Technological innovation, competitiveness and international trade

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The relative position of a country or region in the international market is increasingly determined by its rate of creation and dissemination of technology , which together enable the increases in competitiveness necessary for carving out a stronger position in the world market. Latin America has used industrial and trade policies to change the profile of its production structure and to create comparative advantages in new sectors. The changes brought about in the structure of industry in some countries, in technologically more sophisticated sectors, have been quickly reflected in higher exports.

The obtaining of this result is associated with development of the region's technology capability and the transfer of technology from more developed countries. It is noteworthy that the countries with the best export performance in terms of products with a high technology content are those with high levels of R&D activities. However, it should also be noted that these indexes are modest compared with those of the developed countries.

1. Introduction

A better competitive performance by Latin America in technologically advanced subsectors will require acceleration of the region's own technology effort as well as technology transfers. In the latter case, joint ventures have proven effective for transferring technological expertise. It is also a fact that the liberalization of the region's trade regimes creates a considerable attraction for international investment as long as restrictions on imports are cased. This enables a relationlization of production and enhances the region's attractiveness as recipient of investment capital.

The quest for sustainable development, as defined in the Declaration of Rio 92, places human beings at the center of development concerns, with entitlement to a healthy and productive life in harmony with nature. The growth of trade flows has required the countries to sharpen their competitiveness in order for them to adapt to the growing liberalization and mobility of goods and services. Sustainable

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DOI: https://doi.org/10.48160/18517072reEspecial.806

development and the liberalization of trade require new linkages between the social partners.

Achieving the international standards needed for sustainable development calls for mobilization of the parties involved in the technological innovation process. Universities, research institutes and technology centers have to participate in the formulation of standards for certification and monitoring. The increasing of scientific knowledge about global dynamics, the creation of new capabilities, technology transfer and management of environmental challenges represent the necessary prerequisites for reconciling sustainable development and promotion of international trade.

This study discusses the interface between technological innovation, competitiveness and international trade in Latin America. First it considers the development of the trade relations among the Latin American countries during the past twenty years, in order to quantify the important changes in intensity of this trade over the period. It notes a distinct expansionist trend as of the mid - 1980s, which indicates favorable prospects for the increasing of trade among the Latin American countries and in the hemisphere as a whole. Next, it discusses the possible impacts of the integration processes in the region on the rate of expansion of trade relations, investment and technological innovation, which special emphasis on the minilateral initiatives of Latin America, NAFTA and the European Economic Community. In all of these initiatives there are factors that inhibit and others that foster the increasing of trade relations, but there are indications that the net balance has to be favorable to expansion of such relations and of investment in the Latin American countries.

Thirdly, the interrelationships between technological innovation and sectoral and structural competitiveness in Latin America and their impact on the growth of the region's relative share in international trade are analyzed. Lastly, an evaluation is presented of governmental policies and their impacts on technological innovation and competitiveness of Latin America, together with conclusions and recommendations concerning technology policy and international competitiveness.

2. The trade relations between the latin american countries

The first point to be noted in the development of the trade relations of the Latin American countries is the marked change in the trade policy of the countries involved, a factor that significantly modifies the ins-

titutional framework within which the trade relations develop. The majority of Latin American countries have implemented trade liberalization programs, which have essentially lessened the degree of administrative and tariff-related intervention. This imparted a fresh impetus to the expansion of regional trade during the 1980s and furthered structural changes in the composition of Latin America's international trade.

The structural changes in international trade that have affected Latin America are similar to the pattern observed worldwide: between 1970 and 1990 the proportion of manufactured products in world exports rose from 61% to 75.4% of the total. As can be seen from the data in Table 1, there has been a parallel reduction in the share of commodities and mineral fuels in this total. The developing countries have posted a significantly higher export performance as regards manufactured goods than the industrial countries. While over the past twenty years annual average growth of exports of manufactures by the rich countries has been 6%, the figure for Latin America has been 11% and that for the Asian NICs 15.2%. This performance indicates that the recently industrialized countries have developed competitive advantages in new industrial subsectors which are enabling a technological "upgrade" of these countries.

The main structural changes in Latin America's foreign trade are quantified in Table 2. Between 1970 and 1990, the proportion of commodity exports dropped from 65.8% to 41.2%, while manufactures grew from 10.9% to 32.9% of the total. Among the chief categories of manufactures the machinery and transport equipment segment stands out on account of its exceptional dynamism, rising over the period to an annual average rate of 19%, compared with the average for the other industrial subsectors of some 15% p.a. On the import side, the main shift to be noted is the decline in the proportion of manufactures from 72.4% of the total in 1970 to 66.6% in 1990.

Three countries are primarily responsible for exports of manufactures: Brazil, Mexico and Argentina account for approximately 80% of the region's total exports of these items. Nontraditional segments are assuming increasing importance in these countries' exports, in particular the machinery and transport equipment (external combustion engines and vehicles) and basic manufactures (iron and steel manufactures) subsectors. In addition to this "big three" there is now a second group of "new exporters" who are posting explosive export growth. This group is made up of Chile, Colombia, Peru, Trinidad and Tobago, Uruguay and Venezuela; the average growth of their manufactures exports was around 18% p.a. in the period 1970-90, the products

Table 1. Latin America in the International trade and the World Economic Growth (in %)

	Growth rates Annual Average		% Share	
	1970-1979	**1980-1990**	**1970-1975**	**1985-1990**
World Exportations Value				
Manufactures	7.4	5.6	61.0	75.4
Basic Goods	3.4	0.7	24.4	15.6
Minerals trade	1.5	-3.2	13.2	6.7
Total	4.3	4.1	100.0	100.0
Manufactures Exportation Value				
Industrialized Countries	6.9	5.1	96.7	91.5
NIC's/Asia (*)	17.0	13.5	2.0	6.2
Latin America	12.7	9.1	1.2	2.1
Total	7.2	5.7	100.0	100.0
Manufactures Importation Value				
Industrialized Countries	6.6	8.3	89.3	89.2
NIC's/Asia	12.2	15.2	3.1	7.2
Latin America	6.3	-0.1	7.5	3.5
Total	6.8	8.5	100.0	100.0
Real GDP				
Industrialized Countries	3.3	3.1	94.0	93.4
NIC's/Asia	8.7	6.6	0.2	0.2
Latin America	5.8	1.3	5.7	6.0
Total	3.4	3.1	100.0	100.0

(*) Singapore, South Korea y Hong Kong.
Source: IDB (1992) Socioeconomic Progress in Latin America.

concerned ranging from clothing and textile goods to chemical products and iron steel manufactures.

