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Science and Technology in Latin America

by

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The advancement of science and technology in Latin America — whose population is approximately 500 million inhabitants nowadays (fig. 1) — and despite significant efforts made, has not been able to avoid the immense gap brought about by highly developed countries vis-à-vis less developed nations, within fields of human development and progress.

This technological gap, derived — in part at least — from a lack of interest on the side of political rulers, added to significant economic crisis, has increased dependence horizons that Latin American nations have to face before challenges coming from the so-called first world.

Latin America, with a gross internal product of approximately 1,950 thousand million American dollars (fig. 2), far from having chosen a fate apart from that corresponding to the "chosen" group of nations, does remain within an ocean of particularities which, in turn, generates two main currents: first, societies that retain conservative values, tradition and the attitudes characteristic of their genuine and active self and, secondly, those that perceive the need to begin a transition toward modernity. These last ones have decided to design strategies required to confront this hard challenge.

Research that has been all universities' symbolic code at all times, and mainly throughout the eighties, in order to respond to the above-mentioned crisis, has suffered from nothing but contempt from the ruling echelons and politicians at decision-making levels. Thus scientific research — highly approved in previous times — has been voided or

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PAIS	1998	1999	2000	2001
ARGENTINA	35.10	35.47	35.85	36.22
BARBADOS	0.27	0.27	0.27	0.27
BOLIVIA	8.00	8.16	8.20	8.28
BRASIL	161.79	163.95	166.11	166.11
COLUMBIA	40.83	41.59	42.32	43.07
COSTA RICA	3.34	3.93	3.81	3.91
CUBA	11.14	11.18	11.22	11.24
CHILE	14.35	14.52	14.69	14.87
ECUADOR	12.17	12.41	12.64	12.09
EL SALVADOR	6.03	6.16	6.26	6.42
GUATEMALA	10.80	11.09	11.39	11.68
HONDURAS	6.18	6.38	6.60	6.60
JAMAICA	2.57	2.56	2.56	2.56
MÉXICO	95.30	96.91	97.36	98.75
NICARAGUA	4.80	4.94	5.07	5.21
PANAMÁ	2.76	2.81	3.00	3.06
PARAGUAY	5.22	5.36	5.78	5.83
PERÚ	25.10	25.52	25.94	26.35
RE. DOMINICANA	8.20	8.36	8.55	8.55
TRINIDAD Y TOBAGO	1.28	1.28	1.29	1.30
URUGUAY	3.03	3.33	3.32	3.32
VENEZUELA	23.24	23.24	24.17	24.76
	481.50	489.42	496.40	500.45

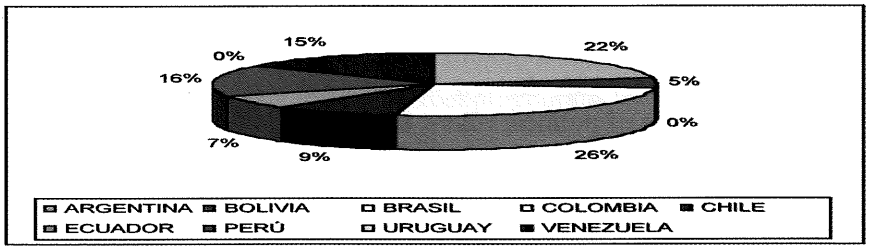


Fig. 1. — Population (in million).

highly deteriorated as a consequence of lower funding in science and technology (fig. 3) in proportion to investment levels within Latin America.

It is in view of this situation, and as a result of personal convictions, that critical observations on this issue have taken place in all scientific meetings, and a common objective has evolved in all scientific meetings, *i.e.* to organize — at the time of this critical situation — a strategy to create instruments capable of incorporating science and the technology research functions on a rational level within national development plans.

As sub-products of this self-determination, it is expected that improvements will be attained in an effort to decrease the ever-growing gap that separates us from the countries of the North. This effort requires modernizing our hemisphere's political structures and creating a new culture and an innovation plan for our political leaders' conscience and psychological make-up.

