

# The accumulation process and agrofood networks in Latin America

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**W**ithin the context of the evolution of world markets and new models of trade openness, several agrofood product lines in MERCOSUR countries have shown strong dynamism in recent decades, becoming focal points (axes) of accumulation and economic growth. The expansion of production and the higher levels of competitiveness achieved have been based on the organization of these product lines in networks or complexes; on the adoption of technology packages from abroad with minimal local adaptation, as part of the globalization of new paradigms; on the emergence or consolidation of groups of big firms in the main stages of these networks, and on clearly defined forms of insertion in external markets. This article argues that the transnationalization of relevant segments and markets of these complexes affects the possibilities of local or regional development, in particular, the generation of locally dense and diversified production networks with equitable distribution of rents, income and profits.

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# I

## Introduction

Ever since the 1990s, within the context of trade openness and market globalization, the countries of the enlarged MERCOSUR<sup>1</sup> have been modifying their specialization patterns towards products based on the use of natural resources. The expansion of production in these years was based on the diffusion and adaptation of technological innovations, the emergence or consolidation of groups of big firms in the main stages of the production networks, and on a clearly-defined pattern of insertion in foreign markets. These factors gave these networks marked dynamism and helped to shape their main technological and productive features. Thus, these production networks are considered as organizational forms inducing the economic growth achieved in those decades, based on their potential capacity to generate genuine competitiveness.<sup>2</sup>

A review of the most successful cases in the region –especially the agrofood industries of Argentina, Paraguay and Bolivia– shows that the basis of this success has been the construction of production networks, i.e., interlinked and coordinated groups of enterprises with long-term relations aimed at the achievement of common objectives. These networks make it possible to assemble abundant high-quality natural resources, substantial individual levels of competitiveness, and suitable mechanisms for inter-relating and linking the actors and/or stages involved up to the final demand level.

The causal sequence behind this dynamism –which will be examined in the present study– may be summarized as follows: i) the MERCOSUR countries have partly redefined their pattern of specialization in order to focus on a set of highly competitive activities based

on natural resources; ii) the expansion in production has been based on the adoption (with only minimal local adaptation) of technological packages from abroad, in the context of the processes associated with the globalization of new productive paradigms; and iii) these elements have been strengthened through a growing tendency to operate on the basis of production networks and the generation of systemic competitiveness.

The potential of these production networks for supporting permanent processes of expansion, however, depend on their characteristics and configuration. In particular, we argue that, over and above the possibilities of boosting the value of natural resources, the achievement of greater joint profits (albeit unevenly distributed) depends on the strategies of a small group of actors (generally big transnational or local enterprises) which coordinate the network from its nodal points.

In this respect, a significant number of recent studies on this matter provide evidence<sup>3</sup> such as the following: i) the main agrofood networks of the enlarged MERCOSUR are efficient forms of business organization for systematically achieving higher levels of competitiveness; ii) within these networks, big disparities are formed and consolidated among the participating firms (disparities based on the control of strategic economic, financial or technological assets), giving rise to hierarchical systems in which some firms control and coordinate the overall group of firms; and iii) except in a few cases, there is a clear predominance in these activities of concentrated and centralized forms of capital, especially as represented by the local branches of foreign-owned firms (or domestic firms which have been absorbed by them) or local economic groups which control the production activities and a significant part of strategy design.

In the light of this evidence, our central hypothesis is that although the agrofood networks of the enlarged MERCOSUR offer great potential for the expansion of production and the achievement of a competitive

<sup>1</sup> The enlarged MERCOSUR includes the member countries of MERCOSUR (Argentina, Brazil, Paraguay and Uruguay) plus Chile and Bolivia.

<sup>2</sup> In this article, we understand by “genuine competitiveness”, from the point of view of the economy as a whole, the permanent advantages associated with the incorporation of new natural or human resources or product or process technologies which are the basis of competitive advantages in international markets. This definition does not consider the domestic distributive or redistributive effects, and it excludes exports based on subsidies (paid for by consumers and/or taxpayers) and those based on the spoliation of natural and human resources.

<sup>3</sup> ECLAC (1995), CNPq (1998), PROCISUR/IDB (2000), ECLAC (2002) and Paulino and others (2004).

position in world markets, the transnationalization of main networks and markets of these production complexes affects the possibilities for local or regional development (understood as the construction of locally dense and diversified production networks with equitable distribution of rents, income and profits). Furthermore, if activities are organized in networks,

and if those networks, although generating profits, do not automatically assure significant development for the economy as a whole, the following step is to inquire –as we do in the final part of this article– into the necessary reformulation of public policies to provide a regulatory framework in accordance with the economic and social development goals.

## II

### Agrofood networks and the competitive dynamism of the countries of the enlarged MERCOSUR

#### 1. Competitiveness, firms and networks

In recent years, new economic approaches have focused their attention on the fact that, in various areas of agrofood production, production networks have arisen in place of the old system of firms operating in isolation. The emergence or consolidation of such networks, partly in response to process externalization strategies (propelled by inter-firm competition and technological change, with consequent specialization in the firm's core activities), leads to forms of vertical and horizontal coordination based on contracts that favour joint productivity and international competitiveness.<sup>4</sup>

The analytical approach to a production network consists of several different steps: i) identification of the technical and economic relations within the network; ii) identification of the nodal firms in the network, that is to say, those with sufficient economic, financial or technological capacity and power to lay down criteria and coordinate the overall functioning of the production cluster; iii) study of the forms of competition prevailing in each stage and the different types of firms taking part (size, capital origin, strategies, business organization); iv) the process of fixing the common objectives of the network (whether agreed, induced or imposed); v) the rules of governance of the group of firms (those imposed by the public regulatory framework, or internal rules laid down in formal or informal contracts, including those on the distribution of benefits and risks, etc.), and vi) the actions and reactions resulting from interaction with the environment.