As regards to the regional breakdown of Latin America's exports, some important changes are evident in the region's export market. Between 1980 and 1992 the importance of the North American and

Table 2. Structure of Latin America's Foreign Trade Main Product Categories (U$S millions)

	Exports			Imports		
	Share %		Value in	Share %		Value in
	1970	1990	1990	1970	1990	1990
Commodities	65,8	41,2	50,75	17,9	20,3	21,34
Foodstuffs and Livestock	38,3	22,0	27,12	9,0	10,3	10,78
Beverages and Tobacco Products	0,8	1,1	1,377	0,7	0,5	520
Raw Materials	25,2	16,6	20,52	7,3	8,4	8,793
Oils and Vegetables and Animal Fats	1,5	1,4	1,732	0,9	1,1	1,242
Mineral Fuels	23,1	24,7	30,48	9,3	12,3	12,94
Manufactured Products	10,9	32,9	40,57	72,4	66,6	69,77
Chemical Products	2,7	5,7	7,108	13,2	15,8	16,55
Basic Manufactures	4,4	11,8	14,54	16,7	12,6	13,24
Machinery and Transports	2,3	11,2	13,88	36,4	30,8	32,29
Misc. Manufactures	1,5	4,1	5,127	6,1	7,3	7,687
Other products	0,3	0,9	1,193	0,4	0,6	656
Total	100,0	100,0	123,0	100,0	100,0	104,7

Source: BID/ONU/COMTRADE Databank.

Asian markets increased in terms of total export sales, while that of other markets declined (the share of the region's exports taken by the USA and Canada rose from 35.8% to 44.3%, and that accounted for by the Asian market from 6.3% to 10.2%, while the relative significance of the other regions, including Latin America, declined over the past decade). The figure is slightly different as regards exports of manufactures, for which intra -Latin American trade features more prominently at one fourth of the region's total exports.

In the space of two decades Latin America almost doubled its share of the international manufactures market. This performance is explained by a number of factors: availability of natural resources, labor productivity, the establishment of categories of industries which enabled the technological "upgrade" of the region, achievement of economies of scale and product differentiation, the pattern of international demand and also the trade policies followed by the region all contributed to this result. Although the specific effect of each component in this performance cannot be evaluated, it is possible to identify the sectors where product penetration in the international market was most marked. This is done by using the Revealed Comparative Advantages (RCA) indexes to measure –for various products categories– the region's export performance in terms of total world exports.[1] On the basis of the data presented in Table 3, Latin America's export performance can be compared with that of the Asian NICs and the industrial countries for products classified by intensity of input use. It can be seen that Latin America has comparative advantages in three categories of goods (human capital/technology-intensive, unskilled labor-intensive, and natural resource-intensive). The highest indexes are in the unskilled labor and natural resources categories, where Latin America's penetration into the world market, compared with the two southeast Asian countries, is higher in leather products, footwear, paper products and fertilizers, but lower in the textiles, clothing, wood and bulk chemical products. Regarding human capital and technology-intensive products, Latin America posts a good showing in a large number of products, specially those deriving from the iron and steel industry, chemical products, explosives, and rubber and plastic manufactures. However, the southeast Asian countries score higher in the more sophisticated segments industry (electrical machinery and professional and scientific

[1] In formal terms, the index is defined as:

$$RCAi = (Xi, la / Xla) / (Xi, w / Xw)$$

in wich:

RCAi = Revealed Comparative Advantage for industry i.
Xi, la = Value of industry i's manufactures export in Latin America.
Xla = Total value of manufactures exports in Latin America.
Xi, w = Value of world exports of manufactures by industry i.
Xw = Total value of world manufactures exports.

Table 3. Manufactured Products Revealed Comparative Advantages (RCAs) 1988-90 by Categories of Input Intensity

	Latin America	Industr. Countries	Asian NICs (*)
Human Cap./Technol. Intensive	1,49	1,04	1,18
Iron and Steel	3,42	0,99	0,70
Chemical Products	1,98	1,03	0,32
Explosives	1,61	0,90	0,19
Rubber Products	1,16	1,03	0,87
Plastics	1,12	1,06	0,57
Metal Manufactured n.e.s.	1,05	1,01	0,80
Chemical Products n.e.s.	0,99	1,06	0,40
Dyeing mats.	0,91	1,06	0,33
Heating and lighting eqpt.	0,84	1,04	0,63
Essential oils, etc.	0,84	1,05	0,42
Transport eqpt.	0,83	1,08	0,29
Nonelectric Machinery	0,75	1,05	0,64
Medical and pharm. products	0,60	1,05	0,17
Misc. manufactures	0,46	0,97	1,53
Electrical machinery and ap.	0,43	0,97	1,89
Professional and scientifical instruments	0,37	1,03	0,88
Unskilled Labor Intensive	2,51	0,80	3,38
Leather and leather goods	5,50	0,88	1,02
Footwear	3,74	0,71	3,40
Textile yarns	1,14	0,85	1,78
Luggage, handbags	1,10	0,72	4,54
Clothing	0,85	0,63	4,23
Furniture	0,36	1,04	0,68
Natural Resources Intensive	1,15	1,00	1,91
Wood and Cork	1,48	0,81	3,38
Fertilizers	1,22	0,95	0,68
Nonmetallic minerals	1,11	0,97	0,52
Paper Products	1,07	1,08	0,30
Bulk chemical products	0,71	0,86	2,64

(*) Singapore, South Korea, Philippines, Hong Kong, Indonesia, Malasya, Thailand and Taiwan.
Source: BID/COMTRADE/ONU.

instruments). To the extent that the region regains its economic development momentum, new categories of nontraditional exports may have the effect of shifting the region's comparative advantage to technologically more sophisticated subsectors of industry.

3. The trade relations between the latin american countries and the integration processes in the region

Two institutional features must be mentioned when considering the development of the trade among the Latin American countries over the past twenty years: first, the unilateral initiatives of the countries of the region in liberalizing their international trade, and second, the implementation/revitalization of minilateral agreements, including MERCOSUR, the Andean Pact, the Chile-Mexico Agreement, LAIA, the Central American Common Market, the Caribbean Common Market and the G-3 (Colombia, Mexico and Venezuela). These agreements are being implemented in a trade environment that is much more open than in the past, so that the possibilities for regional integration are now greater. The available statistics point to a resurgence of regional trade distinguished by characteristics that are different than before and favorable for integration of the region as regards trade. Graph 1 presents the aggregate trend of intra-Latin American trade, which shows a significant decline in the intensity of trade in the first half of the 1980s, followed by a partial recovery.

There have, however, been some important structural changes in regional trade, which increase the interdependencies of the economies of the region and create favorable conditions for intensified regional integration and new investment opportunities. To begin with, the intensification of the trade within the various miniblocs into which the region is subdivided should be noted. For ALADI as a whole, the trade upswing in the second half of the 1980s completely reversed the decline observed in the first half of the decade (Tables 4a and 4d); the great majority of the countries began to focus a significant proportion of their international trading activity on the American hemisphere or the regional agreements in which they are involved. Within the miniblocs the greatest progress was in the Andean Group and in MERCOSUR, where the intensity of trade increased markedly between 1984 and 1994: in the Andean Group, the intra-group trade flow (exports + imports) rose from 3.9% of the total in 1984 to 9.3% in 1994, while in MERCOSUR the increase was from 7.7% to 17.8% of total trade. In annual growth

terms, the trade flow posted 10.1% growth in the Andean Group and 12.9% in MERCOSUR. This growth is substantially higher than that of the American hemisphere's exports to the world as a whole (3.75%) p.a.) and the increase in trade among the countries of the hemisphere (4.08%), and even exceeds that of the regional Gross Domestic Product, which was around 2% p.a. during the period in question.

