliers in the Economy

The presence of internationally competitive domestic t-suppliers creates advantages for downstream industries and has further impacts on development. They support the competitiveness of their customer industries as their rents and productivity are transferred into customer surplus by the process of competition (Kaplinsky 2000). In general, the source of competitiveness depends on the efficient and rapid delivery of price-competitive products. The presence of local suppliers allows firms to obtain the benefits of ongoing coordination, namely reducing transaction costs, stock cost and risk. These externalities are particularly important in clustered industries where they are complemented by technological spillovers (Krugman 1991, Porter 1990).

The competitiveness of domestic t-suppliers adds further advantages to the performance of the whole industry. Suppliers of embedded technology imply further advantages for the demanding industry through the good adaptation of methods and technologies, technical assistance, installation and debugging (Porter 1998), and the innovations on products, processes and quality. T-suppliers have an important role in the enhancement of learning capacity, since some types of knowledge creation depend on a closed relationship between suppliers and customers and the implicit exchange of information. They are actively developing the collective knowledge, promoting the transfer of technology, enhancing cooperation in research and development (R&D) and information transfer and fostering the development of opportune and efficient solutions. The transfers of tacit knowledge embedded in goods and services have become particularly important (Maskell/Malmberg 1999).

T-suppliers contribute to rapid technology upgrading and secure a technological continuity. A recent analysis of 50 clusters concluded that major process innovations are introduced by machinery and materials producers. Opportunities for technological accumulation are focused on improvements and modifications in production methods and associated inputs, and on product design (Pietrobelli/Rabellotti 2004). The absence of domestic competitive suppliers drives firms to cover their demand by imports increasing the danger of creating a gap between the domestic capabilities and those required by the customer NRIs (Kessing and Lall 1992).

Since the production capacities of t-suppliers are flexible with respect to the wide knowledge involved in their activities, there is an opportunity for exploiting economies of scope in benefit of the whole downstream industries. For instance, the know-how acquired due to improvements in the field of hydraulic pumps for irrigation can be transferred to the development of pumps for the movement of minerals, fishes and re-circulation systems, so the interaction among the sectors that employ similar technologies is favored. Through this interaction basic skills and knowledge can easily be transferred from one sector to another increasing the technological learning. Thus t-suppliers can transfer their acquired efficiency and competitiveness from one sector to another and therefore, contribute to the improvement of the whole industrial competitiveness (Lall/Pietrobelli 2002). Technological breakthroughs have led to an increased interchangeability of parts in sophisticated products. That applies also to the case of machinery for food processing which is employed by processing poultry, fish and meat. These innovations have worked to lower barriers to entry and generated, in some countries, a prominent machinery industry with active participation of small and medium sized enterprises (SMEs) (Meyanthan/Munter 1994).

T-suppliers may also counteract the dependence of particular localities on income from natural resources through the division of labor and economic diversification. Localities,

where the labor market is over-specialized on one kind of activity and whose economy depends on one industry, are liable to crisis in case of demand drops or constraints in the supply of production inputs. The development of local t-suppliers requires developing diverse skills and the shift of investment into these industries. They involve activities that have a potential for high returns. Activities such as machinery production and technology-intensive services are a source of high wage jobs and therefore have a positive impact on labor conditions. Furthermore, supplying firms may be considered as complementary industries, which reduce the risk of price instability of commodities because they are able to find several markets for their products. As risk can be considered a cost, the reduction of risk implies a drop in costs and therefore, an increase of local competitiveness (Marshall 1890, Lall/Pietrobelli 2002, Porter 1990).

However, the development of t-suppliers in DCs has three major limitations. In most cases they are small and medium size enterprises (SMEs), belong to less developed sectors and their link within the value chain in NRIs is weak. Since they are SMEs they have to confront issues such as: low economies of scale, difficulties in access to technologies (acquisition of modern machinery) and to financial sources; and others that depend on the business environment of DCs: high transaction costs, small and sometimes decreasing domestic markets, weak institutions and low availability of skilled labor. Moreover, the current trend to open markets and to avoid policies oriented to protect the national industry has given rise to strong domestic competition. Particularly the SME sector has failed to be competitive against often subsidized foreign rivals.

