NEW CHALLENGES FOR THE ACADEMIES IN A CHANGING WORLD

Extraordinary Academic Celebration
Brussels, 9 & 10 October, 2003

IJFENZEVENTIGSTE VERJAARDAG
AN DE ACADEMIE (1928-2003)

SEPTANTE-CINQUIEME ANNIVERSAIRE
DE L'ACADEMIE (1928-2003)

ONINKLIJKE ACADEMIE
OOR
VERZEESE WETENSCHAPPEN

KAOW·ARSOM

ACADEMIE ROYALE
DES
SCIENCES D'OUTRE-MER

2004

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KONINKLIJKE ACADEMIE
VOOR
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Defacqzstraat 1 bus 3
B-1000 Brussel (België)

Tel. 02.538.02.11
Fax 02.539.23.53
E-mail: kaowarsom@skynet.be
Web: http://www.kaowarsom.be

ACADEMIE ROYALE
DES
SCIENCES D'OUTRE-MER

rue Defacqz 1 boîte 3
B-1000 Bruxelles (Belgium)

Tél. 02.538.02.11
Fax 02.539.23.53
E-mail: kaowarsom@skynet.be
Web: http://www.kaowarsom.be

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New Challenges for the Academies in a Changing World

75th Anniversary
Royal Academy of Overseas Sciences
Brussels, 9 & 10 October, 2003
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Foreword

Het is een gewoonte bepaalde verjaardagen speciaal te herdenken. Zo werd het vijftigjarig bestaan van de Academie met luister gevierd in 1978. Dit jaar bestaat onze instelling 75 jaar. Zulke belangrijke data zijn tijdstippen van bezinning. Deze verjaardag biedt daartoe een uitstekende gelegenheid.

Aussi en 2003 la séance d'ouverture de l'année académique revêt-elle un caractère particulier. Au lieu de l'après-midi traditionnelle, une manifestation internationale étalée sur deux jours fut organisée. L'évènement eut lieu au Palais des Académies. La séance inaugurale fut honorée par la présence de son Altesse Royale la Princesse Astrid. Nous tenons à lui exprimer toute notre reconnaissance. Une musique interculturelle adaptée au thème fut très appréciée *.

This celebration gave us the opportunity to reflect upon the theme "New Challenges for the Academies in a Changing World".

The viewpoints from Latin America, Asia and Africa came to us through the voices of the Academies from Bolivia, India and Africa. The role of the Academies in science and technology for development was put forward by representatives of international institutions. During a round-table forum, members of the Academy gave their view on the topic, followed by a large discussion.

Besides being a centre of scientific thinking, a platform for objective discussion, a meeting-place for scientists from North and South, the Academy is characterized by its intellectual independence and neutrality. More specifically, our Academy of Overseas Sciences has the privilege of concentrating overseas expertise.

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* Intercultural music: Philippe Malfeyt, lute; Candido Capillo, arpa y flauta; Hua Xia, p'i-p'a & yueh-qin; Abid el Bahri, 'ūd.

Its specific role of transdisciplinary dialogue, of North-South intercommunication and scientific exchange has been emphasized during this symposium.

This anniversary was the occasion to consider, together with our partners from Overseas, the ways of strengthening the role of the Academy and meeting the challenges of the future.

Yola VERHASSELT
Permanent Secretary
Royal Academy of Overseas Sciences

75th Anniversary
Royal Academy of Overseas Sciences
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Openingsrede / Allocution d'ouverture

door / par

Fientje MOERMAN *

Mevrouw,
Mijnheer de Voorzitter,
Dames en Heren Academici,
Dames en Heren,

Het is mij een genoegen naar aanleiding van het 75-jarig bestaan van de Koninklijke Academie voor Overzeese Wetenschappen deze zitting te openen die Hare Koninklijke Hoogheid Prinses Astrid met haar aanwezigheid opluistert.

Je souhaite aujourd'hui vous faire part des perspectives du développement de la recherche scientifique fédérale, et ce, dans le cadre de nos relations avec les pays d'outre-mer.

Les problématiques scientifiques débordent largement de l'entité locale, qu'elle soit territoriale, culturelle ou politique. La climatologie, l'océanologie ou les sciences de l'environnement en offrent quelques exemples frappants. Plus frappante encore est l'universalité dans des domaines comme la physique, la cosmologie ou les mathématiques. Les technologies de la communication — déjà au stade actuel de leur capacité opérationnelle — ouvrent la perspective d'un aplanissement définitif et total de toute forme de frontière.

En termes de qualité de la vie — je me réfère à l'accès aux ressources alimentaires, à l'eau potable, à l'énergie et aux soins de santé, ainsi qu'à

---

* Minister van Economie, Energie, Buitenlandse Handel en Wetenschapsbeleid / Ministre de l'Economie, de l'Energie, du Commerce extérieur et de la Politique scientifique.

la salubrité environnementale —, des zones d'ombre s'étendent sur notre planète: je veux parler des régions dites «en développement».

Selon les normes définies par le Conseil Economique et Social des Nations Unies, quarante-neuf pays entrent dans la catégorie dite des «pays les moins développés».

Les critères pris en considération par les Nations Unies sont :

— La faiblesse des revenus;
— La faiblesse des ressources humaines;
— Le faible taux de diversification économique.

Niemand betwist nog dat de wetenschappelijke en technologische kennis en haar toepassingen bepalende factoren zijn van de levenskwaliteit. De aard van de criteria waarmee de mindere ontwikkelingsgraad wordt geïdentificeerd en die door de Verenigde Naties werden goedgekeurd, wijst er voldoende op dat het gebrek aan technowetenschappen de ontwikkeling fors afremt. Wellicht is het naïef te denken dat de technowetenschappen voor alles een oplossing bieden. Maar als ze geleidelijk worden ingevoerd en op de lokale behoeften, op de sociaal-culturele specifieke kenmerken inspelen, lijdt het geen twijfel dat ze een echte hefboom worden voor het optrekken van de levensstandaard en de levenskwaliteit.