It must be borne in mind, however, that while intra-hemisphere trade increased significantly during the past decade, a major part of this trade remained concentrated in North America, which accounted for 86% of the hemisphere's total trade in 1994.

Trade in manufactured goods has already assumed an important role in regional trade (19% of the total), with chemical products and machinery and transport equipment featuring prominently in this figure. This latter point suggests there may be factors here that could spur additional regional integration efforts. This can be measured by an "intra-industry" trade index, which quantifies the trade between industrial products of the same branch.[2] In world trade, intra-industry trade accounts for approximately 50% of total international transactions and this type of trade is already thriving in Latin America. High intra-industry trade indexes indicate there is scope for utilizing additional specialization gains resulting from the existence of economies of scale and product differentiation. Intensification of intra-industry trade presents the following advantages:

• it enables increasing of the variety of products with the intensification of regional trade;

• it helps to lower prices as a result of economies of scale;

• its impact on income distribution is small, since what is involved is reallocation of production among segments of industry and not the entire elimination of these segments in the countries involved.

[2] The intra-industrial trade index is defined as follow:

$$IIT = 1\text{-}Si\ Sj\ Sk\ (Xijk - Mijk) / Si\ Sj\ Sk\ (Xijk + Xikj)$$

where:

IIT = Intra-industry trade index
S = Sum
Xijk = Exports of industry i, of country j to country k
Mijk = Imports of industry i, of country j from country k

This index ranges from 0 to 1, and the closer it is to unity greater is the intensity of intra-regional trade.

Table 4a. Trade Within America's Regional Arrangements, 1994 (millions of U$S)

	X+M World	X+M W. Hem.	X+M NAFTA	Regional agreement	Trade Share %			
	(1)	(2)	(3)	(4)	(2)/(1)	(3)/(1)	(4)/(1)	(4)/(2)
CACM	19,73	14,77	10,22	2,50	74,9	51,8	12,7	16,9
1- Costa Rica	6,88	5,05	3,98	0,50	73,4	57,9	7,4	10,1
2- El Salvador	3,65	2,5	1,4	0,68	69,1	38,8	18,9	27,3
3- Guatemala	4,5º	3,68	2,11	0,74	81,5	46,9	16,5	20,3
4- Honduras	3,52	2,66	2,27	0,26	75,6	64,4	7,5	9,9
5- Nicaragua	1,17	0,86	0,43	0,29	73,8	36,8	25,4	34,4
Andean Pact								
6- Bolivia	2,33	1,50	0,58	0,29	64,4	25.2	12.8	19,9
7- Colombia	20,88	12,79	8,51	2,51	61,3	40,8	12,0	19,6
8- Ecuador	7,72	4,85	3,33	0,80	62,8	43,1	10,4	16,6
9- Peru	11,18	5,74	2,82	0,97	51,3	25,3	8,7	16,9
10- Venezuela	26,72	21,62	14,6	1,79	80,9	54,6	6,7	8,3
CARICOM	13,39	7,92	5,7	0,72	59,2	42,6	5,4	9,2
11- Antigua and Barb.	0,58	0,09	0,06	0,002	16,8	11,7	0,3	2,0
12- Bahamas	3,50	1,19	1,02	0,006	34,0	29,2	0,2	0,5
13- Barbados	0,68	0,53	0,29	0,18	78,5	42,7	26,5	33,7
14- Dominicana	0,26	0,06	0,04	0,04	23,8	16,9	15,4	64,5
15- Granada	0,14	0,06	0,03	0,05	46,6	23,6	35,8	76,8
16- Jamaica	3,87	2,75	2,25	0,17	71,0	58,1	4,6	6,5
17- Montserrat	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
18- Saint Kitts & Nev.	0,16	0,10	0,08	0,001	62,6	52,1	0,6	1,0
19- Santa Lucia	0,34	0,17	0,11	0,002	50,1	32,7	0,6	1,1
20- San Vinc. and Gran.	0,29	0,10	0,04	0,004	36,3	15,6	1,4	3,7
21- Trinidad and Tobago	3,53	2,83	1,75	0,25	80,2	49,6	7,3	9,1

	X+M World	X+M W. Hem.	X+M NAFTA	Regional agreement	Trade Share %			
	(1)	(2)	(3)	(4)	(2)/ (1)	(3)/ (1)	(4)/ (1)	(4)/ (2)
LAIA	350,3	213,4	155,5	52,65	60,9	44,4	15,0	24,7
22- Argentina	36,30	19,31	7,44	12,03	53,2	20,5	33,1	62,3
6- Bolivia	2,33	1,5	0,58	0,92	64,4	25,2	39,6	61,5
23- Brazil	81,27	35,18	20,25	15,25	43,3	24,9	18,8	43,4
24- Chile	22,97	10,37	5,46	5,22	45,1	23,8	22,7	50,3
7- Colombia	20,88	12,79	8,51	4,10	61,3	40,8	19,7	32,1
8- Ecuador	7,72	4,85	3,33	1,39	62,8	43,1	18,1	28,8
25- Mexico	128,9	105,8	100,4	3,84	82,0	77,9	3,0	3,6
26- Paraguay	3,83	2,05	0,90	1,11	53,6	23,5	29,0	54,1
9- Peru	11,18	5,74	2,82	2,74	51,3	25,3	24,5	47,8
27- Uruguay	4,68	2,90	0,49	2,50	61,9	10,6	53,4	86,2
10-Venezuela	26,72	21,62	14,60	3,51	80,9	54,6	13,1	16,2
MERCOSUR								
22- Argentina	36,30	19,31	7,44	8,78	53,2	20,5	24,2	45,5
23- Brazil	81,27	35,18	20,25	9,97	43,3	24,9	12,3	28,3
26- Paraguay	3,83	2,97	0,90	0,97	77,5	23,5	25,4	32,8
27- Uruguay	4,68	2,90	0,49	2,70	61,9	10,6	57,8	93,4
NAFTA	1643	778,3	684,7	684,7	47,4	41,7	41,7	88,0
28- Canada	312,8	241,9	236,8	236,8	77,3	75,7	75,7	97,9
25- Maxico	128,9	105,8	100,4	100,4	82,0	77,9	77,9	94,9
29- United States	1201	430,6	347,4	347,4	35,8	28,9	28,9	80,7
Total	1898	908,6	755,7		47,9	39,8		

This index ranges from 0 to 1, and the closer it is to unity greater is the intensity of intra-regional trade.
Source: Direction of Trade Statistics Yearbook (1995), FMI.