In this article we will concentrate mainly on analysis of the profiles and behaviour of the main actors and on some rules of governance, which are key aspects for understanding the process of formation of hierarchies within agrofood networks and explain the different technical and productive strategies of the actors in the networks studied.

In line with the central objective of the firms –namely, to obtain profits and rents or seek market competitiveness – the formation of production networks makes possible, in a context of strong vertical or horizontal linkages, cooperation in specific fields and the coordination of the processes, activities and strategies of the firms and institutions involved in the network.

The characteristics of the participating firms and other agents (such as public bodies or consumers), together with their strategies and the regulations applied from outside, help to explain the existence of hierarchies within the networks. Economic power, access to finance, technological inequalities and control of critical assets or know-how are all factors in the formation of these hierarchies. In this way, inequalities of power within the networks are established, induced or practised. These inequalities permit the most powerful firms to appropriate a larger share of the systemic gains in productivity and profits, generating and reproducing differential capacities for accumulation among the participating firms (a process which usually becomes even more marked at times of crisis).

In each of the production segments which make up the network, firms are operating which have: i) different technological capabilities, which are mutually conditioned and complemented, although

<sup>4</sup> Dirven (1999), Granovetter (1985), Zylbersztajn and Farina (1997), Humphrey and Schmitz (2001), Albu (1999) and Ramos (1998).

some of them are the main determinants of product quality;<sup>5</sup> ii) heterogeneous financial and economic capacities; iii) different linkages with suppliers and with final and intermediate demand; iv) disparities in the levels of information access and quality, and v) different economic scales. These differences lead in turn to different responses to a given change in the environment.

Moreover, the different stages of a network may take place in different geographical locations (regions or countries), which affects the location of employment, income and other variables.

In the evolution of the networks, it is possible to identify the enterprises that act, at different times and stages, as coordinators or command centres, and thus form the nodal points of the network. The control of these nodal points determines the internal hierarchies, generates power, and lays the bases for the unequal distribution of rents. This is why they are the main target of the regulatory frameworks (Bisang, Gutman and others, 2000).

Since the relations or linkages between the firms in the network are governed by formal or (in most cases) informal contracts, the nodal enterprises establish private incentives<sup>6</sup> for aligning the cluster behind certain objectives, achieving them, and subsequently evaluating the overall performance. The acceptance of these parameters—whether agreed by consensus, induced, imposed or accepted in the absence of other alternatives—gives the network cohesion and stability over time. An essential requisite in the contracts is that they should clearly specify the processes and the product or service to be exchanged. The decisions on by whom, how, where, and in line with what criteria the technical norms are fixed usually become key aspects in the subsequent dynamism of the networks.

<sup>5</sup> The products are sold in concentrated markets, with big inequalities in terms of access to information, and correspond to very specific products and/or processes which involve the use of various complementary technologies at different points in the network. Thus, for example, transgenic soya seeds resistant to glyphosphate are highly specific in their design and predetermine much of the agronomic package and the corresponding technologies (use of direct sowing and glyphosphate) and production process (pre-sowing tasks, sowing and harvesting periods, weed and insect control systems, etc.). They are sold in markets where the supply is very concentrated and there are big inequalities, both technological, information-related and even economic.

<sup>6</sup> The system of incentives is based on a reference price, corrected by schemes of rewards and punishments as a function of quality, delivery times, industrial productivity of the primary input, and other factors.

Operating in networks can increase overall efficiency in some lines of production and, depending on the circumstances, can reduce transaction costs (especially in the case of differentiated goods); minimize faults of market information and coordination, both on the consumption and investment sides; increase the scale in high-risk projects; facilitate the processes of generation and dissemination of innovations; establish mechanisms for spreading risks, and lead to the formulation of more consistent strategies (minimizing errors) for the future evolution of the overall set of firms.

As a result of these dynamics, pronounced technological, economic or financial inequalities are usually generated within the production networks which result in the unequal distribution of the rents generated by the network as a whole. The different rates of accumulation of the various actors in the network are closely related with their structural characteristics.

As particular forms of inter-enterprise organization, networks are specially important in agrofood activities. This is due, among other reasons, to the fact that they make it possible to spread the risks associated with the natural and biological factors and processes characterizing these activities, including unpredictable weather conditions; the autonomous nature of the biological cycles (of harvesting, stock-raising, fermentation, etc.) that set the pace of the production processes; a certain degree of determinism imposed by the quality of the raw materials on the subsequent industrial processes, and the particular and idiosyncratic features of a cultural or regulatory nature which affect food production and consumption from the logistics of marketing to the final consumer (Gutman, 1999a). These characteristics have been reflected from an early stage in the formation of strong inter-enterprise links as the organization backbone of these production activities.

## 2. Agrofood networks in the enlarged MERCOSUR: recent evolution and challenges

In this context, the main agrofood networks of the countries of the enlarged MERCOSUR have been taking on ever-increasing importance since the early 1990s, thanks to rapid domestic growth and a strong insertion in international markets. With different individual features and intensities, edible oils, dairy products, meat, wine, fruit and other products have registered considerable changes compared with the recent past in various countries.

Some aspects are common to all these cases: growth of production and technology use; the presence of new and renewed agents in the different stages of production, marketing and the supply of inputs; a clear orientation towards exports, and, fundamentally, a growing tendency towards the formation of networks (PROCISUR/IDB, 2000).