Nieuwe voorschriften worden vastgelegd die de uitwisselingen beïnvloeden. Een nieuwe ethiek regelt voortaan de relaties tussen staten. De meest ontwikkelde landen zijn zich bewust van de interconnectie met de minst ontwikkelde landen. De kenniskloof wordt steeds groter en de natuurlijke rijkdommen zijn het voorwerp van grootschalige wrevelingen of zelfs open conflicten.

In wezen stemt de kaart van de landen met een „mindere ontwikkeling" vrijwel perfect overeen met de kaart van de landen met een wetenschappelijke achterstand.

De ce point de vue, les académies des sciences ont un rôle à jouer qui, pour être efficace, doit s'inscrire dans une perspective d'adaptation de leur vocation traditionnelle aux réalités modernes. Ce défi, la communauté des académies s'efforce de le relever depuis des années.

Consciente avant la lettre qu'en matière de sciences et de technologies *big might be beautiful too*, la communauté des académies s'est d'emblée structurée en réseaux — modalité d'action que la Commission européenne prône par ailleurs abondamment et qui est incontestablement un gage d'efficacité et d'efficience accrues. L'*International Council of Scientific Unions*, qui existe depuis 1931, en est la plus patente illustration. Mais cet organisme n'est pas le seul effort des académies nationales pour renforcer leur action par la mise en réseau. L'*InterAcademy Council*, l'*InterAcademy Medical Panel* et l'*InterAcademy Panel* — qui tous travaillent en concertation, entre eux, et avec des organisations internationales comme l'Unesco — en sont autant d'illustrations. La diffusion des connaissances est par ailleurs une réalité ancrée depuis toujours dans la tradition des académies.

Tal van academies hebben commissies of secties in het leven geroepen die zich bezighouden met problematieken waarvan het belang voor de sociaal-economische toekomst van onze planeet duidelijk is, zoals duurzame ontwikkeling, ontwikkelingsstrategieën, biodiversiteit of bestrijding van natuurrampen. De internationale verenigingen van academies blijven niet achter. De *International Council of Scientific Unions*, bijvoorbeeld, heeft in 1990 een *Special Committee for the International Decade Natural Disaster Reduction* opgericht dat later de naam *Committee on Disaster Reduction* gekregen heeft. Inzake kennisverspreiding heeft die laatstgenoemde commissie, in samenwerking met de Unesco en de *Third World Academy of Sciences*, het *International Network for the Availability of Scientific Publications* [1]* opgezet, waarvan één van de doelstellingen is om de wetenschappelijke kennis verder te verspreiden in de derdewereldlanden.

De academies voor wetenschappen hadden als oorspronkelijke taak het promoten van de wetenschappelijke methodologie en kennis. Nadien formuleerden zij ook wetenschappelijke adviezen waarmee de besluitvorming kon worden ondersteund.

Thans voegen de academies er de technologische en de toepassingsgerichte dimensie aan toe. Zoals wij konden vaststellen, streven zij er met veel inzet naar om de wetenschappelijke en technologische kloof te dichten, één van de belangrijkste hinderpalen voor de ontwikkeling van sommige overzeese landen.

La mondialisation comporte le risque évident de voir s'accentuer ce clivage dans les prochaines années. Un effort accru de la Communauté internationale s'impose, qui doit s'inscrire dans une perspective durable et adaptée à la réalité de ces régions. Les académies des sciences disposent d'atouts certains pour s'inscrire de manière efficace dans un tel processus : elles forment des réseaux transnationaux ancrés dans le Tiers-Monde ; elles apportent une vision centrée sur la seule approche scien-

* Het cijfer tussen haakjes [ ] verwijst naar de noot, p. 12 / Le chiffre entre crochets [ ] renvoie à la note, p. 12.

tifique; elles agissent en toute indépendance selon cette approche ; elles rassemblent des personnes qui parlent toutes le même langage — celui de la science; elles sont animées par des scientifiques de très haut niveau ; elles ont une expérience considérable en matière de diffusion des connaissances; enfin, elles connaissent bien les réalités des régions d'outre-mer.

Mon souhait est que leur rôle soit aussi développé dans le cadre de nos missions de Commerce extérieur. Il est pour moi indispensable que notre savoir-faire scientifique puisse trouver une place dans nos échanges avec les pays d'outre-mer.

Bij het federale Wetenschapsbeleid staan er programmatorische oriëntaties op stapel om overzeese landen te helpen in hun ontwikkeling.

De nieuwe acties van de „Programmatorische federale overheidsdienst Wetenschapsbeleid" zijn immers gericht op drie hoofdlijnen die die richting uitgaan :

— De invoering van de Noord-Zuid dimensie in sommige onderzoekprogramma's ;
— De ontwikkeling van synergieën met ontwikkelingssamenwerking, met name via sommige federale wetenschappelijke instellingen ;
— De uitvoering van een onderzoekprogramma met aids als hoofdthema.

Bij wijze van besluit kunnen we met genoegen stellen dat de academies voor wetenschappen bijdragen tot die verandering en ik complimenteer ze hiermee.

Je vous remercie de votre attention et vous souhaite à tous une réunion des plus fructueuses.

NOOT / NOTE

[1] De Heer M.H.A. Hassan, uitgenodigd op deze sessie, is lid van de *Committee on the Dissemination of Scientific Information* die het netwerk in kwestie organiseert.

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Science and Technology in Latin America

by

Antonio SAAVEDRA-MUNOZ *

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

* President *Academia Nacional de Ciencias de Bolivia*, La Paz (Bolivia).