Table 4b. Trade Within America's Prior to the Present Regional Arrangements, 1984 (millions of U$S)

	X+M World	X+M W. Hem.	X+M NAFTA	Regional agreement	Trade Share %			
	(1)	(2)	(3)	(4)	(2)/(1)	(3)/(1)	(4)/(1)	(4)/(2)
CACM	9,12	6,35	3,83	1,44	69,6	42,1	15,9	22,8
1- Costa Rica	2,07	1,43	0,88	0,30	69,3	42,7	14,8	21,4
2- El Salvador	1,69	1,26	0,71	0,40	74,4	42,3	24,1	32,4
3- Guatemala	2,54	1,89	1,04	0,47	74,7	41,3	18,5	24,8
4- Honduras	1,71	1,23	0,86	0,14	72,3	50,5	8,4	11,6
5- Nicaragua	1,09	0,51	0,32	0,11	47,0	29,2	10,7	22,7
Andean Pact	41,19	26,1	18,49	1,62	63,3	44,9	3,9	6,2
6- Bolivia	1,19	0,84	0,23	0,003	70,8	19,7	2,8	3,9
7- Colombia	7,97	4,52	3,04	0,72	56,8	38,2	9,1	16,0
8- Ecuador	4,34	2,97	2,24	0,12	68,4	51,6	2,9	4,3
9- Peru	4,57	2,43	1,74	0,23	53,1	38,2	5,2	9,7
10- Venezuela	23,10	15,31	11,22	0,50	66,3	48,6	2,2	3,3
CARICOM	11,00	7,21	5,59	0,37	65,5	50,8	3,4	5,2
11- Antigua and Barb.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
12- Bahamas	3,79	1,92	1,74	0,003	50,7	46,1	0,1	0,2
13- Barbados	1,05	0,81	0,56	0,11	77,1	53,8	10,5	13,6
14- Dominicana	0,08	0,05	0,02	0,002	61,4	25,3	2,4	3,9
15- Granada	0,07	0,06	0,01	0,01	82,4	24,3	25,7	31,1
16- Jamaica	1,92	1,52	1,09	0,08	79,2	56,6	4,3	5,4
17- Montserrat	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
18- Saint K. & Nevis	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
19- Santa Lucia	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
20- St. Vinc. and Grens.	0,04	0,01	0,01	0,004	23,9	0,00	8,7	36,4
21- Trinidad and Tobago	4,03	2,83	2,14	0,15	70,2	53,3	3,9	5,5

	X+M World	X+M W. Hem.	X+M NAFTA	Regional agreement	Trade Share %			
	(1)	(2)	(3)	(4)	(2)/ (1)	(3)/ (1)	(4)/ (1)	(4)/ (2)
LAIA	140,5	75,65	56,21	16,52	53,8	40,0	11,8	21,8
22- Argentina	12,69	5,01	2,09	3,02	39,5	16,5	23,8	60,4
6- Bolivia	1,19	0,84	0,23	0,60	70,8	19,7	50,5	71,3
23- Brasil	42,21	16,73	12,19	5,11	39,6	28,9	12,1	30,6
24- Chile	7,13	3,32	1,82	1,43	46,6	25,6	20,1	43,2
7- Colombia	7,97	4,52	3,04	1,21	56,8	38,2	15,3	26,9
8- Ecuador	4,34	2,97	2,24	0,47	68,4	51,6	10,8	15,8
25- Mexico	34,7	23,27	21,27	1,21	67,0	61,3	3,5	5,2
26- Paraguay	0,84	0,47	0,07	0,38	56,1	8,5	45,1	80,5
9- Peru	4,57	2,43	1,74	0,66	53,1	38,2	14,5	27,4
27- Uruguay	1,71	0,74	0,26	0,52	43,5	15,4	30,8	70,7
10-Venezuela	23,10	15,31	11,22	1,86	66,3	48,6	8,1	12,2
MERCOSUR	57,47	22,97	14,71	4,45	40,0	25,6	7,7	19,4
22- Argentina	12,69	5,01	2,09	1,63	39,5	16,5	12,9	32,6
23- Brazil	42,21	16,73	12,19	2,02	39,6	28,9	4,8	12,1
26- Paraguay	0,84	0,47	0,07	0,35	56,1	8,5	41,7	74,4
27- Uruguay	1,71	0,74	0,26	0,43	43,5	15,4	25,5	58,5
NAFTA	760	340,8	283,1	283,1	44,8	37,2	37,2	83,1
28- Canada	166,2	124,3	120,1	120,1	74,8	72,3	72,3	96,6
25- Mexico	34,7	23,27	21,27	21,27	67,0	61,3	61,3	91,4
29- United States	559	193,2	141,6	141,6	34,6	25,3	25,3	73,3
Total	875,9	406,7	327,4		46,4	37,4		

Source: Direction of Trade Statistics Yearbook (1995).

Table 4c. Trade of America's Regional Arrangements (millions of U$S)

	1994 (1)				1984			
	X+M World	X+M W. Hemis.	X+M NAFTA	X+M Regional agreem.	X+M World	X+M W. Hemis.	X+M NAFTA	X+M Regional agreem.
CACM	13.158	9.853	6.811	1.969	9.120	8.351	3.835	1.448
Andean Pact	45.903	31.011	19.913	4.252	41.192	26.087	18.498	1.624
CARICOM	8.931	5.283	3.809	0.485	11.005	7.212	5.591	0.375
LAIA	233.538	142.289	103.704	35.100	140.510	75.654	55.215	16.528
LAIA (2)	147.545	71.744	36.731	32.537	105.801	52.384	34.944	15.315
MERCOSUR	84.057	40.249	19.393	14.957	57.470	22.072	14.718	4.452
NAFTA	1095.659	518.885	456.506	456.506	759.989	340.795	283.086	283.085
W. Hemisf.	605.674	406.742						
W. Hemisf. (3)	96.879	65.947						
Total	1265.263	875.915						

(1) Nominal dollar values corrected by the change of the US real effective exchange rate (IMF) between 84-94.
(2) Excluding México.
(3) Excluding NAFTA.
Source: Tables 1 y 2.

The data presented in Table 5 provide an idea of the development of intra-industry trade in LAIA pointing up the marked increase in this type of trade which, as already noted, suggests the existence of additional possibilities for regional integration.

The main LAIA countries show intra-industry trade indexes of around 0.5, which though high compared with those of the other countries, are significantly lower than those observed in the industrial countries (where the average is 0.6) and particularly in the EEC where they

Table 4d. Trade of America's Regional Agreements Annual Rate of Growth Between 1984-1994 (1)

	X+M World	X+M W. Hemisf.	X+M NAFTA	X+M Regional Agreem.
CACM	3,73	4,49	5,91	1,43
Andean Pact	1,09	1,74	0,74	10,10
CARICOM	-2,07	-3,06	-3,77	2,58
LAIA	5,21	6,52	6,31	7,82
LAIA (2)	3,38	3,20	0,50	7,83
MERCOSUR	3,88	5,77	2,80	12,88
NAFTA	3,73	4,29	4,89	4,89
W. Hemisf.	4,06			
W. Hemisf.	2,79			
Total	3,75			

(1) Nominal dollar values corrected by the change of the US real effective exchange rate (IMF) between 84-94.
(2) Excluding Mexico.
(3) Excluding NAFTA.
Source: Tabla 3.

reach 0.7. These high indexes in the countries with the highest GDP indicate that market size is an important factor in explaining the utilization of economies of scale and production differentiation. Since the expansion of Latin American trade is taking place in an environment marked by rapid trade liberalization, there are possibilities for more intensive use to be made of the gains associated with the growth the re-

Table 5. Changes in Intra-Industry trade in LAIA

Exports to LAIA	1965	1990
Argentina	0,248	0,556
Brazil	0,162	0,451
Chile	0,162	0,314
Colombia	0,370	0,452
Ecuador	0,321	0,102
Mexico	0,229	0,485
Peru	0,070	0,177
Paraguay	0,032	0,042
Uruguay	0,072	0,432
Venezuela	0,061	0,483

Source: Braga, C.A.P. *et al.* (1993) A New Investment Opportunities in Eastern Europe and Latin America@.IPE/USP - Discussion Paper No. 15/93.

gional market. In addition, the increased nontariff barriers to Latin American exports in the developed countries may also be a factor in the expansion of regional trade.