T-suppliers are involved in knowledge-intensive activities. However, the technological skills as well as the infrastructure required for these purposes are frequently not available in DCs. They suffer from the traditional shift of investments into the more profitable primary sector, the low absorptive capacity and the low investments in research and development, above all within the private sector.

3. Factors Determining the Development of T-Suppliers – a Model of Analysis

The model of analysis proposed here and summarized in *Table 1* distinguishes between three groups of factors that determine the potential development of t-suppliers: industry factors, firm-level factors and external factors. The first involves the potential offered by the main industry for the development of t-suppliers. It considers aspects such as the size and growth of demand, the structure of the industry and the institutional role of large customer firms. The second identifies the main sources of competitiveness in supplier firms, which are

based on its resources and its dynamic capabilities (Teece/Pisano 1994). Management, productivity, finance and skilled labor are included within this group. The third group contains the factors that are external to the main industry and to supplier firms. It is composed of macro, meso and meta variables which are particular to the respective country.[3] The macro factor involves variables such as the capital market and the labor market (e.g. wages, quality and skills level). The meso factor considers the legal framework, institutions and policies. The meta factor refers to cultural aspects. In the next section, these factor groups are analyzed separately; the analysis of the external factors is limited to the review of the most influential policies.

Table 1: Main Determinants for the Development of Domestic T-suppliers

Main Industry-Level	Firm-Level	Industrial Policy-Level
Demand (size, growth, diversification, the cumulative effect of other domestic demanding industries, the scale and technology-level required, the age and maturity of technologies worldwide and the distance to potential international suppliers) Structure (high concentration and instability have a negative influence on cooperation – rivalry favors innovation and bargaining power of t-suppliers) Geographical concentration (influences through transport costs, technological spill-overs, labor pooling, cooperation, trust, low risk and transaction costs, high specialization, institutional role of buyers, and internationalization)	Competitiveness (production and operations, research and development, management, financial factors, marketing and sales) Intrinsic factors (location, size, familiar base, formality, industrial sector) Entry strategy (acting on the competitive factors, strategic management and cooperation)	SMEs (innovation, venture and start-up capital, export promotion, training, technology and information transfer) Linkages (territorial promotion, information transfer, coordination, local content requirements, linking dynamical sector with strategic but less dynamical ones, tax incentives, encouraging the institutional role of large buyer firms) Infant industry (credit subsidies, tax concessions, investment in infrastructure, building capabilities, coordination of activities and investments, public procurement financing of R&D, and technology support)

Source: Own compilation

3 See the systemic competitiveness model presented in Esser et al. (1994) and Meyer-Stamer (1997), and the three level model of Albadejo (2001).

3.1. Industry Factors

3.1.1. Demand

The direct way in which an industry influences the development of t-suppliers is through its demand. A large and growing home demand is required for the growth and deepening of supplier industries. Considering that t-suppliers attend several industries the stimulus will be the cumulative effect of the demand of a group of main industries. That is the total linkage effect, which includes the linkage effect of each industry plus the combined effect of all of them (Hirschman 1958). Although the demand of single industries is not large enough the cumulative effect of diverse industries builds up the linkage potential.

Newly emerging industries offer better opportunities than traditional industries. Natural resource-based industries in DCs are usually followers. The gap between them and those mature industries in industrialized countries hinders the development of domestic technology and supplying industries. The rise of traditional industries (that use mature technologies) in DCs, where there was no technology-supplying base before, has implications on the import of products and services. Even after a learning period, imports might remain important due to the fact that knowledge is hardly transferred to local suppliers. Suppliers from industrialized countries have already obtained important first-mover advantages at the time when followers from DCs enter (Torres 2006).

The effect of the main industry demand on local t-suppliers also differs according to the form in which value is added along the production chain.

> 'Production and services characterized by discrete, multi-stage activities and involving the use of a large and varied number of materials, parts and components, are more amenable to linkage' (Battat et al. 1996, pp. 32-33).