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

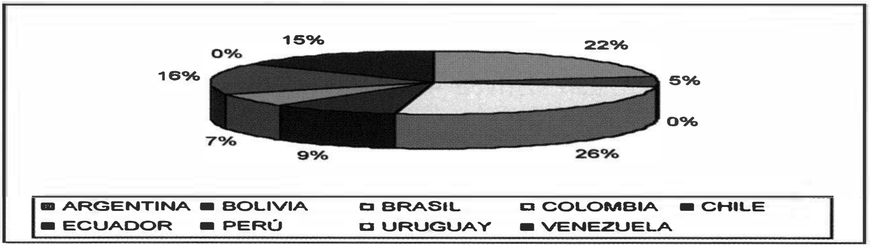


Fig. 1. — Population (in million).

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

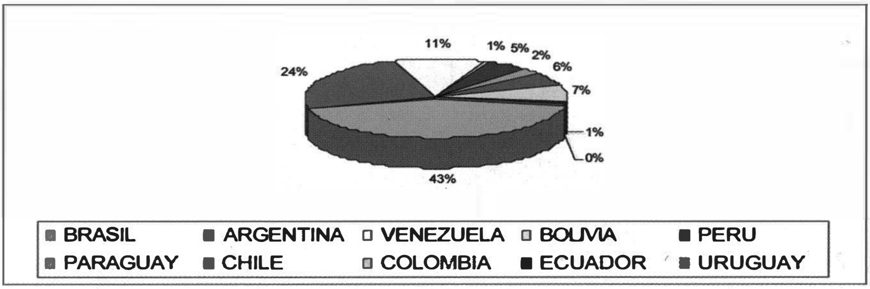


Fig. 2. — Gross Development Product (GDP) (millions of $US).

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				

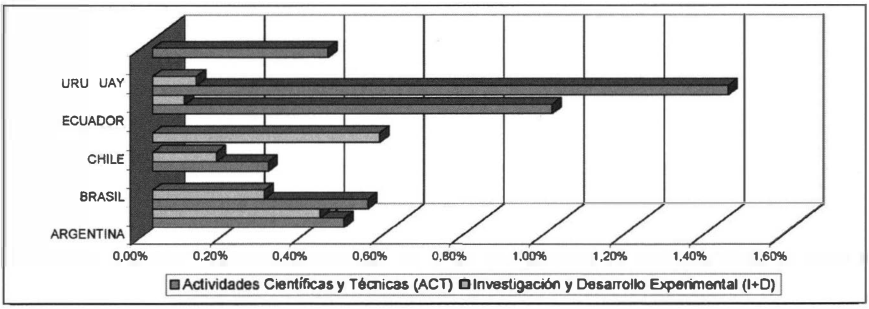


Fig. 3. — Investment science and technology (% GDP).

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			

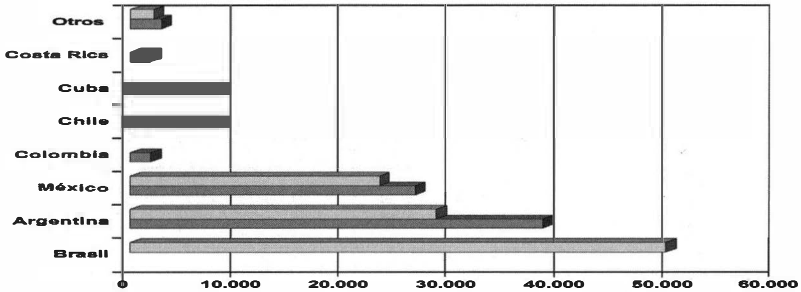


Fig. 4. — Researchers.

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	81	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

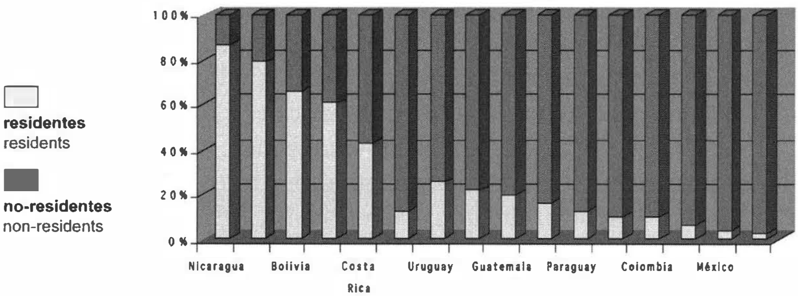


Fig. 5. — Patents request (residents / non-residents).
* N.B. : Costa Rica, Ecuador, El Salvador and Nicaragua : licence patents.

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.

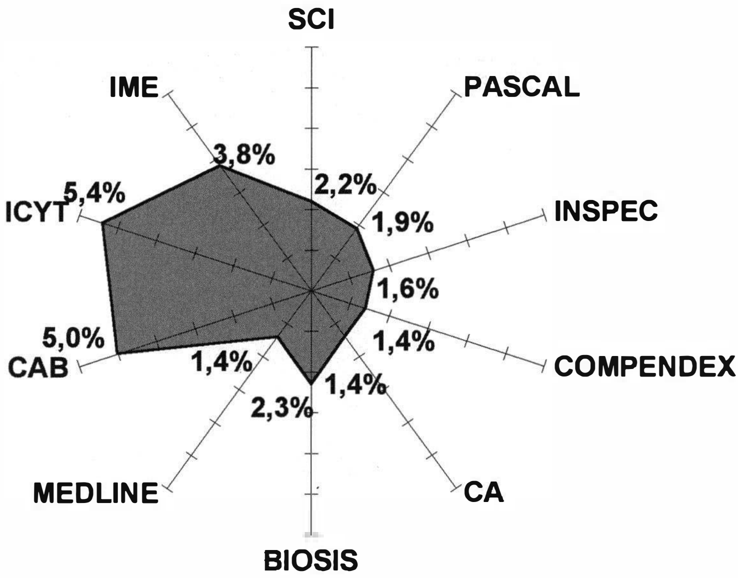
ANNEX 1

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

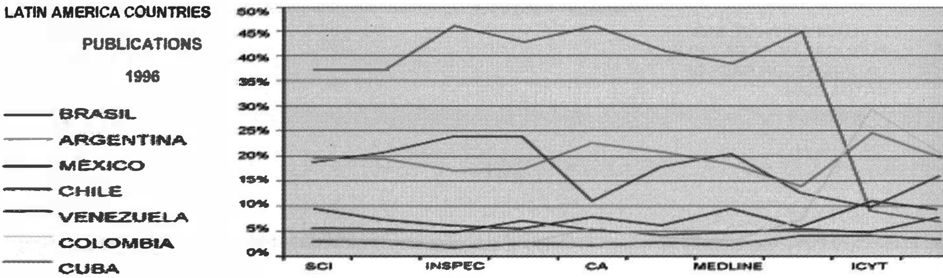
BIOSIS: Biological Abstracts.