The recent dynamism of some agrofood networks in MERCOSUR confirms these assertions (table 1).

The cases of the **dairy products network** and the **oilseeds network** are typical examples of these new dynamics. Through a process of powerful business restructuring, process and product innovations, and the reorientation of its exports towards MERCOSUR, the Argentine dairy products network grew between 1992 and 1998, in its primary stage, at a sustained cumulative annual rate of close on 7%, after having displayed a cyclical performance and an average annual growth rate of less than 1% in the previous six years; industrial production, for its part, grew at an annual rate of 12% between 1992 and 1998 (Gutman, Guiguet and Lavarello, 2004; Gutman, 1999b). The expansion and restructuring of this sub-system in Brazil, driven by domestic demand, was equally strong (Bortoleto and Wilkinson, 2000).

The production, milling and export of **soya beans** and their sub-products are one of the most dynamic agrofood networks in the region. At the primary level, production grew rapidly in Argentina, Brazil, Paraguay, Bolivia and, more recently, Uruguay. In the case of Argentina, this expansion was based on the generalized adoption of a new technological package (transgenic seeds, direct sowing and fertilizers), using a production organization model marked by separation between the landowners and the firms responsible for carrying out the production process and by the growing influence of suppliers of inputs (Bisang, 2003a and 2004). The other countries of the region follow similar models, although in Brazil there are restrictions on the use of genetically modified seeds.

The industrial stage of the milling of oilseeds in Argentina and Brazil (the two main exporters of the cluster, at both the regional and world levels) accompanied this expansion of primary production with heavy investments (largely by transnational corporations) and incorporation of technology. These investments put the milling industry in these two countries on levels of technology and scale similar to the best international standards (Gutman and Lavarello, 2003; Gutman, 2000).

TABLE 1

**MERCOSUR, Chile and Paraguay: Evolution of production in some agrofood networks**

Network	Argentina		Brazil		Uruguay		Chile		Paraguay	
	1990	2002	1990	2002	1990	2002	1990	2002	1990	2002
Milk (production in thousands of litres)	6 281.0	8 500.0	15 075.0	22 452.0	963.9	1 431.2	1 390.0	2 180.0	225.0	375.0
Powdered milk (exports, in thousands of tons)	14.0	136.0	0.01	1.30	2.21	29.05	1.60	9.98	-	0.14
Meat (production in thousands of tons)	2 650.0	2 700.0	5 008.0	7 314.0	334.0	411.0	242.0	199.0	189.0	205.0
Meat (exports, in thousands of tons)	451.0	348.0	249.0	881.0	192.0	259.0	0.0	1.0	130.0	20.0
Meat (exports, in thousands of dollars)	158.0	160.0	49.0	430.0	132.0	148.0	0.0	1.0	97.0	13.0
Wine (production in thousands of tons)	1 400.0	1 200.0	310.0	320.0	94.0	71.0	390.0	570.0	7.0	6.0
Soya beans (production in vmillions of tons)	11.0	35.0	19.8	42.1	0.0	0.1	-	-	1.8	3.3
Soya complex (exports, in millions of dollars)	2 025.0	5 026.0	2 554.0	6 009.0	6.0	10.0	0.0	3.0	246.0	417.0

Source: Prepared by the authors on the basis of data from the United Nations Food and Agriculture Organization (FAO) and the United States Department of Agriculture.

The production of soya—strongly oriented towards world markets, with innovations in production processes and techniques in the primary sector and a major presence of big transnational corporations in the milling and marketing of oilseeds—doubled in Brazil between 1990 and 2002, while in Argentina it trebled over the same period, with a corresponding increase in milling capacity (Bisang, 2003b). In both countries this was reflected in an increase in exports.

Other important agrofood networks in MERCOSUR registered processes of evolution similar to those of dairy products and soya: the cereals network, for example, registered notable expansion and restructuring of the wheat and maize agrofood chains (PROCISUR/IDB, 2000; Lavarello, 2003).

In meat production—leaving aside the health problems of the 1990s—the countries of the region have made quite important leaps forward in both quantitative and qualitative terms. Although there are still some maladjustments in this activity in some of the region's networks, there are nevertheless sub-circuits linked through contracts in the high-quality meat segments which have shown marked dynamism. At the aggregate level, the cases of Uruguay (which sells over 70% of its production on foreign markets) and Brazil (which doubled its exports in less than five years) are among the most outstanding in this respect. A special case is that of Chile, which, although it has little tradition as a producer in this field, has specialized in high-value market niches and is clearly oriented towards exports.<sup>7</sup>

Other examples of dynamic new areas of growth in the region are the poultry and wine networks. The poultry network, which is better articulated and has greater long-term stability, has registered clear progress in the region, reflected in Argentina and Brazil in improved supply of the domestic market and growing imports.

The case of wine is noteworthy because of its evolution towards products of greater value added, through a reconversion process which was propelled by big investments of capital both from within the region and from outside it. In addition to the advances made initially by Chilean wines, similar progress is now being made by wines from Argentina and, in the case of some specific varieties, from Uruguay (Azpiazu and Basualdo, 2000; INTA, 2003).

The above-mentioned set of activities—without prejudice to the natural heterogeneity within and

between networks in the various countries involves—displays a number of common features in its forms of organization and technical and productive behaviour. Although the linking together of production activities in networks has made it possible to improve the processes of generation of dynamic competitive advantages, especially at the innovation and commercial levels, the dynamism of production has some particular features.