PAIS	1998	1999	2000	2001
ARGENTINA	298.948	283.523	284.204	268.697
BARBADOS	2.389	2.072	2.155	2.155
BOLIVIA	8.571	8.527	8.729	9.000
BRASIL	787.889	531.057	594.247	503.857
COLOMBIA	100.539	79.62	85.243	84.781
COSTA RICA	10.443	11.301		
CUBA	23.901	25.504	27.635	28.878
CHILE	73.063	67.658	70.019	63.768
ECUADOR	19.711	12.645	13.649	17.982
EL SALVADOR	11.864	12.436	13.217	13.739
GUATEMALA	18.942	18.108	19.332	19.332
HONDURAS	5.247	5.387	5.831	5.831
JAMAICA	7.042	7.083		7.083
MEXICO	421.024	479.448	574.512	629.787
NICARAGUA	2.126	2.213	2.423	2.529
PANAMA	9.144	9.557	11.196	11.235
PARAGUAY	8.594	7.741	7.727	7.208
PERU	56.831	51.692	53.512	53.998
R. DOMINICANA	15.846	17.398	19.723	19.723
TRINIDAD Y TOBAGO	6.083	6.543	8.107	9.003
UNUGUAY	20.831	21.59	20.053	
VENEZUELA	95.023	103.314	121.263	126.197
	2004.051	1764.417	1942.777	1884.783

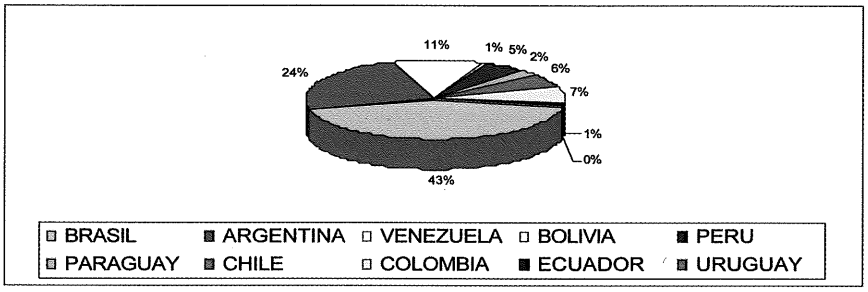


Fig. 2. — Gross Development Product (GDP) (millions of $US).

To understand this truism, based on a well-understood reality, research was conducted in some Latin American nations, which, in the early nineties, went about acquiring capacity in these areas of science and technology. These innovative research tasks shaped up a generation of policies that, once implemented, served as platforms for the design of various development plans which are based on the concept that public policy must support development.

However, it is within this scene that most countries of the region have not been able to find ways to place themselves on the level with highly developed nations, and where only a few have attained significant levels of accomplishment and progress. This level of effort and accomplishment is, of course, what marks the difference among nations of the region. This reality is clearly expressed in the annual budget for science and technology as a percentage of the GDP in Latin America (fig. 3); equally sig-

PAIS	ACT/I+D	1998	1999	2000	2001
ARGENTINA	ACT	0,50%	0,52%	0,50%	0,48%
	I+D	0,41%	0,45%	0,44%	0,42%
BOLIVIA	ACT	0,54%	0,55%	0,54%	0,54%
	I+D	0,29%	0,29%	0,28%	0,28%
BRASIL	ACT		1,35%		
	I+D		0,87%	1,05%	
COLOMBIA	ACT	0,37%	0,43%	0,36%	0,29%
	I+D	0,21%	0,22%	0,18%	0,16%
COSTA RICA	ACT	1,58%			
	I+D	0,35%			
CUBA	ACT	0,92%	1,04%	1,05%	1,17%
	I+D	0,54%	0,51%	0,53%	0,62%
CHILE	ACT				
	I+D	0,54%	0,55%	0,56%	0,57%
ECUADOR	ACT	0,22%	0,19%	0,19%	
	I+D	0,08%			
EL SALVADOR	ACT	0,84%			
	I+D	0,08%			
MÉXICO	ACT				
	I+D	0,47%	0,43%	0,40%	
NICARAGUA	ACT				
	I+D				
PANAMÁ	ACT	0,89%	0,94%	0,91%	1,03%
	I+D	0,34%	0,35%	0,40%	0,40%
PARAGUAY	ACT				1,00%
	I+D				0,08%
PERU	ACT	1,11%	1,25%	1,29%	1,44%
	I+D	0,10%	0,10%	0,11%	0,11%
URUGUAY	ACT				
	I+D	0,23%	0,26%	0,24%	
VENEZUELA	ACT	0,36%	0,33%	0,33%	0,44%
	I+D				