The figures in Table 6 show that an appreciable proportion of regional exports are discriminated against in the industrial countries, which contrasts with Latin America's trade policy in the 1980s which tended to be characterized by unilateral liberalization. Nowadays, the industrial countries have much more in the way of nontariff barriers than Latin America, in terms of import coverage.

The world trade environment is becoming more complex and requires greater geostrategic sensitivity for international negotiation. New capabilities are called for so that concessions made by a country or region can be proportionately compensated. Unlike the GATT, the re-

Table 6. Incidence of Nontariff Barriers against Imports of Selected Products in the Industrial Countries

	Import Coverage Coefficient*		
	United States	**CEE**	**Japan**
Leather	0,0	7,7	47,0
Rubber	0,0	9,1	13,6
Wood and Cork	0,0	1,0	0,0
Paper	0,0	5,9	0,0
Textiles	34,5	34,7	55,5
Cement, Plaster and Glass	0,1	2,9	24,1
Iron and Steel	76,3	46,2	0,0
Nonferrous Metal	0,0	0,8	0,4
Metal Manufactures n.e.s.	11,0	2,1	1,0
Nonelectrical Machinery	0,0	3,1	4,4
Electrical Machines	1,4	11,1	0,3
Machines and Transports Eqt.	41,1	23,6	17,3
Pipe	0,0	0,0	0,0
Furniture	1,1	0,3	0,0
Luggage and Travel Accesories	18,9	0,9	0,0
Clothing	76,4	65,7	11,3
Footwear	0,1	11,3	6,9
Instruments	0,0	3,8	14,1

* Proportion of imports subject to nontariff measures.
Sources: IDB (1992).

cently established World Trade Organization (WTO) can impose penalties. This means that mistakes made in foreign trade policy can have economic consequences. For the trade interests of a country or region to prevail, it will need to have a sufficient number of qualified professionals to be able to meet the challenge of negotiating by sector. Access to data and conditions for international trade is necessary. The next ministerial meeting scheduled by the WTO to be held in Singapore at the end of 1996 will be an occasion for discussing topics of interests to the countries of the region, with a view to creating favorable conditions for raising their international competitiveness.

4. Competitiveness and technology policy

The globalization of markets, the new technologies coming into use and the privatization of activities are trends which explain the interest of governments and the business world in the question of competitiveness. Competitiveness plays a role at different levels, which are, however, interconnected.

The international competitiveness of a enterprise results from the ability of its managers to manage the interaction among various environments and thereby obtain a significant and stable share of the international trade in goods and services. The concept of competitiveness is connected with a healthy share of the domestic and international market that can be quantified and evaluated. Accordingly, defining competitiveness involves considering three mutually complementary levels: the structural, the sectoral and the business-related.

Structural competitiveness derives from the economy of a country as a whole and describes that economy's ability to increase or sustain its share of the international market of goods and services, with a parallel increase in the standard of living of the country's population. A structurally competitive country is one in which the components of the national environment serve to stimulate business efficiency and involve increasingly broad segments of society.

Sectoral efficiency reflects the ability of the economic sectors to generate bases for creating and developing the advantages that sustain a competitive international position. It is the degree to which an economic sector offers, simultaneously, growth potential and investment returns that are attractive for the enterprises composing it.

Business-related competitiveness relates to enterprises' ability to maintain the higher efficiency standards now required in terms of resource utilization and the quality of the goods and services they offer. A competitive enterprise has to be able to plan, produce and market products that are superior to those offered by the competition in both price and quality terms.

The combination of these three levels of competitiveness produces a self-sustaining basis for competition. Countries that have been successful in achieving industrial growth have freed themselves from the market/plan conflict. In these countries, plans neither ignore the market nor take its place, but use it and shape it.

Richard Nelson, of Columbia University, has formulated a set of questions for officials responsible for technology policy. These questions echo the concerns of Martin Bangemann, former German Minis-

ter for Economic Affairs and now responsible for the European Union's industrial policy. In a context of scarce resources and the challenges posed by becoming and remaining competitive, the following questions have to be asked:

• Should public funds in support of technological innovation go to individual enterprises or should they be used to induce linkages among productive sectors built around incentive programs?

• How should precompetitive research in a productive sector be structured and managed in order to lead to greater competitiveness?

• Should the results of research projects financed with public funds be available to all or appropriated by one or more enterprises?

These are questions that will have to be answered in order to delineate a technology policy. Without aiming at a full and conclusive response, it is desirable to assign priority to motivational programs designed to raise sector competitiveness. The agriculture sector, for instance, has a number of initiatives which link research, human resource training, production and market. These initiatives have positive impacts both through increasing the availability of foodstuffs for the domestic market and by helping to meet the growing demand from the international market.

Precompetitive research also contributes to strengthening of the sector linages. It must be managed with participation by the member of the sector. Comanagement of incentivational programs involving the scientific community, government and the productive sector favors appropriate decisions on dissemination of research findings, thereby preventing undue and often unnecessary appropriations.

The main objective of technology policy is to promote "new forms of competition", i.e., innovational enterprises, constructive relationships between suppliers and clients, and associations between firms and agencies outside them, which will facilitate continuous improvement of production. It is also characterized by a strategic sector orientation. For some sectors measures are adopted aimed at developing a group of enterprises capable of making themselves internationally competitive by being better organized.

The introduction of sectoral technology policy may result from the initiative of enterprises in a certain sector. They may, for instance, collaborate in labor training, export marketing, in the financing of research or development of capacity to adjust to new challenges and new opportunities. The maintaining of competitiveness, in any of the levels referred to, requires increased training in the technologies involved. This means training in learning to use the expertise available in

the decision process, in domestic production, in transfers, in dissemination or in any other mechanism that brings about higher productivity and enhancement of the quality of products and services.

5. Technology policy and management of innovation in enterprises

Regarding technology policy, the importance must be underscored of developing a culture of innovation in enterprises, which is where, in the last analysis, the majority of innovations will see the light of day. The promotion of innovation in these organizations must be envisioned in four distinct levels: within the enterprise, in its relations with the scientific and technical environment, in governmental initiatives and with respects to international cooperation.

In enterprises, it will be clear that innovation requires special climates and management styles. The study made by the CYTED Program on "100 Innovational Enterprises in Ibero-America" demonstrated that the basic ingredients for such enterprises to be successful are connected with: (a) a driving concern for quality improvement; (b) systematic and planned application of research and training; and (c) an internal climate based on motivation, team work and clear direction by those in charge. The vital relationships between technology and business strategy is noteworthy. The enterprises does not innovate for innovation's sake, but to achieve clearly defined market objectives and economic results.