Firstly, it should be noted that in most cases the new forms of production organization raise the technical and economic levels (minimum size of production activities or industrial plants, equipment, labour training). Both at the primary and the industrial and commercial levels, these advances require increasing amounts of fixed and working capital.<sup>8</sup> Consequently, the demands associated with the new technologies (in terms of fixed and/or working capital and minimum business or labour skills) are reflected in unequal possibilities of access by firms to new techniques, which further accentuates the process of concentration of production.

The special features of some types of final demand, variations in international prices, and the lack of competition in financial markets are other factors that heighten the process of differentiation. As a result, there is a clear tendency towards the concentration and dualization of production structures, because of the generation of two differentiated circuits:

i) The circuit made up of activities over a certain scale, with ongoing technical improvement, quality control and adaptation to international standards, propelled by concentrated retail marketing<sup>9</sup> when

<sup>8</sup> The adoption of a technological package based on direct sowing + biocides + transgenic seeds calls for extra capital of at least US\$ 100,000 or so, which makes vertical integration is unviable for agricultural producers with less than 100 hectares, especially in view of the weak capital markets of the countries studied. A similar tendency may be observed in the dairy products sector, where mechanization and genetic improvements (together with the associated process technologies) raise the minimum viable size of operations, so that not only is more fixed capital required, but also more working capital. The same is true in key industrial sectors (such as oilseed milling or export packing plants) or in the production of agricultural inputs (commercial development of plant or animal genetics; manufacture of agro-chemical products). In Argentina, for example, the average size of a dairy farm rose from 65.9 cows to 145.1 cows between 1988 and 2000. In the case of the oilseeds industry, the average size of a milling plant rose from 1,100 tons per day in 1990 to 2,300 tons per day in 2003; in the latter year, the largest plant installed in Argentina had a processing capacity of 12,000 tons per day.

<sup>9</sup> That is to say, big retail distributors such as supermarkets, hypermarkets and the like.

<sup>7</sup> Bisang (2003c), Buxedas (2003), Paulino and others (2004), and Zylbersztajn and Pinheiro Machado (2000).

production is for the domestic market, and by the dynamics of external markets when production has a high export coefficient. Such activities must also have major potential for increasing exports, output and yields. It is this type of activities (in the case of Argentina, the oilseeds, cereals, wine and –to a lesser extent– dairy sectors) which have a positive impact on the external accounts.

ii) The circuit centered on small or heavily indebted agricultural producers and industrial or commercial enterprises (which we will call henceforth simply “firms”) which have difficulty in converting or gaining access to new techniques; generally speaking, their activities are limited to regional or local markets, with low quality standards and few possibilities of entering virtuous circles of production. This production circuit, which accounts for the major part of agricultural units and industrial enterprises and has an undeniable impact on employment, is located even in the best of cases at the minimum levels for keeping going, with low or non-existent possibilities of accumulation and development.<sup>10</sup>

Secondly, the growing presence of new actors (or the growth of other, long-standing actors) in some of the main activities or nodes of the networks leads to the internal redistribution of power over who decides what to produce, how, and for what destination. In this sense, both the producers of agricultural inputs and the big retail distributors tend to establish new areas of power which struggle to gain a share of the levels of accumulation of the network as a whole (Gutman, 2002). In both cases, these processes of reconfiguration have been accompanied by greater concentration and transnationalization of markets.<sup>11</sup> This evolution was accompanied by frequent tension between agricultural producers and firms operating in different stages of the

network, at the same time as marked techno-productive dynamism.

The wave of foreign investments which entered the countries of the region in the 1990s further heightened these processes. Foreign direct investment (FDI) –attracted by the new regulatory conditions and the enlarged MERCOSUR, and within the framework of globalized expansion strategies– was focused in particular on some industrial segments, especially the provision of inputs, industrial processing, and large-scale retail distribution. In line with global growth strategies based on technical advances, which require large-scale operations, this investment formed part of a rapid process of concentration or strategic alliances, which led in effect to regional-type expansion strategies.<sup>12</sup>

Thus, the most dynamic networks simultaneously displayed major techno-productive changes, the establishment or consolidation of new forms of organization (networks), growth propelled by foreign markets, and the reconfiguration of the hierarchies and nodes or command points within the networks. All this brings up once again the issues of the rules of governance, hierarchies, and power inequalities in the networks with a capacity for accumulation (Wilkinson, 2002).

### 3. Changes in the hierarchies and business strategies

The changes in the institutional and regulatory context which took place in the 1990s in the countries of the enlarged MERCOSUR and in world markets gave rise to new forms of governance of the main agrofood networks, based on a larger presence of transnational capital, the emergence and consolidation of agents, and a new set of public regulations in keeping with market deregulation and trade openness. The new rules of governance of the agrofood networks tended to be based on:

<sup>10</sup> As a result, in the countries studied there are marginal dairy production circuits at the primary level, which have links with small –almost artisanal– factories and supply segments of local or regional markets with lower technical standards and limited possibilities of accumulation. Something similar occurs in the meat and flour-milling circuits.

<sup>11</sup> The evolution of the retail food trade in Argentina is an eloquent example of these processes: in 2000 the supermarkets and supermarkets stratum accounted for over 50% of food sales, and the seven biggest firms out of the 77 in the chain accounted for 78% of the sales of this stratum as a whole. Four-fifths of this percentage corresponded to branches of transnational corporations (Gutman, 2000).

<sup>12</sup> In the context of the flow of foreign investments into these countries, in the 1990s the enterprises which entered them for the first time or considerably increased their activities in them included almost all the world suppliers of seeds and inputs (Monsanto, Bayer Agrocrop Science, Syngenta, Hoechst, Cargill, Nidera, Ishiara, Dow Chemical, ICI, Bunge, Novo Hydro, and ABS Genetics), as well as USA Genetics, Nestlé, Danone, Parmalat, Unilever, CPC USA, Pepsico, and the Ahold, Wal-Mart and Carrefour/PROMODES marketing chains, among others.