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



75th Anniversary
Royal Academy of Overseas Sciences
Brussels, 9 & 10 October, 2003
pp. 23-32 (2004)

Science and Capacity Building for the Knowledge Society

by

Goverdhan MEHTA *

First of all, I would like to offer very best wishes and congratulations on behalf of the Indian National Science Academy and on my own behalf on your 75th anniversary. Your Academy has a very distinguished record of service to science and allied disciplines, giving due attention to the developing countries and I hope that you will continue to prosper in these endeavours in years ahead. It is a very special privilege for me to address this august gathering of members of your Academy and other dignitaries including HH Princess Astrid. Thank you for the kind invitation.

This afternoon, I am going to focus on a theme that is of utmost importance and concern to the S&T community as well as society at large, of building science and technology capacity for the knowledge society.

In the recent past, many leading lights have addressed the issue of science and technology capacity building and therefore it is not easy to say something profoundly new or original. But, I do believe that as the issue is of great contemporary concern, it needs to be periodically revisited and re-emphasized in a fast changing world. This is particularly so as S&T capacity building is going to be a key element in our transition to the knowledge society, for sustainable development and for a more peaceful and equitable world.

In an overall sense, my presentation on S&T capacity would be from a global perspective but I would develop the theme with particular focus on challenges faced by the developing countries as the issue is of critical

* Past President Indian National Science Academy, New Delhi (India) ; Director and Professor Indian Institute of Science, Bangalore (India).

importance and concern to them. For someone coming from a developing country, this deep concern is natural and emanates from deep within. The structure and content of this narration is an adaptation of the power-point presentation made at the conference and there might be some elements of disconnectivity but I hope it will still convey the main message of my song.

These are very vibrant times and we are fortunate to be living in an era that is witnessing a transition to the knowledge society. There is an emerging consensus that the 21st century will be the "century of knowledge". This stage of transition to the knowledge society has been arrived through an evolutionary process involving economic growth and societal transformations that has run for centuries. Thus, the agriculture society gave way to the industrial society and in the past few decades information society has come to the fore. With the galloping pace of ICT and rapid globalization on the economic front, the era of knowledge-driven world has been ushered in much sooner than could be contemplated even a decade ago. While technology and networks have been the main drivers of some of the earlier transitions, overarching influence of competition, innovations and entrepreneurship, in concert with developments in S&T front, will drive the knowledge society.

What is a knowledge society? It is not easy to confine knowledge society into a definitional framework, but its broad contours can be recognized in the following manner. A knowledge society is the one that uses knowledge holistically to empower and enrich people and is an integral driver of sustainable development. It has to be a lifelong learning society committed to innovation. Besides, having capacity to generate, diffuse, utilize and protect knowledge, it also creates economic wealth and social equity. Lastly, an important aspect of the knowledge society is that it enlightens people towards an integrated view of life as a fusion of mind, body and spirit.

This is an age of science and there is general consensus that the 20th century's unprecedented gains in advancing human development and eradicating poverty have come from wide ranging and at times spectacular technical breakthroughs. The role of science and its applications is going to be even more important in the future. S&T is now recognized as the main engine for development and for sustainable economic growth. It is estimated that at least half if not more of the economic growth in the developed countries is directly attributable to S&T and this contribution is only going to increase in a rapidly globalizing world. This is going to impact societal developments immensely. D. K. Price has said "There is hardly any social problem on which science cannot make some contribution". But, this needs to be tempered with a caveat that "science is never sufficient to solve a problem completely; it is however always necessary". This underscores the need for harmonization of science for policy and policy for science.

Contributions of science and technology to development process and in particular towards improving the quality of life of the people have been overwhelming but the spread of these benefits has been very uneven. The development process is usually defined as "expanding the choices people have to lead lives that they value". But, the most troublesome reality of today's world is that nearly half of the world population lives in conditions of relative to complete deprivation. What choices do they have? Let us look at some alarming figures to highlight both the reality of the present-day world and the challenges that we need to overcome to make our planet a better place to live for all. Nearly 1 billion people have no access to safe drinking water, 2.4 billion live under conditions that lack basic sanitation and over a billion people in our world cannot read or write! And this is really the paradox of the times that we live in. Despite great scientific achievements and technological breakthroughs, and unprecedented economic progress, the inequalities continue to rise alarmingly between nations and within nations. Assets of the world's three richest people exceed combined GDP of the poorest 48 countries. Nearly 1.2 billion people live on less than one dollar a day income, and another 2.8 billion on less than 2 dollars a day. They are 1998 figures and it is doubtful if the figures have changed much for the better. Currently, 50 % of the world's population lives on an income of less than 2 dollars a day. These growing inequalities are both the cause and consequence of the knowledge divide. The world has witnessed the damaging consequences of economic inequalities in the recent past. The knowledge divide can create new and difficult problems that are hard to foresee.

While economic disparities between the countries of the North and South are a matter of great concern, the problem of S&T capacity and human resources in the emerging knowledge society is even more important. Let some figures speak for themselves. If one looks at the power of human capital, in terms of scientists and engineers (researchers) per ten thousand populations, the numbers are 44 for Japan, 26 for the United States, 20 for Europe, 1.3 for India and 0.7 for the poorer countries of the world in Asia and Africa. In these numbers, one can clearly see how the S&T human resource capacity or lack of it manifests into economic strength or weakness. There is another interesting statistic relevant to the knowledge society. 15 % of the world's population lives in the developed countries. They account for 88 % of the Internet connectivity. In the developing world, the situation is reverse. Nearly 85 % of the people live there, but have only 12 % of the worldwide Internet connectivity.