This feature defines the scope of product lines, the cost structure and hence, the requirements on technology-intensive products and services. Local t-suppliers gain from a large number of activities carried out locally and a highly fragmented demand.

3.1.2. Industry Structure

Once demand and growth are present, the industry structure becomes important. Some of these characteristics are size, number of firms (or concentration), product differentiation, vertical and horizontal integration, and diversification. They depend upon basic conditions on the demand and supply sides such as price elasticity and economies of scale, and other, non-market aspects such as government policy and chance that together explain the rise of particular formations (Scherer/Ross 1990).

Less concentrated industries are more favorable to t-suppliers than highly concentrated ones. Suppliers benefit from atomistic structures (i.e. numerous firms of small size) due to the risk-reduction effect compared to the dependency from a small number of customers; the intense rivalry among customers and the possibilities of cooperation with firms of similar size puts suppliers in a better position. The reason why firms of similar size tend to interact better than those of different size is mainly explained by the bargaining power associated to firm size and by the capacity of supplying according to scale and technology (Porter 1990, 1998). Domestic rivalry encourages the participants of the MI to enhance their competitiveness through process improvements and innovation. This continuous process of technological learning and upgrading will be transferred to suppliers. Rivalry among customers induces suppliers to upgrade or to go out of business, intensifies investments and specialization, and accelerates the rate of innovation due to the differences in needs within the customers (Porter 1990). Oligopolistic industries tend towards vertical integration or are supplied by captive integrants of a single corporation (Altenburg 1999, Schmitz/Nadvi 1999).

3.1.3. Geographical Concentration

There are three direct forms in which geographical concentration can offer better opportunities for the development of t-suppliers. The first refers to external economies of scale. In the geographical concentration of the MI t-suppliers find a significant local market and therefore an opportunity to run specialized machinery continually and to pursue often expensive research and development activities (Marshall 1890, Porter 1998). The second refers to the marketing costs, which are kept low due to the proximity of customers. Third, knowledge transfer is enhanced. Although communication advances allow long distance interaction, there are still numerous activities, particularly associated to the transfer of tacit knowledge and information, which must be done face-to-face. Suppliers and buyers benefit from learning by interacting in industrial clusters (Maskell/Malmberg 1999).

Geographical concentration generates also an environment favorable to cooperation. Firms have more opportunities to interact with each other because of the geographical, social and cultural proximity. Suppliers take advantage from established relationships, whereas the trust on local suppliers may motivate a less vertically integrated industry structure and enhance the institutional role of customers. This relates to the disposition of large customers to transfer factor pools, such as skills and knowledge, to local t-suppliers. The buyer assists the supplier in resolving certain problems and the supplier helps develop new products through a close collaboration with the personnel of the buyer firm (Porter 1990, Batatt et al. 1996). Inves-

tors and financial institutions are familiar with the local industry which facilitates the access to capital (Maskell/Malmberg 1999, Porter 1998). Governmental institutions may support its development. Improvements of infrastructure and investments in education, research and communication; and the setting-up of institutions such as universities and technical schools generate a favorable environment for the rise of suppliers.

Another advantage of geographic concentration is the generation of a favorable environment for new entries. Workers of the main industry perceive gaps in products or services and leave the firm to set up new supplier businesses. They find low barriers to entry and low risk since assets, skills, inputs and staff are available locally (Krugman 1991, Marshall 1890, Porter 1998). Internationally successful export industries including NRIs, can also help local suppliers to internationalize. Clustered industries attract more effectively the attention of foreign demand than an isolated firm; consequently specialized suppliers have more chances to follow the industry in the process of internationalization (Porter 1990).

> 'In Denmark, for example, the large export-oriented dairy and fishing sectors have stimulated dozens of supporting industries in areas such as food processing machinery, fishing boats, varnish for boats, and radiotelephone communications equipment. A number of these industries are internationally competitive' (Porter 1990, p. 140).