The management of the technology and the process by which the interfaces forming the innovation are bought together involves the work team, those who implement the innovation, the financiers, the end users, the other institutions and the market. Studies show that the majority of failures in innovation processes are attributable to problems of this sort, rather than to intrinsic scientific and technical shortcomings.

As a result, an essential prerequisite for development of the region's creative potential is production of a considerable number of professionals who posses the knowledge, skills and experience to lead the innovation process. There is a gulf between the management of innovation and the administrative disciplines, the sciences and engineering. As a consequence, both the Schools of Science and Engineering and those of Administration tend, with rare exceptions, to fail to include education and research programs in this area.

José Israel Vargas, Brazil's Minister of Science and Technology, observes that

> […] today's competitiveness can be quickly lost if the country does not posses the scientific bases and technological infrastructure that will enable it to continue improving quality and productivity and also creating new products and services.

It should be borne in mind that the new technologies simultaneously render unskilled labor unneeded and are insatiable in their demands for trained human resources.

The new technologies in themselves must not be seen as a threat to full employment and, therefore, to social justice and the exercise of citizen' rights. Limited access to quality basic education, mainly, together with a situation in which higher and technical education is restricted to a social elite, is what can block any national project, either at the scientific and technological, economic, political or social level.

6. Basic education, citizenship and competitiveness

Research coordinated by Professor Affonso Fleury of the University of Sao Paulo among enterprises with quality and productivity programs led to certain findings that confirm the above arguments.

The most involved enterprises, and those which are posting the most success with quality and productivity programs, are the big export companies or their suppliers. It may be that the pressure of competition in the export market forces export concerns to act more vigorously and imaginatively. These then in turn transmit the pressure to their suppliers, who in order to keep hold of such major clients are then themselves obliged to hustle.

When they seek to implement quality and productivity programs, the enterprises inevitably run up against the barriers caused by the low level of education of their workers. Only then do they discover the tremendous disadvantages of a work force without special skills.

Successful introduction of quality programs produces positive effects in a variety of areas. One of them, already noted above, is to make management aware of the vital importance of education and of continuing training for the enterprise's performance. Another is the realization of the advantages of employment stability. While no enterprise offers guaranteed stability in a particular position, a considerable number recognize the need to avoid moving workers around too much, a policy which increases as their confidence and reduces training cost.

The enterprises which are most successful in implementing quality programs are those which invest the most in training programs.

The fact is that the acceleration of automation and the widespread use of information and communication tools affect both the production process and the forms of organization associated with it. This encompasses the concept of goods and services, relationships and forms of labor management. These underscore the replacement of the "Taylorist" division of tasks by integrated activities, performed by teams or by individuals. These tasks require an understanding of the whole, independence, initiative, problem-solving capability and flexibility. They also increase the need for basic training, so that permanent updating of skills and expertise becomes an increasing necessity.

These abilities, to be acquired by means of basic education, are critical in working life. In this way, the new demands of the production process place responsibility on the schools for ensuring that students gain a solid mastery of the codes, language skills and mathematics, as well as a thorough grounding in the sciences and development of cognitive skills. In addition, development of qualities –such as leadership, initiative, decision-making capability, the ability to work independently and communication skills– is a further challenge in the education sphere.

It is basic education, rather than vocational training, which enables people to benefit best from specific training courses. It also helps them to understand the importance of their citizenship in society and as personnel members of an enterprise, equipping them better for the performance of their duties and for personal and professional growth. These forms of exercise of the rights and duties of citizenship depend, for their effectiveness, on understanding of the nature of the concrete problems that motivate people, on access to and selectivity in the use of information, and on information, and on familiarity with the legal and institutional mechanisms for channeling their requests and demands.

Various countries, in accordance with their historical characteristics, are moving ahead with reforms of their education systems in order to make them more efficient and equitable. They also trust they are developing a new breed of citizen who will be capable of coping with the revolution taking place in the production process and its political, social and ethical repercussions. However, the majority of Latin American countries have to deal with difficulties deriving from their past, which can be summarized as follows:

• short-term economic adjustment policies which make it difficult to reach consensus on long-terms objectives, such as those of education;

• instability and fragility of governmental institutions, which hamper establishment of linkages between political institutions and the social partners;

• major inequalities in income distribution and in the supply of education services of quality.

In these countries, the strategies for becoming competitive players in the world markets must necessarily be linked with those aimed at promoting equity. In such cases education, possibly on a priority basis for these countries, is also called upon to express a new relationship between development and democracy, and to serve as one of the factors that can help to link economic growth with improvement of the quality of life and consolidations of democratic values.

In point of fact, the realization that economic growth does not automatically result in elimination of social inequalities has spurred a rethinking of the role of education as an element that can dynamize other social processes to bring about greater equity. This discussion also forms part of the consideration of values and attitudes that formal education ought to be instilling, as well as those that should be promoted through the family, the media and other informal instruments of education.

Democratization of basic education is moreover fundamental, since exposure to and experience with new information and communication technologies are today routine in all levels of society. Just as the economic model based on abundance of raw material and of largely unskilled labor has been superseded, the old education pattern with a well-informed and highly educated elite combined with a barely literate underclass to take care of the elementary tasks of industrialization and urbanization has become a thing of the past.

Nowadays few indeed can escape the impacts of technological progress. Society as a whole must be equipped to make proper use of the instruments provided by present-day technology. This means learning to apply them to improve the quality of life, expand the consumer market base and raise the requirements as regards quality.

It is therefore necessary to prepare people to live with and utilize the advances brought by technology, to integrate society and lessen the exclusion of broad segments of the labor and consumer market. This means that attention should be focused on basic education, with special emphasis on ensuring that the education provided is consistent with these strategic objectives and able to reserve the present situation and equip the nation to move ahead in accordance with the new development dynamic.

Democratization and construction of a basic education system of quality are therefore urgent necessities for the countries of the hemisphere. In this connection, cooperation between those nations with similar problems is one of the mechanisms that can help remove these constraints.

7. Transnational corporations, trade and technological innovation

The new technologies, especially those concerning information and communication, have been used effectively by transnational corporations, which are tending to concentrate increasingly on production capacity and provision of services. Manufacture of medical equipment, turbines, locomotives, and automobiles, and financial, telephone, retail, prospecting or energy distribution services, among other, are concentrated in a few global enterprises.

Gilberto Dupas, of IEA/USP, has observed that the twelve largest global corporations (GM, Ford, EXXON, Wal-Mart, AT&T, Mitsubishi, Mitsui, Itochu, Sumitomo, Marubeni, Nissan and Shell), billed US$ 1,408 billion in 1994. This figure is equivalent to the combined GDP of Argentina, Brazil, Chile, Colombia, Mexico, Peru, Uruguay and Venezuela. They are truly transnational corporations because 48% of their assets are abroad, 61% of their sales are made on the international market and they have 57% of their employees outside of their headquarters country.

As to the 100 largest world corporations, they concentrate 33 % of the global stock of direct investment and are responsible for 80 % of the flow of international payments of royalties and technology transfer fees. Not only do these corporations concentrate a representative segment of world trade, i.e. they account for one third of international trade flows, but they are also responsible, directly or through strategic alliances, for 80 % of all technology flows. The importance of these corporations is such that governments are obliged to maintain constant contact with them concerning the flow of investments, and employment and technology.