Practice of modern science and technological innovations need creation of R&D infrastructure and require large investments. Once again the asymmetry in scientific spending versus incomes is even more glaring between the developed and the developing countries. The income gap between OECD countries and economically least developed countries is about sixty times. But, the difference in their S&T related R&D spending is two hundred and fifty times. OECD countries account for about 85 % of the total R&D expenditure in the world. This huge difference in spending in R&D is duly reflected in the S&T output. In fact, OECD countries contribute 94 % of world's indexed scientific literature, and 96 % of the world's patents are filed by these countries.

Accumulation and flow of information has witnessed explosive growth and is going to be of fundamental importance in the knowledge society. Let us look at the profile and pace of evolution of information. Since the time of Christ to 1750 AD in nearly 1,700 years, information doubled. From 1750 to 1900 AD, information again doubled but in a shorter time span of over a century. Between 1900 and 1950 it took just fifty years for the information to double again. It is estimated that since 1950 information has doubled every three or four years. There has been an unprecedented growth of information and some estimates indicate that more information has been generated in the last three years than in the previous 5,000 years. The yawning gap between generation, access and diffusion of information among the developed and the developing countries is another area of major concern that needs urgent attention.

In the past few decades technology has been growing at a galloping pace in shrinking time domains. Advances in ICT are taking place at breathtaking pace. Currently, the computer power doubles in 18 months, networking doubles in 12 months and storage or hard disk capacity doubles every 9 months. Time domains from the scientific discovery to technological applications and the market place are getting shortened dramatically. For example, it took over fifty years from Faraday's discovery of electromagnetic theory in 1830 to the commercial light bulbs; Watson and Crick's discovery of DNA double helix in 1952 took just twenty years for first genetic engineering applications. Currently, new innovations in ICT are taking a year or less to get into the market place.

Earlier in this presentation, it was emphasized that creation of modern R&D infrastructure in all parts of the world is not only very important and essential but it is also a capital intensive enterprise. Consider the emerging frontier areas in S&T like genomics and nanotechnology, the investments that developed countries are making in them are more than the GDP of many countries. US alone spend upwards of 2 billion in research in nanotechnology and Japan and UK are trying to catch up with this level of funding. How do the poorer nations of the world do, including the eighty countries classified as scientifically lagging, having no capital to cope with this challenge?

As already mentioned above, among the many challenges of the global knowledge divide, the increasing S&T gap between the North and South is the most important. Distribution of S&T capacities is even more lopsided than the economic power. This is reflected in many facets of life in the countries of the South. Let me illustrate this through the picture of a classroom in some part of the developing world where there is no electricity to light a bulb. You also see in the same projection a classroom offering a business management course in a developed country with on-line internet connectivity for every student. This picture in a dramatic way symbolizes the challenge ahead to bridge the knowledge and economic divide plaguing our world.

Having portrayed a somewhat dismal and depressing picture of the present, let me turn to hope and promise for the future. Let me show you the famous "hole-in-the-wall" experiment carried out in India, where a hole was made in a wall, and a computer screen was installed with key-board and internet access in a slum area. It was observed that the semi-illiterate slum children, quickly learned how to surf on the net, and were able to download very useful information. This experiment is actually a demonstration of what is referred as minimally invasive education. In fact it opens up new paradigms in education as such and also for learning science and information access. It highlights the fact that talent and ability are all pervasive but access and opportunity are not. Given an opportunity, the poor and the underprivileged can perform wonders: there can be blossoms in the dust too.

What is clear is that there is a great potential for the rich human capital in the South. Population, though at times an embarrassment and causative factor of poverty, can also be a renewable knowledge resource as important as capital. Of course, I am not making a case for an over-populated planet, which has already crossed 6 billion mark and must stabilize itself at the earliest. The need today is to fully harness the existing human potential in all parts of the world for a better future for all.

A solid foundation for a better future for all, both the developing countries and the developed countries, can be envisaged by capitalizing on the human resources and by building sustainable S&T capacities in an all inclusive manner. S&T capacity needs to be recognized as a global challenge. A new understanding of the South is needed.

What is the road ahead? For the S&T capacity building enterprise, some important milestones need to be recognized. There is need for a global perspective and commitment on the issue along with harmonization with local requirements and contexts. There is an urgent need for new initiatives and strategies by global institutions that deal with scientific knowledge. S&T capacity building is a complex issue and therefore, practical, pragmatic and multi-pronged strategies have to be evolved. There has to be a long-term vision and support should be on a continuous basis. New thinking is needed as the efforts of the past have not fully delivered and appear to be outdated.

It is important to recognize that S&T capacity building is a continuum and not an "on-off" or seasonal exercise. There is also desirability for a "broad-band" approach to building S&T capacities. There is a perception among some, particularly among some international funding and aid-giving agencies, that developing countries need only relevant technologies. I completely disagree with this thesis. Many, even among the scientific community, theorize that desert states in North Africa should focus on improving the breed of their camel or a developing country in Central America should concentrate on building capacity to improve the quality of bananas as these are relevant problems and bring economic benefits. My country, India, is doing well in information technology and some venture to advise us that do only that. I completely disagree with this thesis. Such approaches in my view are justified only in a limited context. I believe a much more long range and holistic view of knowledge and science and technology requirement in all parts of the world is necessary. *Every country needs the capacity to understand and adapt global technologies and therefore needs a self-standing S&T base and it should be the endeavour of all to see that happen.* Such an approach will cultivate self-esteem among all. The road along this path may be long and difficult but the commitment to traverse the distance should not be shrouded in ambiguity. In fact, the universal and compulsive nature of knowledge and sharing it with all was recognized nearly ten thousand years ago, and I quote here from the Vedas, ancient Indian texts of Wisdom, "...Let knowledge come from all sides". I would rather like to paraphrase it by saying, "let knowledge come to all from all sides".