3.2. Firm-level Factors

The development of t-suppliers may follow two diverse paths, the set up of new firms or the integration of suppliers from other sectors. The set up of new firms depends on diverse local factors such as the labor market conditions and the availability of well-trained and risk-taking entrepreneurs, and of capital. Thus, the set up of totally new suppliers is unlikely to occur in DCs where a competitive industrial base is not available. Therefore, many of them may be firms that previously supplied other sectors.

The capacity of an existing firm to move from one sector to another depends on its acquired competitiveness and strategy. Acquired competitiveness refers to internal capabilities in areas such as production and operations, research and development, management, financial factors and marketing, and other resources such as reputation, brand, or other advantages which are the result of the firm's history. Further intrinsic factors, such as the firm-size, family base and the industrial sector to which it belongs may also influence the development of the firm, but they are not easy to change. Strategy involves dynamic capabilities associated with innovation and proper decisions, which in turn reinforce the mentioned areas of competitiveness. This determines the rapid and flexible response to changing environments

(Schumpeter 1911, Teece/Pisano 1994). In general SMEs are more sensible to the strategy than large firms which dispose of resources to survive the consequences of failures. Especially new enterprises must find creative strategies and take adequate decisions in order to enter the market.

In SMEs, the entrepreneur is the most important factor. Indeed, the firm's success is connected with the entrepreneur rather than the firm. The entrepreneur makes use of his acquired skills, contacts and management ability to enter a new market. Usually the contact networks made the entry of small-size suppliers easier but it is less important for medium firms or those that produce more standardized products. A second element of competence is the employment of professionals and training programmes which favor the establishment of quality standards and the compliance with the market requirements. A further element is the competitiveness in marketing. Sales growth and the capability to offer credit to customers are critical for the entry. Finally, the importance of being located close to the MI is relative. It is important in such cases as small-scale and high-specialized metalworking firms. This gives them an advantage communicating with each other and with the customers and hence they can quickly respond to the requirements of the industry. In other cases, such as the case of standardized manufactured products, the distance to other potential markets and the availability of raw materials and inputs may have a larger weight in the location decision (Torres 2006).

The firm's strategy also depends on the entrepreneur. Particularly in small or micro businesses or family businesses, the strategy is largely based on the entrepreneurs' intuitions and their ability to manage the firm. They are more informed about the firm's strengths and weaknesses and they are responsible of transmitting the strategy to the employees (Wright et al. 1996). Organizational capabilities that involve relationships with other firms have been recognized as an important strategy. Cooperation increases the competitiveness of SMEs through the achievement of external economies of scale and scope, collective efficiency and joint action (e.g. a political voice which a single firm is not able to obtain otherwise). Among these cooperation strategies are joint ventures, license agreements and representations. Firms take advantage of processing based on proved designs, extending the contacts network and access to sources of capital. These measures allow firms to overcome one of the more difficult obstacles, which is the mistrust of customer firms. The most common configurations of joint ventures among t-suppliers are forward integration and multi-stage arrangements (one party integrates forward while the other integrates backwards in order to transfer proprietary technology and to facilitate the access to the market for foreign firms). Another possible strategy is the diversification of markets, which is relevant to confront investment crises in the fluctuant primary sector (Torres 2006).

3.3. External Factors – Industrial Policy

The constraints to the development of t-suppliers suggest the use of industrial policies. They should promote the competitiveness at the firm-level but also enhance the establishment of inter-firm linkages and the development of strategic sectors. One can distinguish three important kinds of industrial policies: SME promotion, backward linkages promotion and infant industry promotion. Before reviewing these policies it is worth mentioning that the effective performance of these policies presupposes the availability of efficient institutions, well-trained bureaucrats, appropriate evaluation methods and the consideration of international restrictions to the application of certain subsidies.

3.3.1. SME Promotion

SME promotion follows divergent objectives. On the one hand, it has a strong socio-political objective due to the SME's capacity for generating jobs and reducing poverty and, on the other hand, it attempts to increase industrial efficiency and to provide opportunities for organizational learning and technology transfer. Here the focus is on policies oriented towards this second objective.