- changes in the structure of suppliers, since trade openness favoured the importation of capital goods and inputs;<sup>13</sup>
- the presence of heavy foreign investments made under a logic of international complementation, which changed the operating dynamics of a number of these networks;
- changes in the legal framework, and especially in the laws on foreign investments, which facilitated this reconfiguration and guaranteed more favourable treatment of these investments and fewer restrictions on the repatriation of the profits of foreign firms;
- technological policies centered essentially on the widespread incorporation of imported equipment, with few restrictions on the flows of technology and capital (SEPCYT, 2003);
- the elimination (in Argentina and other countries) of mechanisms regulating some production activities (in Argentina, the National Grain Board, the National Meat Board, the Dairy Industry Coordination Commission, etc.) and their replacement by the competitive pressure of foreign markets.

In this context, changes took place in the internal hierarchies of several of the most dynamic networks of the region, which were reflected in various ways. Above all, they were reflected in the generalized presence of the main international suppliers of inputs for the primary production of the agrofood chains; in this case, their supremacy over private suppliers and even over public research and development (R&D) bodies was based on their dominating technological position (as in the case of transgenic crops), together with powerful financial domination. At the same time, foreign investments which brought high technology and close international relations to some key phases of the industrial stage entered the region in addition to the local capital of a limited number of economic groups, which rapidly adopted internationalization strategies. In these cases, the rearrangement of the hierarchies was due to technological and economic domination and access to large-scale

international markets, in the case of networks operating in globalized markets. In addition, as already noted, there was a strong entry of big retail distributors as major new actors in most of the networks.

There are various reasons why these latter actors became new nodal points in the networks: above all, their financial power and easy access to international sources of finance; their strategic position in the market for detecting and promoting changes in the consumption patterns and buying habits of the population; their control of key areas such as the logistics of distribution, and in particular their possibility of taking advantage of disparities of prices and quality between the domestic and international markets in the context of economic openness processes (Gutman, 2002).

As may be gathered from the foregoing, innovation and technological change were the main elements in the reconfiguration of hierarchies and, hence, the possibilities of changing one's position in the networks, thus giving rise to marked inequalities between agricultural producers and firms. In this sense, the strategies of the leading firms in the different markets, based on major technological and organizational innovations, were centered above all on:

- the relocation of activities and the opening of new plants;
- greater control over raw materials, in terms of both quantity and quality;
- the establishment of closer relations (contracts or quasi-contracts) with suppliers and clients;
- logistical and commercial advances;
- strategies of differentiation and diversification of production in the industries producing final goods;
- the externalization of functions and activities and the reorientation of core activities;
- linking up of production processes for the overall achievement of greater productivity (efficiency), quality and food security (establishment of quality control systems and systems of maintenance of identity and/or traceability);
- absorption of local firms and their supply and distribution channels by foreign enterprises;
- formulation of regional-scale strategies including the regional distribution of stages and segments of the agrofood chain, the distribution of markets, and regional and global coordination among the big transnational corporations operating in the different stages;
- development of business networks and joint activities in the areas of production, marketing and technology (Bisang and Gutman, 2001).

<sup>13</sup> The bulk of the Argentine biocide firms were absorbed by a limited number of leading international firms (Monsanto, Syngenta, Dow) which, as well as expanding their production facilities, established nationwide trading networks (Bisang, 2003b). The local machinery and capital goods industry was knocked out of the market by the big international suppliers; in the case of the oilseeds cluster, the firms which entered the area included Alfa Laval, De Smet, Buhler and Crown (Gutman and Lavarello, 2003).

The foregoing places the issue of technological inequalities at the centre of the relation between hierarchical position in the networks, power and accumulation. From this standpoint, we will now examine the profile of the supply of technology in the main agrofood networks studied.

#### 4. The supply of technology in the main agrofood networks of the enlarged MERCOSUR

In the region, the main agrofood networks display wide heterogeneity both among the agents participating in the supply of technology and in the nature of the forms of technology (tacit and explicit) disseminated.

Thus, small-scale artisanal forms of production (in establishments close to subsistence level, with only minimal possibilities of capital reproduction) exist side by side with large-scale enterprises using production techniques of the latest generation (Bisang, Gutman and others, 2000).

Identification of the leaders of these processes in each of the most dynamic productive networks and the way in which they lead them is essential in order to analyse the contribution of these forms of organization to the local accumulation process.

From this point of view, at the primary level, there have been significant changes in recent years in the supply profile, within a rapid process of innovative updating. Improvements in seeds (introduction of transgenic seeds and other techniques), animal genetics, the use of new cultivation techniques (such as zero tilling and complementary rotations between crops) and more intensive use of herbicides and biocides are forming a new technological paradigm which a number of authors have called knowledge-dominated agriculture (Cap, 1997).

As already mentioned, the technical and productive changes within the networks have not only generated two productive circuits—a large-scale, outward-oriented circuit, and a small or medium-scale circuit of a local or regional nature—but have also increased the leading role of the big firms through the scale of their operations.

The process of concentration has restricted the top hierarchies of agrofood networks to a limited number of actors: transnational corporations, cooperatives and local-capital economic groups or large firms. Their presence in each network varies according to the line of activity and the country. In Chile, the dairy products industry displays a strong international presence, while in Uruguay and Paraguay it is centered in two cooperatives; in Argentina and Brazil, there is a certain degree of

balance between large local-capital firms and subsidiaries of transnational corporations. The presence of foreign capital in the meat industry is limited to particular niches or processes in most of the countries, but in the wine industry there is a strong international presence, as also in the industrial milling of oilseeds (apart from a few important local-capital business groups).