There is a valid perception among some that segmentation of knowledge leads to divisiveness. This is something we should take note of as we make transition to the knowledge society.

What is the road ahead for S&T capacity building and bridging the knowledge divide? I wish to offer you a sampling of a few action points that I think are very important.

As human resources are very important in S&T capacity building, there is need to promote and look for new paradigms in science education. In my view, science education has not undergone much reform in the last 30-40 years. It is time for a "rethink" on science education at both pedagogy and curricular level. In doing so, the intrinsic complementarity between science education and other knowledge streams, particularly, enlightens humanities and social sciences must be taken into account. Science education must rekindle interest in experiments and in the skills of observation. Scientists were always called natural philosophers, who relied on observations through their sensory perceptions. But, today this aspect is nearly forgotten and today many learn chemistry without entering a laboratory and learn machining without touching a lathe.

I should also like to make a strong plea for the restoration of the inspirational role of the teacher as a motivator and mentor. Yes, let us have web-based education, let us have reach-out through internet but without compromising the central role of the teacher in shaping and inspiring scientific careers. Integration of science education with concepts of sustainable development is definitely required for tomorrow's world. There are many initiatives and experiments underway in science education through the efforts of the Inter-Academy Panel (IAP), UNESCO, TWAS and many leading Academies and NGOs of the world are participating in these endeavours. These experiences need to be shared and built upon.

A movement is needed worldwide, encompassing every country for universal, scientific and technical literacy. "Science for all, science for everyone" must get across. Learning science should be projected as an enlightening experience.

Science, its values and its societal engagement need to be brought into central stage. National Science Academies have a major role to play in this endeavour. Scientific revolution as we all know has outpaced social revolution for almost a century now. In this context, the linear conception of science and technology for progress in the emerging knowledge society may be inadequate.

New institutions, active networks and modern infrastructure need to be created, particularly in the context of the developing world, where more than two thirds of humanity live and work. The traditional view of flow of knowledge from the advanced countries to the developing countries, with the latter always at the receiving end, needs to be replaced with a better understanding of the complexity of interactions between nations in tomorrow's world. Every country should be encouraged to think strategically to develop its S&T base giving due attention to local concerns (health, food security, natural resources, etc.) and keeping in mind its traditional knowledge base and future aspirations in the global value chain.

Information access is very important, particularly access to scientific journals, books and data. But there is a silver lining. I will just give a couple of examples here. MIT's open courseware initiative is an effort to make teaching aids and teaching material available on the web. Digital library in Alexandria in Egypt, is again a very fine example of what a developing nation can do to preserve its heritage and information storage and dissemination. As far as journals are concerned, one would like to draw attention to the public library of science, PLOS, which was launched a month ago. The first issue of PLOS in biology is already making waves with some path-breaking findings. Hopefully this initiative will bring some relief. We, of course, know that the National Academy of Sciences does make available proceedings of the National Academy of Sciences (PNAS) after a time gap for ready access.

I should now like to raise a few more issues of concern, although in a random fashion.

The interactive complexity of the S&T innovations and commercialization, modern IPR regimes and the value of indigenous knowledge need new understanding. Recognize indigenous knowledge as a common heritage of humankind as many of its features could be the key elements of sustainable development strategies.

New paradigms need to be devised for exploring the immense potential in international cooperation in S&T, particularly in the context of building both the infrastructure and human resource capacities. Both North-South and South-South cooperation is important. But, I would like to highlight the primacy of South-South cooperation in international collaboration in science and technology. There must be a shift from a culture of patronage to partnership in international collaborations. We must consider new alliances to build capacities for the generation infusion and absorption of technology in real time. This is the kind of capacity that two thirds of humanity need in the next few decades.

Finally, I wish to focus on the role of science academies. I firmly believe that in science and technology capacity building endeavours, science academies can play a very important role. I had earlier referred to the Inter-Academy Panel (IAP) and its energetic role in promoting science education in capacity building and so on. In 2000, more than eighty science academies of the Inter-Academy Panel decided to establish the Inter-Academy Council (IAC), with the mandate of mobilizing the world's best science for a better tomorrow. The IAC strategy is to address pressing S&T issues of global concern through authoritative, merit-based studies by internationally acclaimed experts. These studies are subjected to a review process and then published for wider dissemination. The target audiences for these reports range from national governments to academies to society and NGOs to name a few. There is an executive board of the Inter-Academy council with fifteen representatives (mostly Presidents) of the world's leading academies. The IAC is currently co-chaired by Bruce Alberts, President of the National Academy of Sciences, USA and myself, and the secretariat is located in the Netherlands and hosted by the Royal Netherlands Academy of Arts and Sciences. ICSU, IAP and the Royal Netherlands Academy are observers on the Inter-Academy Council.

As already mentioned, the Inter-Academy Council carries out studies on areas of topical interest and global concern. This is done on a project-by-project basis. The studies are generally initiated through sponsorship and the process is transparent. This is also an independent process, because study panels are established to broad consultation with IAP Academies and the composition of the IAC Board approves of these study panels. This is a merit-based study. The draft reports are subjected to extensive peer review, and then when the IAC Board approves, it is released.

The first study initiated by the IAC Board was on a strategy for building worldwide capacity in science and technology. We can see that this is a burning issue of utmost concern as we make transition to the knowledge society. It is expected that this first study report will be released in the first week of December during the IAC General Assembly in Mexico City.

The second study on science and technology for improving agricultural productivity in Africa is nearing completion and should be ready for release in mid-2004. This study was undertaken on a request from Mr Koffi Annan, the Secretary General of the United Nations.