Activities, which enhance the productivity of firms, such as improving production and innovation capabilities through the introduction of up-to-date technology and R&D activities, are expected to be promoted as SMEs in general are not able to finance expenses of research and hardly have access to technology (Battat et al. 1996, Albaladejo 2001). Governmental support may consist of subsidizes for the testing of materials, quality certification, R&D and maintaining information databases. Special attention should also be paid to activities of marketing and sales which are frequently neglected by SME managers or involve high costs. Institutional support may also consider market research and databases about the different requirements of the industry, both at the domestic and international levels. The access to know-how and the acquisition of technology should be complemented with the development of skills not only at the production-level but also in administrative activities such as management, accounting, inventory handling and marketing (Altenburg 1999). Institutional support can vary from the simple collection of information and its diffusion among the firms through workshops, conferences and personal assistance, to investment in training programmes and educational facilities (Battat et al. 1996). Normally and particularly in the early stages, all these programmes require public funding, in addition to fees paid by participants. In the long run, however, they should be self-financed.

Firms require both loans and equity as venture capital to finance activities and gather information about technology. The most common financing schemes are subsidized credits, tax incentives, guarantee funds and regulatory mechanisms which oblige commercial banks to allocate a certain proportion of their credits to SMEs (Battat et al. 1996). However, although subsidized financing is helpful for SMEs, it generates problems such as the availability and supply of large amounts of public financial resources, and a high cost of bureaucracy for the firms to obtain these subsidies. Therefore, improvements in the capital market itself remain the best option supplemented by support for managers through information and training on financial planning (Battat et al. 1996).

To promote cooperation is another important issue. However, firms engaged in cooperation schemes transfer know-how and mobilize capital which involves risks that many firms are not able to take. Therefore, the effectiveness of policies that promote cooperation may be limited if there is a lack of trust. Actions such as generating a competitive environment, the training of management personnel and the reduction of transaction costs might help to generate trust (Altenburg 1999).

3.3.2. Backward Linkages Promotion and Development of T-suppliers

Because the linkage between t-suppliers and the primary industry is weak the state should combine SME promotion with the creation and enhancement of inter-firm linkages. Institutions may contribute to coordinate the allocation of resources and to enhance links of local t-suppliers to global industries generating formal or informal large networks that allow a rapid information flow (Rodrik 2004). One of the main reasons to do this is associated with coordination externalities. The market usually does not provide the necessary conditions that facilitate the interaction and assistance of large firms to their smaller counterparts since it is based on a cost-benefit analysis.

The range of programmes and its theoretical support varies from allowing market forces to create linkages to powerful state intervention (Albaladejo 2001, Meyanthan/Munter 1994). On the one hand, the traditional way of government intervention has been through import substitution measures such as financial incentives, tax incentives, domestic content requirements and preferential interest rates for purchasing domestic products (Altenburg 1999, Meyanathan/Munter 1994, Wood 2003). However, there is enough evidence to reject the efficiency and benefits of such programmes. On the other hand, market-friendly policies have been very successful achieving inter-firm cooperation, in particular in the East-Asian economies. Some examples are: 1) specific institutional arrangements and vendor development schemes, which are cooperation structures to encourage a large firm to assist local

suppliers to upgrade their technical and management capabilities; and 2) information provision and exchange programmes, which are designed to enhance the flow of information to SMEs. These programmes include activities such as market research, match-making, monitoring and troubleshooting. Producers and buyers as well as complementary subcontractors and institutions are linked, natural industrial districts are enhanced and new ones are planned from its origin (Altenburg 1999, Battat et al. 1996, Meyanathan/Munter 1994, Roberts 2003). As well as the case of SME promotion, emphasis should be put on coordinating different institutions, creating self-financed institutions and propagating the corresponding programmes. Linkage programmes should not only address the support of linkages but also remove regulatory or procedural impediments to linkages (Battat et al. 1996).