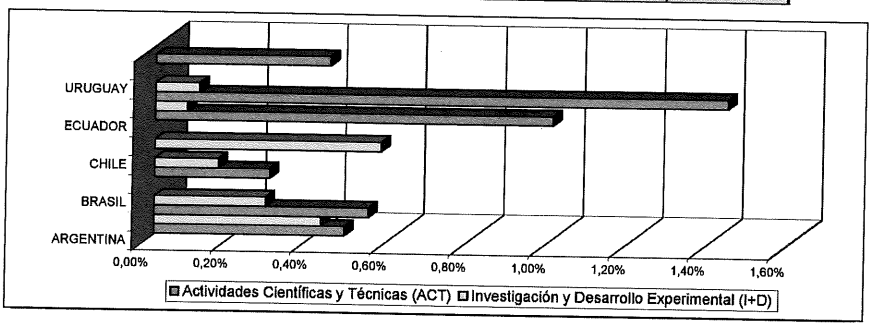


Fig. 3. — Investment science and technology (% GDP).

nificant is the number of research fellows (fig. 4) and the number of patents' registration and uses (fig. 5).

Before the undeniable presence of this new paradigm in this era of knowledge, the deep transformations that take place in our world, in their economic, political and social aspects, do not reveal anything but the necessity to look for solutions that march to the rhythm of the cultural dynamics of our time.

These solutions may be linked to injections of external capital investment, to initiatives on the part of public and private enterprises, to systematic activation of productive processes, to technological innovation of companies to deal with traditional products, to incentive to export, and to the establishment of new management and administration systems. They all must be studied.

PAIS	1994	1995	1996	1997	2001
ARGENTINA	34.459	36.915	38.254		39.250
BOLIVIA	1.180	1.200	1.300		1.350
COLOMBIA			7.700	8.000	8.500
COSTA RICA	1.453		1.867	1.950	
CUBA	5.893	6.086	6.734	7.512	7.850
CHILE	6.746	6.996	7.302	7.550	
ECUADOR		474		750	
EL SALVADOR	180	200	218	231	320
MEXICO	23.133	26.479		46.800	48.900
NICARAGUA				900	950
PANAMA	626	676	850	821	1.500
URUGUAY		883			

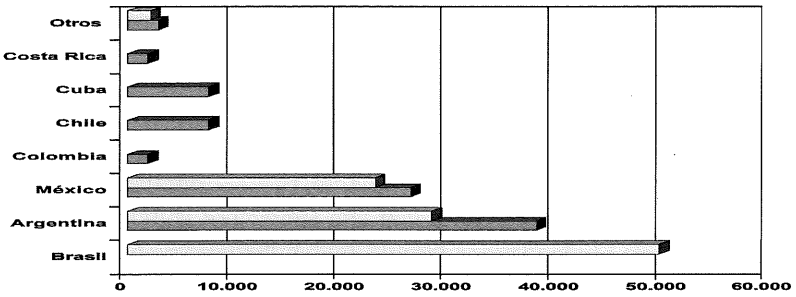


Fig. 4. — Researchers.

It was at several meetings attended by responsible representatives of science and technology from Latin America and the Caribbean nations, that possible action items were recognized as fit for implementation for the development of "Common Markets of Knowledge". Among them there is the necessity to add capacities and efforts on the part of each nation to support research and innovation plans, as indispensable factors required in order to attain integrated and sustainable development, in a form of reciprocal cooperation. This has become a clear and distinct goal.

It is with that objective in mind that it is deemed necessary for each government to dedicate a specific percentage of the national budget to scientific research, thus avoiding to leave this kind of actions to private initiative alone or to abandon resources that can be captured through the exclusive participation of international organisms.

In the Summit of the Americas, carried out in the city of Miami, in December of 1994 under the initiative of the MERCOCYT, the economic future of America was analysed and a strategic role was foreseen and developed in order to deploy science and technology in the economic development strategy along with an environmental protection plan. It was