This is not necessarily reflected, however, in similar forms of technological behaviour by the main actors. Both the cooperatives and the big local-capital firms generally display a very low level of technological dynamism, as shown by recent data for Argentina and Uruguay (Gutman and Cesa, 2002). This fact usually results in a loss of leadership position compared with the technical predominance of transnational corporations which have their own capacity for marking technical advances and eventually selling them or entering into strategic alliances.

In this respect, mention should be made of the behaviour of the public research institutes, which are very heterogeneous in terms of the scale of activities, age, specialization profiles, and human and economic resources. Most of them have tended to adapt to the new circumstances. Apart from their contribution to the formation of local capabilities, however, their performance has been hampered by i) serious lack of links between different public research institutes which deal with partial aspects but have no global strategies for creating critical assets in all the networks; ii) the inertia of work programmes centered on problems of the old form of production, which often become a barrier to entering on updated innovation processes;<sup>14</sup> iii) serious budgetary problems associated with the financial crises of the States in question, especially since the second half of the 1990s, which have led to budgetary cuts affecting research and development institutes (PROCISUR, 2002; Lindarte, 1994).

The weakness of these institutes and the strength of the transnational corporations make the activities of public science and technology institutions very

<sup>14</sup> At the primary level, the programmes of activities of the main public research institutes—the National Institute for Agricultural Technology (INTA) in Argentina, the Brazilian Agricultural Research Enterprise (EMBRAPA) in Brazil, and the Institutes of Agricultural Research (INIA) in Chile and Uruguay—have a strong flavour of the past. Thus, there is a marked tendency to correct factors which limit the amounts produced, rather than the quality of production, which affects the subsequent industrial stage. Furthermore, despite recent policies, there is a tendency to concentrate on technical problems of production at the farm level, without much attention to the network as a whole.

important, especially in the case of the larger institutions oriented towards fundamental research. In this sense, we wish to stress the need to rethink public actions in respect of these activities at the central level.

On the basis of this profile of the behaviour of the main actors in the networks, changes have been made in the technological supply of the main networks: a supply led by international firms from the industrial field and favoured by the economic openness processes. In all the agrofood networks studied, this supply is complemented by local suppliers of decreasing importance, including both private firms and public agricultural research institutes (Bisang, Gutman and others, 2000). The fact of operating in networks has

also facilitated the process of dissemination and adoption of new technological packages.

The process of the spread of new technologies has been facilitated by some market variables (including favourable price movements and particular selective demands deriving from marketing) and by the institutional framework of the networks, in which the supply contracts between industries and agricultural producers and between those producers and the big retail distributors have impelled these changes.

Table 2 shows that, both in the provision of inputs for primary activities and in industrial activities, a large part of the main technologies are concentrated in a limited number of transnational corporations.

TABLE 2

**Argentina, Brazil and Uruguay: Main suppliers of equipment and inputs in some agrofood networks**

Inputs/suppliers	Uruguay	Argentina	Brazil
Transgenic soya seed (variety RR)	Nidera <sup>a</sup> Don Mario <sup>b</sup> Relmó <sup>b</sup> Others	Nidera <sup>a</sup> Don Mario <sup>b</sup> Relmó <sup>b</sup> Others	Not approved for commercial use
Non-transgenic soya seed			Agroceres/Monsanto <sup>a</sup> Fund. Estadales/EMBRAPA <sup>c</sup> Sementes do Brasil <sup>a</sup> Others
Transgenic maize (variety bt)		Monsanto Pioneer <sup>a</sup> Monsanto Dekalb <sup>a</sup> Don Mario <sup>b</sup>	
Hybrid maize	Pioneer <sup>a</sup> Dekalb <sup>a</sup>	Monsanto Pioneer <sup>a</sup> 70%	Agroceres/Monsanto <sup>a</sup> 32% Cargill <sup>a</sup> 25% Pioneer <sup>a</sup> 13% Unimilho/EMBRAPA <sup>c</sup> 12% Sta. Helena Sementes Ltda.
Wheat	INIA <sup>c</sup> Buck-ACA and others <sup>a</sup> Pioneer <sup>a</sup>	Bioceres/INTA Buck Klein INTA <sup>c</sup>	EMBRAPA <sup>c</sup>
Tractors		Agrinar <sup>a</sup> John Deere <sup>a</sup> Zanello Pauny	Valmet/Valtra CATERPILLAR <sup>a</sup> Massey Ferguson <sup>a</sup> FIAT <sup>a</sup> Deutz-Fahr <sup>a</sup> SLC John Deere <sup>a</sup>
Harvesters		Vasalli/Don Roque John Deere <sup>a</sup> Claas <sup>a</sup>	Claas <sup>a</sup> John Deere <sup>a</sup> AGCO do Brasil <sup>a</sup> Agrale Deutz-Fahr <sup>a</sup>