3.3.3. Infant Industry Promotion

Infant industry promotion (IIP) attempts to foster the rapid development of a particular and strategic sector. And this is precisely the main problem, since targeting a specific sector may lead to substantial errors. However, there are some reasons which support the use of IIP in the case of t-suppliers. First, there is a lack of capabilities in most technology-intensive sectors in DCs. Second, there is a need of investment coordination. Investment in these industries is critically dependent on investment in primary production[4] which in turn responds to the swing of international prices – particularly stressed in the case of commodities. IIP can effectively reduce the risk associated to this level of uncertainty (Wade 2003). Third, IIP also complements foreign direct investments which otherwise may remain isolated. The coordination of complementary investments, though not expensive, requires internalization by a public agency (Rodrik 2004). Finally, local suppliers in the particular case of DCs compete against foreign rivals that already master technologies through a long learning process with strong institutional support and are already better inserted in global networks (Lall 2003).
The strategy to be followed depends on particular factors such as the size and scope of the domestic market, the initial local capabilities and the potential sustainability. IIP may be helpful where the R&D requirements are high and the skills may hardly be transferred. The scope of IIP commonly include the creation and diffusion of knowledge (public procurement financing of R&D and technology support), coordination of activities and investments, specialized training (building capabilities) and the mobilization of resources (investment in infrastructure) but in same cases IIP also includes other more debatable incentives such as tariff barriers, credit subsidies and tax concessions (Lall 2003, Roberts 2003, Wade 2003).

4 This is also valid for the case of export oriented consumer goods industries.

4. Conclusion

Developing countries lack an integrated and diversified industrial base. This structural deficiency is even more a problem in resource-based economies where the dependence on resource-based industries inhibits the formation of a solid and more diversified industrial base.

As shown by the literature review conducted in this paper, the development of domestic t-suppliers has had a positive impact in the industrialization process of today's industrialized resource-based economies. On the one hand, domestic t-suppliers induce productivity growth as they are responsible for technological upgrading and continuity; they support the competitiveness of downstream industries as they reduce transaction costs and risk, improve communication among the industrial sectors and are sources of innovations; they promote the development of technological capabilities through the transfer of technology and knowledge, interchangeability of technologies, organizational methods and other intangible values; they contribute to the diversification of the labor and economy. On the other hand, the development of t-suppliers has to overcome the handicaps that they are mostly SMEs of less developed sectors and are poorly linked to the main industries, NRIs in this particular case.

According to the model of analysis developed in this paper, the development potential of t-suppliers should not be solely associated to the backward linkage potential of a main industry. Ideally it should be a combined effect with other factors at the firm-level and country specific factors external to the MI and supplier firms. On the level of the main industry, a growing demand for technology-intensive products, an atomistic industry structure and geographical concentration foster the development of local t-suppliers. On the firm-level, acquired competitiveness is particularly important for the upgrading of firms from other sectors. The qualifications of the entrepreneur, the introduction of quality systems and the marketing competitiveness are of central importance. They should be complemented by an appropriate strategy related to labor training, inter-firm cooperation and marketing skills.

Industrial policy, on which the analysis of external factors has concentrated in this paper, can foster the development of t-suppliers mainly through the interaction of programmes for SME promotion, the support of inter-industry linkages and infant industry promotion. All of them should give preference to market-friendly programs and be supported by adequate institutions, well-trained bureaucrats and adequate selection criteria and must consider international restrictions. SME promotion should aim at the improvement of competitiveness providing venture and start-up capital, technology and information transfer as well as training and promoting innovation and exports. The support of linkages should focus also on in-

formation transfer, on the coordination of investments, linking dynamic sectors with strategic ones, and on encouraging the institutional role of large buyer firms. Infant industry promotion should be implemented carefully and should pay attention to market efficiency. Investing in infrastructure, building capabilities, coordinating activities and investments, financing R&D and technology support constitute important options.

The analysis in this paper was limited to a theoretical exploration of the three groups of factors important for the successful development of t-suppliers in developing countries. Major research will be required to corroborate these statements by empirical evidence. Special efforts should be put on the analysis of the interrelations of the factors outlined in this paper and their change over time.

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