PAIS		1994	1995	1996	1997
ARGENTINA	residentes	694	676	1.097	
	no-residentes	2.820	3.588	4.012	
	TOTAL	3.514	4.264	5.109	0
BOLIVIA	residentes	27		98	
	no-residentes	90		52	
	TOTAL	117	0	150	0
BRASIL	residentes	5.719	7.010	7.021	
	no-residentes	3.429	3.895	4.628	
	TOTAL	9.148	10.905	11.649	0
COLOMBIA	residentes	124	141	87	166
	no-residentes	867	1.093	1.172	1.575
	TOTAL	991	1.234	1.259	1.741
COSTA RICA*	residentes	1	3	3	
	no-residentes	10	20	4	
	TOTAL	11	23	7	0
CUBA	residentes	121	104	84	110
	no-residentes	31	33	39	30
	TOTAL	152	137	123	140
CHILE	residentes	415	324	359	432
	no-residentes	1.591	1.757	2.024	2.250
	TOTAL	2.006	2.081	2.383	2.682
ECUADOR*	residentes		5		5
	no-residentes		82		207
	TOTAL	0	87	0	212
EL SALVADOR*	residentes	6	8	6	7
	no-residentes	80	82	97	102
	TOTAL	86	90	103	109
GUATEMALA	residentes	5	5		
	no-residentes	50	20		
	TOTAL	55	25	0	0
JAMAICA	residentes	6	7	2	9
	no-residentes	60	54	77	61
	TOTAL	66	61	79	70
MÉXICO	residentes	498	432	386	420
	no-residentes	9.446	4.961	6.365	10.111
	TOTAL	9.944	5.393	6.751	10.531
NICARAGUA*	residentes	53	30	39	33
	no-residentes	2	2	0	5
	TOTAL	55	32	39	38
PANAMÁ	residentes	10	16	31	21
	no-residentes	86	62	142	191
	TOTAL	96	78	173	212
PARAGUAY	residentes	15	12		21
	no-residentes	60	88		191
	TOTAL	75	100	0	212
URUGUAY	residentes	108	122	115	
	no-residentes	201	281	344	
	TOTAL	309	403	459	0
VENEZUELA	residentes	2.125	2.301	2.309	2.713
	no-residentes				
	TOTAL	2.125	2.301	2.309	2.713

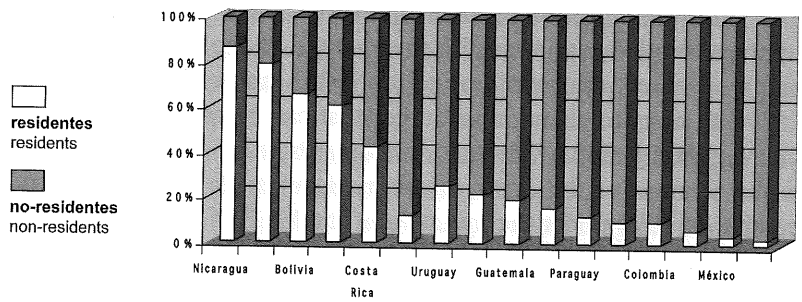


Fig. 5. — Patents request (residents / non-residents).
* N.B. : Costa Rica, Ecuador, El Salvador and Nicaragua : licence patents.

in this scenario that was also confirmed the urgency to create cooperation bonds among all countries of the hemisphere.

In order to activate this cooperation strategy, a working task group was constituted, under the supervision of the OAS, with the mandate to look for the best possible cooperation mechanisms among countries of our hemisphere and to exchange experience obtained mainly in the different fields of scientific research : those referred to the development and application of information, innovation and sustainable development technologies. One of the virtues of this declaration is that its purpose does not exclude technological development projects for smaller nations.

These initiatives, approved in a meeting of Ministers of the science and technology field, gave place to the constitution of an executive committee that had the mission of supporting pertinent organisms of the region and creating commissions and work groups to pursue and carry out concrete tasks.

With these antecedents in the background, an action plan — privileged by common decision — was elaborated in order to render the highest levels of importance to science and technology research for purposes of socioeconomic development, which simultaneously could strengthen tasks to protect the environment in the countries of our hemisphere.

It was also within the scope of the Hemispheric Summit that some recommendations were formulated to complement the above-mentioned action plan. They constitute references as to ethical considerations that safeguard human dignity, social well-being, and peace among nations.

It has also clearly recognized that the hierarchy level and importance of the role carried out by cultural diversity and the identification of native populations living in the region is a priority among issues dealt with.

As part of the same agenda, it was recommended that all necessary adjustments be made to advance the development of innovation systems, framed in the new economy of open markets, and within all programmes for human resources development.

It was as an answer to demands formulated by Heads of State and Ministers working in the field of this 1994 Summit of the Americas, that four big action areas were defined and they are as follows :

— Science and Technology and Social Development ;
— Science, Technology, Innovation and Managerial Sector ;
— Science and Technology for Sustainable Development ;
— Development and Application of Information Technologies.