The bureaucratization of the big R&D laboratories (e.g. IBM's) led transnational corporations to trim the size of their innovation centers, transferring small groups to locations nearer their production units and their markets. The establishment of a new Fujitsu laboratory in London, England, or a Volkswagen laboratory in São Carlos, Brazil, are examples of this process which opens a window of opportunity for the developing countries. Present-day electronic communications systems make it possible to carry on activities in different parts of the world without losing touch.

To cope with instability, uncertainty and complexity, transnational corporations have assured their competitive advantage by means of technological training. The establishment of "profit centers" in the corporations themselves (e.g. Nestlé, Xerox) introduces the principle of competition into the heart of those global enterprises. Recent trends also show the emergence of real world networks in global corporations

that favor independence for and specialization of research centers. What is happening is that the "profit centers" located in different countries are competing among themselves in a spirit of healthy rivalry. In doing so they are demonstrating their competitiveness, wich also derives from the sector and the country in which they are operating.

How can the "profit centers" of global corporations be linked with technology modernization initiatives, preservation of the environment and human resource training? How can investments that include R&D projects be attracted into the region and to the countries of the hemisphere? How can conditions favorable for attracting new R&D centers be created? These are questions that must be asked and to which answers must be found in formulating a new technology policy.

8. Government policies, technological innovation and international competitiveness in latin america. resuls, constraints and prospects

Government policy is a decisive element for the competitiveness of a region. International experience has shown that the countries which have been most successful in terms of economic growth, improvement of material well-being and competitiveness were those that were able to maintain economic policies compatible with rapid productivity growth by means of the creation and/or dissemination of technology.

On the one hand, the importance of a country's macroeconomic policies in obtaining these results must be stressed: macroeconomic stability, understood as a single-digit annual inflation rate, is one of the prerequisites for an environment favorable to technological innovation, since it minimizes the macroeconomic and institutional risks that are the greatest inhibitors of investment. On the other hand, in a globalized economy, one of the main constraints on competitiveness is what is today termed the "country cost", i.e. a set of distortions that inhibit and may even cancel out the competitive advantage of national production. Particular instances are archaic tax systems, deficient transport infrastructure and high domestic interest rates, which can all severely impact the region's international competitiveness.

Education policy has also been decisive for international competitiveness: availability of a relatively well-qualified work force coupled with wage costs lower than in the developed countries, has been a major factor behind the increased in investment-both domestic and foreign-in the recently industrialized countries, in technology upgrading and in improvement of employment opportunities and in income distri-

bution. Special emphasis will accordingly have to be placed on human training, with improvement in the quality and performance of basic and university education to equip individuals for working in research and development. Management of technological innovation plays an important role in this dimension.

It should also be noted that the liberalization of trade regimes currently taking place in the region makes it distinctly attractive for domestic and international investment. The reduction of tariff and nontariff barriers against imports, when properly negotiated, enables production rationalization on a global scale and heightens the region's attractiveness for new investments by global enterprises. It is desirable that such investments be accomplished by R&D initiatives.

The existence of an industry and technology policy consistent with competitiveness is vital for improvement of Latin America's position in the world scene. The virtual absence of a science and technology strategy in the region has hampered development of new "knowledge-intensive" sectors and therefore that of technological innovation. Promotion and financing of activities aimed at technological innovation are essential for the competition strategies of enterprises and for healthy economic performance over the long term. Special support will be needed for government policies designed to provide incentives and financing for technological innovation by small and medium enterprises, because they are the source a significant proportion of the employment generated in any society. ❑

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Annexes

Note I

Nafta and the EEC and their impacts on trade relations with Latin America

As regards the liberalization of trade between the United States and Canada, the bulk of the bilateral trade was already free of tariff before NAFTA went into effect; 65% of U.S. exports to Canada and 80% of Canadian exports to the USA were exempt from import duties. The agreement is unexpected to bring about major economic reallocation effects, chiefly in Canada, owing to the size difference between the two economies (in 1991, the U.S. GDP was US$ 6.5 trillion whereas Canada's was US$ 510 billion).

Canada will have to increase its exports of light, labor-intensive manufactures, such as footwear and clothing, and of products based on standardized technology, such as steel and automobiles –in addition to those that are natural resource-intensive, such as sugar, copper and petrochemicals. The USA's comparative advantages are in high-technology products, services and agricultural products.

Both countries resorted extensively to nontariff restrictions for controlling imports in the 1980s. The creation of a free-trade zone will accordingly necessitate harmonization of these measures in order to prevent third countries from taking advantage of differences in national treatments to increase their exports to the free-trade zone.

This will necessarily involve a diversion of trade, by discriminating against exports from the rest of the world. The Latin American countries, in particular, will have greater difficulty in exporting iron, steel, chemical products, footwear, and chemical wood pulp, etc., to the USA, all of which are articles in which the region competes directly with Canada to supply the U.S. market. Mexico also has a high degree of trade integration with the USA. Of its total exports amounting to US$ 28 billion in 1992, 84% were for the U.S. market, while 75% of the country's US$ 48 billion in imports were from the USA. It is therefore evident that the effects on the Mexican economy of the creation of a free-trade zone will depend basically on the bilateral relationship between these two countries. Is should be noted that U.S. multinational

corporations account for a significant proportion of the Mexico/USA trade, through international intra-firm trade in the form of transactions via "maquiladoras" (in-bond assembly companies). Forty-seven percent of Mexican exports to the USA are transport equipment, while 32% are made up of commodities and mineral resources. Because of Mexico's membership in NAFTA, the Latin American countries will encounter greater difficulty in exporting natural resource-rich products such as coffee, orange juice and sugar, and also more sophisticated metallurgical products, machinery and transport equipment.

The creation of a unified domestic market in Europe as of 1993 will also have a major reorienting impact on the region's economic activity and on international trade. The establishment of this unified market is a reaction on the part the EEC to the lower growth rates prevailing since the 1970s and an attempt to provide European companies with a better base for competing with the Americans and Japanese.

The present degree of integration of the European economies is already appreciable, but the measures that will be implemented in this new phase are nevertheless expected to have a considerable impact: growth is likely to move up from the 1.8% observed in the 1980s to the 3.5-4% range by the end of the 1990s.

Available estimates place increases in real income in the EEC in the period 1993-97 at around US$ 250 billion, with creation of 2 million new jobs. Regional trade is expected to expand significantly with the elimination of all border controls on movements of goods and services, adoption of uniform industrial standards, harmonization of value-added tax rates, liberalization of capital movements and financial services and the opening of public contracts to EEC bidders on a footing of equality.

All these measures will bring about diversion of trade, because they discriminate against nonmember countries. In addition, there are at present approximately 1,000 national quantitative restrictions and a complex system for defining national-content indexes for intra-regional trade which will have to be harmonized with the establishment of a single market. The single-market project is therefore expected to result in an increase in protection in Europe. It has not been by chance that investments in Europe by American, Japanese, Korean, Canadian, etc., firms have increased considerably over the past five years. The EEC's agreements with African and Pacific and Caribbean countries make it hard for Latin American products to penetrate the European market, since imports from those countries benefit from preferential treatment that puts the Latin American countries at a competitive disadvantage.