Inputs/suppliers	Uruguay	Argentina	Brazil
Seed drills for direct sowing	Bertini <sup>a</sup> Agrometal <sup>a</sup> Mainero <sup>a</sup> Apache <sup>a</sup> Others	Bertini Agrometal Mainero Apache Others	Yanmar do Brasil Massey Ferguson Brasil <sup>a</sup> John Deere <sup>a</sup>
Sprayers		Pla Metalfor Others	
Glyphosphate		Monsanto <sup>a</sup> PASA <sup>a</sup> ATANOR <sup>a</sup>	
Urea		Profertil <sup>a</sup>	Petrobrás Ultrafertil <sup>a</sup>
Other agricultural chemicals	Hydro Agri <sup>a</sup>	Dow <sup>a</sup> Dupont <sup>a</sup> Bayer <sup>a</sup> Monsanto <sup>a</sup> Atanor <sup>a</sup> YPF <sup>a</sup> Mosaic <sup>a</sup> Bunge	Produquímica Serrana Fertilizantes <sup>a</sup> Norsk Hydro <sup>a</sup> Cargill <sup>a</sup> Copebrás Fosfertil
Animal genetics and reproduction	Private breeding facilities ABS <sup>a</sup>	Private breeding facilities CIALE/La Elisa ABS <sup>a</sup> Alta Genetic <sup>a</sup> Bovine Elite Inc. <sup>a</sup>	ABS <sup>a</sup> Alta Genetic <sup>a</sup> Bovine Elite Inc. <sup>a</sup>
Animal health	Lab. Santa Elena Bayer <sup>a</sup> Novartis <sup>a</sup> Hoechts <sup>a</sup> Glaxo <sup>a</sup> Pfizer <sup>a</sup>	Biogénesis Lab. San Jorge Bago Rosenbush Bayer <sup>a</sup> Novartis <sup>a</sup> Hoechts <sup>a</sup> Glaxo <sup>a</sup> Pfizer <sup>a</sup>	Bayer <sup>a</sup> Ciba <sup>a</sup> Novartis <sup>a</sup> Hoechts <sup>a</sup> Glaxo <sup>a</sup> Pfizer <sup>a</sup>
Milking machines		Alfa Laval <sup>a</sup>	
Oilseed solvent milling equipment		De Smet <sup>a</sup> Crown <sup>a</sup> Buhler <sup>a</sup>	De Smet <sup>a</sup> Crown <sup>a</sup> Buhler <sup>a</sup>
Special packaging	Tetrapak <sup>a</sup> American Plast <sup>a</sup>	Tetrapak <sup>a</sup>	Tetrapak <sup>a</sup>

Source: Bisang, Gutman and others (2000).

<sup>a</sup> Transnational corporation.

<sup>b</sup> Under license from Monsanto.

<sup>c</sup> Public agency.

These tendencies are forming a new innovation model marked by:

- the growing importance of information technologies and bio-technology, which have strategic value in the primary stage (especially as regards seeds and animal genetics for the dairy products and meat industries), in subsequent industrial processing, and in marketing; in this stage, the influence of input suppliers predominates, most of which come from the industrial field;
- the redefinition of the nodes from which innovative impulses are generated; in this respect, the most outstanding roles are those of the input suppliers, especially in primary activities and the industrial phases, and the big retail distributors in the case of industrial processing (in this case, through the technical requirements incorporated in the supply mechanisms);
- the increase and higher concentration of the supply of the main technologies in a few private firms, mainly leading transnational corporations with regional scope. The central research and development activities of these firms are concentrated almost exclusively in their headquarters; these activities are much fewer at the local level and are generally for the adaptation of technologies to local edaphological and climatic conditions and to the local consumer profiles. The exceptions to this situation are some advances made by national research institutes and by a few local private firms in a very limited range of activities (such as the development of hybrid seeds);
- the reordering of the internal hierarchies of the networks through the dynamism of some agents and their predominance in the accumulation process, thus establishing a mechanism of technological inequalities in the networks. There is a tendency to form technological packages which dominate the different agrofood networks. These are production functions (of various agricultural producers) which are coordinated on the basis of a small number of main technologies. These production functions are also made up of a varied range of complementary technologies which –despite their diversity– are linked together by the main technologies, which give them a certain direction.<sup>15</sup> Thus, the main technologies tend to

<sup>15</sup> Among the main technologies, the most outstanding examples are those of genetically modified seeds, special plant varieties, and certain types of animal genetics, which are accompanied by

shape the technological package of agricultural producers and affect their subsequent links with other technologies.

The technological packages formed and their dissemination display some common features in the agricultural sector:

- The generation and dissemination of technology takes place increasingly in the form of technological packages prepared by various public and private agents. The degree of codification of the package is increasingly high, and the room for adaptation of the technology is limited.<sup>16</sup> Such adaptation requires high levels of training of rural producers; it calls for a reformulation both of the profile of the entrepreneurs and of that of the organizations which adapt and disseminate technology, and indirectly it leads to a change in public/private relations and a review of public sector actions.
- The degree of codification of the technologies (and of the technological packages) is closely associated with both plant and animal genetics. A growing degree of specificity may be observed in some of the technologies making up the packages used in the primary stage, especially in terms of production environment, scale of production, and the characteristics of the raw material produced.<sup>17</sup>
- There is a gradual increase in the intensity of the interaction between the technological packages of the primary phase and the industrial phase, caused both by the system of prices and by the demands of the final consumer. This obliges firms, on the one hand, to introduce systems of traceability and, on the other, to reformulate their strategies of relations in the case of broader networks.<sup>18</sup>
- In the processes of the generation, dissemination and innovation of technology, there is a progressive tendency to form more complex

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particular process scales and technologies in primary production (for example, sowing systems, use of biocides, fertilizers and irrigation, forms of harvesting and type of feeding of livestock) and sometimes in industrial processing.

<sup>16</sup> In order to introduce new plant or genetic varieties, however, they must be adapted to local conditions, which opens up considerable room for adaptation activities.