All these items were sanctioned and approved by all Heads of State in the "Summit for Sustainable Development" which took place in November, 1998, in the City of Santa Cruz de la Sierra, Bolivia.

In this section, to conclude my synthesis, I would like to make it known that the Academies of Science of Latin America and the Caribbean, gathered in the city of Mexico in the month of August of this year, have expressed their will to work in a combined way in order to find solutions for regional problems; however, this wish could only have success if European Academies of Science found ways to participate in this process. Thus, I invoke you all to integrate this effort on behalf of "knowledge" for the world.

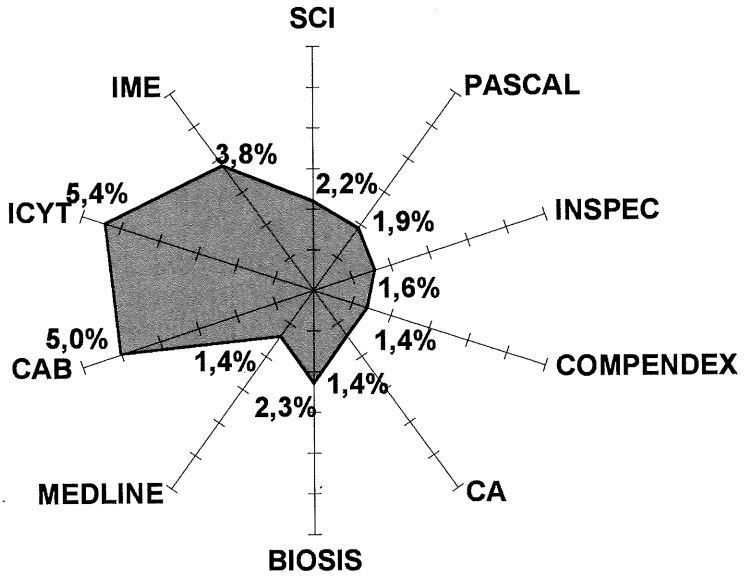
ANNEX 1

PUBLICATIONS

1996

PAIS	SCI SEARCH	PASCAL	ICYT
ARGENTINA	3.820	1.677	95
BARBADOS	35	15	0
BOLIVIA	60	32	2
BRASIL	7.401	3.267	32
CHILE	1.739	583	41
COLOMBIA	459	228	14
COSTA RICA	249	70	3
CUBA	421	223	113
ECUADOR	82	35	4
EL SALVADOR	14	7	4
GUATEMALA	62	26	0
HONDURAS	20	4	1
JAMAICA	312	87	0
MÉXICO	3.693	1.808	37
NICARAGUA	21	14	1
PANAMÁ	144	48	1
PARAGUAY	28	24	0
PERÚ	180	111	6
REP. DOMINICANA	34	14	2
TRINIDAD Y TOBAGO	84	46	0
URUGUAY	245	92	13
VENEZUELA	886	383	16
TOTAL	40.549	8.794	5.479
TOTAL MUNDIAL	900.303	476.759	7.194

PARTICIPACION DE LAS PUBLICACIONES DE AMERICA LATINA, SEGUN BASE DE DATOS, 1996



ANNEX 2

PUBLICATIONS

1996

BIOSIS: Biological Abstracts.

CAB: Commonwealth Agricultural Bureau.

MEDLINE: Index Medicus.

IME: Indice Español de Medicina.

PAIS	BIOSIS	CAB	MEDLINE	IME
ARGENTINA	2.624	1.040	1.008	59
BARBADOS	15	22	9	0
BOLIVIA	16	30	10	0
BRASIL	5.197	3.408	2.151	19
CHILE	655	396	506	27
COLOMBIA	259	271	88	9
COSTA RICA	160	203	57	2
CUBA	386	496	132	60
ECUADOR	37	19	24	15
EL SALVADOR	5	17	1	11
GUATEMALA	40	32	18	11
HONDURAS	8	18	1	0
JAMAICA	87	43	63	0
MÉXICO	2.240	934	1.137	48
NICARAGUA	9	20	8	0
PANAMÁ	77	38	14	0
PARAGUAY	69	11	7	2
PERÚ	138	90	54	5
REP. DOMINICANA	15	10	7	4
TRINIDAD Y TOBAGO	41	51	22	1
URUGUAY	156	61	74	9
VENEZUELA	411	361	197	22
TOTAL	12.645	7.571	5.588	7.182
TOTAL MUNDIAL	552.227	151.680	401.722	7.900