To sum up, it can be stated that the present stage of the European integration process includes features that are unfavorable for increased trade with Latin American, but the effect of these unfavorable features might be mitigated by higher growth of European incomes which could generate a rise in imports.

Note II

Latin american's international competitiveness and its capacity for technological innovation

The relative position of a country or region in the international market is being increasingly determined by the rate of creation and dissemination of technology, which provides the basis for the heightened competitiveness necessary for increased competitive power in the world market. Latin America has been using industrial and trade policies to change the profile of its production structure and to create comparative advantages in new sectors. The shifts in industrial structure toward technologically more sophisticated sectors in certain countries have quickly been reflected in a concomitant change in the structure of their exports. Brazil, Mexico and Argentina stand out in this connection as countries whose exports include a growing proportion of high-technology products. Table 7 indicates the weight of these products in Latin America's exports,[1] showing that they account for 54% of Brazilian exports of manufactures, 60% of Mexico's and 28% of Argentina's. The growth rate of these exports over the past 20 years has been close to 20% p.a. representing US$ 17.5 billion in 1989, or approximately 50% of the region's total exports.

The achievement of this result is associated with the development of the region's technology capacity and technology transfers from more developed countries. The available data indicate that Latin America has technology training indicators (relative number of scientists and engineers in R&D activities and proportion of R&D expenditures in GDP) that are significantly lower than those of the more developed Asian NICs and the developed countries. For example, the number of scientists and engineers per 10,000 inhabitants is 33 in the USA, 50 in Ja-

[1] Includes the following products: chemical, medicines and pharmaceuticals, plastics, electrical and nonelectrical machinery, transport equipment and professional, scientific and control instruments.

Table 7. Latin American Exports of High-Technology (H-T) Products (U$S millions)

	H.T. Exports		Proportion of HAD exports in exports of manufactures			Growth rate of H-T exports
	Value 1989	Regional	1970	1980	1989	1970-1989
Brazil	8.700	49,4	33	53	54	23,7
Mexico	7.090	40,2	51	60	60	20,3
Argentina	1.212	6,8	41	43	28	10,4
Otros	503	3,6	22	18	14	9,6
Total	17.505	100,0	39	49	50	19,8

Source: BID/COMTRADE/ONU.

pan, 13 in South Korea and Singapore, 3.5 in Argentina, 3.9 in Brazil and 3.6 in Chile. In the same way, R&D spending is 2.6% of GDP in the USA, 1.9% in South Korea, 3% in Switzerland, 0.4% in Argentina and 0.7% in Brazil.

Technology transfer plays an important role in Latin America competitiveness. Two channels for this transfer are foreign direct investment and imports of high-technology products. Regarding the former, no detailed data are available on total foreign capital investment in the region's industry, but data on U.S. and Japanese investment point to a figure of the order of US$ 25 billion, the bulk of it in the chemical, machinery and transport equipment sectors, which are important for exports of sophisticated high-technology products.

Importation of high-technology products is also a way to learn about production and process technologies. The data in Table 8 show such imports are running at US$ 30 billion and have grown at a rate of 8.4% p.a. in recent decades.

A better competitive performance by Latin America in technologically advanced segments will require that the region both accelerate its own technology development efforts and intensify technology transfers. For the latter, joint ventures have proven to be extremely effecti-

ve vehicles. In addition, the liberalization of the region's trade regimes will also make it more attractive for international investments, to the extent that tariff and nontariff restrictions on imports are removed. This will enable a rationalization of production on a global scale and increase the region's attractiveness for foreign capital. As regards domestic technology development efforts, more resources will need to be devoted to R&D and the supply of researchers will have to be increased, since the Latin American indexes are only one tenth of those observed in the developed countries and one fourth of those in the Asian NICs. Deployment of all of these factors is essential for positive changes in Latin America's dynamic comparative advantage.

Table 8. Latin American High-Technology Imports as Indicators of Technology Transfer (U$S millions)

	Imports of H-T products*	Exports/Imports of H-T products		Growth rate of H-T imports
	1989	1970	1989	1970-1989
Mexico	10.567	0,13	0,67	1.020
Brazil	8.038	0,09	1,08	560
Chile	3.505	0,05	n. d.	1.000
Colombia	2.720	0,03	0,08	1.050
Argentina	2.326	0,14	0,52	740
Ecuador	961	0,01	0,01	1.080
Uruguay	581	0,03	0,14	1.050
Trinidad &Tobago	448	0,26	0,53	970
Honduras	364	0,01	0,01	850
Panama	284	0,02	0,03	660
Bolivia	215	0,09	0,18	690
Latin America	30.017	0,08	0,59	840

* Chemicals, medicines and pharmaceuticals, plastics, electrical and nonelectrical machinery, transport equipment no professional, scientific and control instruments.
Source: BID/COMTRADE/ONU.

Note III

Public policies for education

In response to the University of São Paulo's call for collaboration in the wider Education for Responsible Citizenship Program, coordinated by Professor Alfredo Bosi, a group was formed to consider certain key topics. According to this group's findings, reversal of the present deterioration of basic education will necessarily require:

• Qualification of school administrators - making training available to the schools for preparation of a pedagogic proposal, for management of human and financial resources and to equip administration staff to perform planning, organizational, execution and evaluation work.

• Teacher training - in contents and methodologies required for effective participation in the formulation and execution of pedagogic projects, while remaining within their particular area or discipline.

• Seeking alternative for teacher training - by establishing basic levels of competency in contents and methodologies for basic education; running courses for complementing and/or correcting the training of future teachers; providing technical support for training experiments that adopt innovative strategies; and institutional organization of models of centers specifically devoted to training of both secondary and higher-level teachers.

• Formulation of a policy on textbooks and learning resources - by separating it from the other assistance provided by the government and applying special care in the preparation, creation, publishing, and production of textbooks and learning resource materials.

• Revision of the planning for expansion and occupancy of physical facilities - by considering, mainly, elimination of the intermediate shift (third day shift); lengthening of the school day for all students in the public school system; rationalization of space occupancy by integrating the state and municipal systems and/or the schools of a particular microregion.

• Establishment of guidelines for tying schools in with the health, leisure and culture infrastructure - by providing financial incentives for innovational experiments that offer alternatives for the time when children are not in school, by means of child-care facilities or activities of various kinds.

• Revision of the financing and resource-allocation arrangements - by establishing long-term strategies in which changes in the mecha-

nism for obtaining and allocating resources promote gradual adjustments with a view to fairer distribution of same.

• Removal of the difficulties and promotion of alternatives concerning the salary question - by adopting a responsible and realistic position regarding the problem of low teacher salaries, including allocation of more funds and rationalization of the use of those already available.

• Upgrading of demand - by prompting society to demand quality education, by arousing concern about education in local communities, families and the media.

Implementation of these basic requirements can prevent many countries being left on the sidelines of world history, which would only perpetuate the inequalities and social injustices that are still to this day major factors in the relations among nations. However, while investments in quality basic education are of vital importance, other areas of training also require attention at the same time. ❑