I would like to end my talk by a quote from Professor Abdul Salam, who was the founder of the Third World Academy of Sciences. And this again focuses on the S&T capacity aspects for the Third World or the developing world. " (...) Some people say there is nothing like Third World, there is only one world. But, this is not the general perception.

Today the Third World is only slowly waking up to the realisation that in the final analysis, creation, mastery and the utilization of modern science and technology is basically what distinguished the south from the north. On science and technology depends the standards of living of nations".

Well, I would once again like to thank KAOW/ARSOM for the kind invitation and opportunity to speak to you today and although my focus has been on the developing world, I do believe that science and technology capacity building is really a global problem. It requires global solution, global approaches and more importantly global commitment. I trust, we will all be able to muster the collective will to see that happen in the near future.

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Royal Academy of Overseas Sciences
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pp. 33-39 (2004)

Towards a Culture of Scientific Excellence in the South in a Changing World

by

Mohamed H.A. HASSAN *

It is indeed an honour to be here today to speak before H.R.H. Princess Astrid of Belgium and such a distinguished group of scientists and scholars on the occasion of the 75th Anniversary of the Royal Academy of Overseas Sciences.

The Royal Academy of Overseas Sciences is a unique institution bringing together eminent scientists and scholars from around the globe to examine some of the world's most critical social and moral issues. The Academy, of which I am a proud member, serves as a valuable link between science and our larger global community — at a time when such links have become ever-more fragile in our increasingly fractured world.

Indeed the theme of this opening session — "New Challenges for the Academies in a Changing World" — has assumed even greater importance in recent years.

Academies, under the umbrella of the-Inter-Academy Panel on International Issues (IAP) — a global network of 90 science academies worldwide with its secretariat in Trieste and operating under the administrative umbrella of the Third World Academy of Sciences (TWAS) —, are seeking to respond in innovative ways both to the challenges and opportunities faced by our knowledge-based global community.

Unprecedented advances in science and technology — first in physics and, more recently, in biology — have drawn science and cultural values

* Member of the Academy ; President African Academy of Sciences (AAS), Executive Director Third World Academy of Sciences (TWAS), Trieste (Italy).

closer together in a difficult but enlightened debate over fundamental principles concerning nothing less than the meaning and goodness of life.

No genetic scientist can blithely ignore the ethical dilemmas posed by biotechnology, just as no religious authority can turn a blind eye to the potential benefits that this technology could bring to millions of people suffering from such chronic and often debilitating diseases as HIV/AIDS, diabetes and malaria.

The gap in scientific capacity between the North and South, however, means that many of these advances are made by scientists working in well-equipped laboratories in developed countries primarily for the benefit of people in the North.

I am sure that we all agree that the developing world will not break out of its unending cycle of poverty and material deprivation unless it embraces a similar culture of excellence in science and technology.

And I also am sure that we all agree science will only take root within a society if it is embraced as an integral part of the prevailing culture. This can only happen if the local population views science as powerful instrument for solving real-life problems.

That is why scientific innovation and traditional cultural values must be considered partners, not adversaries, in our global quest for a better future.

In the context of this discussion, it is important to note that traditional knowledge has continued to play a critical role in developing countries — long after the ability of these countries to pursue cutting-edge scientific inquiries had been compromised by political and social conflicts and a host of other factors —, some self-inflicted, others created by forces beyond the society's control and influence.

Acquired and tested over centuries, today traditional knowledge is proving increasingly important as we try to tailor our global concerns for economic and social well-being to a myriad of local circumstances.

Respect for such knowledge, in fact, could provide a gateway for re-establishing a culture of scientific excellence in the developing world while simultaneously giving universities and research institutions in both the North and South valuable time-tested information and techniques for examining some of the world's most difficult food security, public health and environmental problems. In other words, traditional knowledge may serve as a vital connection between science and our global society, steering both into closer collaboration.

Take the example of a group of farmers in Ghana who, contrary to the tenets of modern scientific research, have successfully grown crops underneath trees.

Modern science tells us this is a bad practice because the tree roots suck up the very water that the plants need to grow. What the farmers of Ghana have discovered, through experience, is that the tree roots not only absorb water but help to disperse it, laterally, just beneath the soil's surface. As a result, the roots prove to be an aid, not a hindrance, to crop production. The trees and plants live in an harmonious, symbiotic relationship in which the health of one promotes the health of the other. More roots, better crops.

Yet, what is perhaps most fascinating about the experience in Ghana, as discussed at a meeting of the British Association for the Advancement of Science held last month and reported in a recent article in the electronic news portal SciDev.Net, is that it is not an isolated experience. In fact, hillside farmers in Nepal pursue similar tree-shaded farm practices with equally impressive results.

What all of this shows is that local knowledge may not be local at all. Instead it may represent a way of understanding based on experience and born of an innate of sensibility that draws on the time-tested strategy of "knowing by doing".

It is a kind of knowledge that modern society should not romanticize, yet should not ignore.

In this spirit, I think it is important for all of us to recognize — as the founding president of TWAS, Abdus Salam, often said — "science is the cultural heritage of all humankind".

No culture has a "god-given" monopoly on science and technology. And all cultures have a great deal to learn from exchanging experiences and knowledge, both on the wonders of our natural world and on the scientific and technological benefits derived from human ingenuity.

Given all this, what practical steps should the developing world take to create a culture of scientific excellence ?

Put another way, what factors could help the South knit scientific excellence into the fabric of its cultures in ways that would enable traditional values and modern science to be woven together in a pleasing harmonious pattern ? And, at the same time, allow the North to embrace science not just as a tool for individual material acquisition but as a source of social and cultural advancement in the broadest sense of what it means to be "advanced".