<sup>17</sup> Different types of flour, chemical composition of vegetable oils and milk, and beef cuts, among other characteristics.

<sup>18</sup> Firms which were previously strictly industrial have begun not only to enter the fields of bio-technology and genetics but also to occupy leading positions in them, as well as to market final products at the end of the agrofood chain.

networks, made up of different public and private agents. The latter occupy important leading positions both in various areas of research and development –some of which were the almost exclusive technological preserve of the public sector in the previous model– and in the processes of dissemination of technology.

- There is an innovation dissemination network, with a heavy predominance of private capital, which is formed on the basis of the marketing networks of input suppliers or the relations established between agricultural producers and the big retail distributors.

Within the framework of this innovation model, with the variants registered in the MERCOSUR countries, the presence of forms of inter-firm linkages based on the control of given technologies places the suppliers of the latter in an important strategic position. Those who control these technologies occupy important roles in the hierarchy of the networks and are in a position to influence the direction and characteristics of the accumulation process.<sup>19</sup> The strategy of the network as a whole is strongly conditioned or induced by the agents who dominate the generation and dissemination of the main technologies. An important part of those technologies is currently developed by transnational private capital.<sup>20</sup>

### III

## Networks, accumulation and institutions

On the basis of this logic of the functioning of the system (a limited set of agrofood firms with accumulation capacity deriving from control of the nodal points of the networks, primary resources and technology), we may ask ourselves what is the strategic role of the public institutions.

It may be assumed that an important objective of those institutions is to help to ensure that the most dynamic networks locate their operations in the national territory so as to strengthen the trickle-down effect on the rest of economic activities and secure an equitable distribution of rents among the participating agents. If this is so, there are at least two analytical levels: the first refers to the most suitable strategy for achieving those aims, while the second refers to the operational instruments to be used.

At the strategic level, if accumulation is based on the fact that in the hierarchy of the network, high positions are occupied by firms that are clear leaders in the supply of the main technologies, then the actions of the public institutions should concentrate on those activities. Public policies should be directed above all towards the generation, adaptation, appropriation and dissemination (in this latter case, through the formulation of suitable norms) of the main technologies in each of the production networks. From this point of view, the institutions specializing in science, technology and innovation are key actors for the application of the strategies adopted.

Within the framework of such a strategy, it is necessary to adjust the traditional public policy instruments to achieve the overall goal: not only those designed to regulate the levels of profit of the firms (norms on taxation, competition, etc.), but also those

that assume importance when considering the network as an object to be regulated by public policies:

- i) the set of norms (in the areas of health, food technology, content, etc.) which define the quality of the products generated in the various networks;
  - ii) the minimum requirements to be applied to the production processes in terms of quality and safety;
  - iii) tax policies (including tariff policies) which modify relative prices to favour the local development of stages with greater value added;
  - iv) restrictions on the free flow of capital, as a counterpart to the local procurement of net rents associated with the occupation of important hierarchical positions in the networks;
  - v) policies of arbitrage and control of the relations between the various stages making up the network.
- On another level, and from a broader perspective, another set of policies (in the fields of credit, taxation, etc.) should be aimed at promoting the technological and productive development, by local firms and/or institutions, of the key nodes capable of redirecting the accumulation processes towards the local market.

<sup>19</sup> In this process, there is constant tension among the different agents over the control of the networks and the appropriation of surpluses, as reflected, for example, in the tensions between some strata of industry and the marketing sector, or between industry and primary production.

<sup>20</sup> The recent processes of mergers and acquisitions led by a few international firms (Monsanto, Syngenta, Bayer, Dow, etc.) in the case of transgenic seeds is a good example of this behaviour.

## IV

### Conclusions

In recent decades, some types of production based on natural resources and organized in the form of networks have displayed strong dynamism in the MERCOSUR countries. Within the framework of the evolution of world markets and the new models based on economic openness and globalization, this dynamism has turned them into focal points of accumulation and economic growth through their insertion in international trade. Much of this production dynamism is associated with the form of organization adopted –networks–, which facilitates the process of generation and adoption of innovations.

In the main agrofood networks of the region, a small number of large firms, mostly belonging to transnational corporations, have reached important hierarchical positions in recent years. These firms tend to establish growing degrees of control through their ownership of some of the main technologies, within the context of a trend towards the formation of technological packages. Even if softened by the presence of the public sector in some areas, the dynamism of these big firms reorders the previous hierarchical structure of the networks and establishes new internal power balances.

This situation is not neutral, from various points of view; in particular, it is not neutral from the point of view of regional accumulation, since those firms form their global strategies with objectives that do not always coincide with national or regional (strategic) views.

This new scenario –economic openness in the merchandise, capital and technology markets, regional configuration of the networks, reordering of their internal hierarchies in favour of transnational corporations, and the greater weight of private capital in the generation and dissemination of innovations– makes necessary the reformulation of public policies. As one of the main objectives is the strengthening of local/regional accumulation capacity, it is necessary to redefine both the purpose and the implementation of public policies, as a function of a broader strategic purpose. Consequently, when formulating public policies it will be necessary to take account of the structure of the networks and the dynamics of their functioning (their hierarchies, their main technologies, the nodal points of their systems of dissemination) and to design specific instruments to ensure a stronger spillover effect throughout them. It will also be necessary to reformulate part of the previous public institutions, especially in the technological areas. Future policies to establish or strengthen the activity of networks must concentrate on the formulation of strategic criteria to ensure that a substantial part of the surpluses are channelled to the local or regional areas where these organizations are located, within the framework of a growing tendency to generate more local value added and establish agreed, sustainable and equitable ways of distributing those resources.

(Original: Spanish)

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