Let us first acknowledge that the task is not an easy one. Here are some snapshots that reveal the depth of the challenge :

— The South is home to 80 % of humanity but produces just 10 % of the articles published in international peer-reviewed journals and accounts for only 5 % of the world's total expenditure on research and development ;

— Since the Nobel prize was initiated over a century ago, it has been awarded to only three scientists who have conducted research in the developing world: C.V. Raman in India (1930), Bernardo Houssay in Argentina (1967), and Luis F. Leloir in Argentina (1969) ;
— Israel, which has only 4 million people, publishes more science and technology research papers in international peer-reviewed journals than the entire 57 countries belonging to the Organization of Islamic Conference (OIC), with a total population of nearly 1.3 billion.

Yet, we should not be discouraged by the challenges we face. By investing in their higher education systems and their research and development infrastructures, several countries — notably Brazil, China, India, Mexico and South Korea — have dramatically advanced their science and technology capabilities in a variety of fields, from electronics and computer software programmes to biotechnology and remote sensing.

These countries and several others have expressed a strong desire and commitment to engage in South-South cooperation programmes in education and research aimed at helping less privileged countries to develop their own scientific capacities.

Such experiences — along with more effective strategies for North-South cooperation — suggest that the road to scientific excellence in the developing world may no longer be marked by wrong turns and dead ends.

In fact, we know what it takes to succeed and we now have examples of how to get there :

— First, we need to establish national foundations for science and technology, in countries throughout the developing world, that continuously provide generous research grants based on competition and a peer-review system and that remove nepotism and seniority from the selection process. Here the efforts of such organizations as TWAS and the African Academy of Sciences to provide competitive grants in a variety of fields bode well for the future of science in many places throughout the developing world where similar national foundations do not exist. Such programmes, however, need substantial additional funding if we are to build and sustain a critical mass of world-class scientists in every country of the South.
— Second, we need to engage institutions of excellence that can attract, train and retain scientific talent and undertake problem-solving

research. Here the work of the Third World Network of Scientific Organizations (TWNSO) may prove particularly significant. TWNSO, which operates under the administrative umbrella of TWAS in Trieste, first identified and then involved institutions of high standing in the South in the building of networks dedicated to addressing real-life concerns in the developing world. To date, TWNSO has launched networks in indigenous and medicinal plants, dryland biodiversity, water management and, most recently, renewable energy. These networks closely track the critical problems — water, energy, health, agriculture and biodiversity — that UN Secretary-General Kofi Annan recently cited as a framework for action in events leading to the World Summit on Sustainable Development held in Johannesburg last year.

— Third, we need to devote sufficient resources to the problems of least developed countries (LDCs) whose scientific communities have become increasingly isolated and marginalized in recent years. Here is where TWAS's recent programme to recognize and support the best research groups in the LDCs could prove to be a critical strategy for developing and sustaining scientific excellence under difficult conditions. The programme offers annual grants of up to US$ 30,000 a year for three years to research groups in universities and research institutions. Again, this is an excellent initiative requiring an infusion of additional funds if it is to reach its full potential.

— Fourth, scientists need to communicate, in an atmosphere marked by mutual respect and understanding, with the keepers of other forms of knowledge — notably, practitioners of traditional knowledge in health, the environment and natural resources. Here TWAS's call for greater interaction with indigenous sources of knowledge, as outlined in its most recent strategic plan, could help bridge the divide — melding the universality of modern science with localized traditional knowledge in ways that serve both these noble pursuits.

— And, fifth, we need to nurture an environment that fosters cooperation between leading organizations that support the pursuit of excellence in science and technology. Here the initiatives of the Inter-Academy Panel for International Issues (IAP) to strengthen merit-based national science academies in the South could help transform a vastly underutilized source of scientific expertise into a strong and effective voice for science-based decision-making.

In all these endeavours, we must never lose sight of the fact that promoting a culture of scientific excellence generates benefits beyond a society's material well-being — that, in fact, a culture of scientific excellence is a boon to the entire culture. Opportunities to interact with individuals associated with education and research organizations beyond one's national borders promote greater understanding of the cultural values of different societies. This interaction, in turn, enriches and transforms cultural attitudes and customs.

And it is within this matrix of scientific interaction where Academies, working individually and in concert through such organizations as TWAS and IAP, can play a vital role.

Historically, Academies have provided an intellectual sanctuary for eminent scientists. Indeed the world's first science academy, *Accademia dei Lincei*, was created 400 years ago largely for the purpose of fostering an insular environment of camaraderie among the burgeoning pockets of scientific inquiry found in Renaissance Italy.

In the 21st century, however, Academies have a more critical role to play in three vital areas central to the relationship between science and society:

— First, Academies must promote high-quality science within their own nations. This means they must seek to recognize scientific achievement and encourage the pursuit of scientific excellence. Such goals are fulfilled through the merit-based election of its members, the awarding of prizes and medals, and the forging of links with scientific communities abroad.
— Second, Academies must seek to promote public understanding of science through public lectures and interaction with the media. At the same time, Academies should seek to support quality science education and establish exchanges with other sectors of society, including the private sector.
— Third, Academies must reach out to government by offering independent, objective advice on issues of vital importance to their nations. Academies must also become intimately involved in programmes sponsored by international institutions, especially those that focus on science-based development issues.

For too long, and in too many countries, Academies have been an underutilized intellectual resource. The Academies themselves, often content to operate as clubs rather than as dynamic forces within their societies, bear part of the responsibility for the science community's limited involvement in policy discussions.

But today, we can ill-afford to have the voice of science remain muted in a world where so many of the critical forces shaping our present and driving us into the future are fuelled by scientific discovery and technological advancement.

Our understanding of the state of the world depends in many ways on science — and so does our ability to mitigate critical problems and take advantage of unprecedented opportunities.

This does not mean that science alone should be our sole source of knowledge and understanding. We are, after all, also a people anchored by deep cultural values and spiritual awareness — sources of strength and well-being that depend more on faith than reason.

But to keep science out of the equation is to fight our battles for a more equitable and just world with a paralysing handicap.

Academies of science can — and must — play a crucial part in efforts to create a more scientifically enlightened world. It is a role that our Royal Academy of Overseas Sciences has sought to play in the past and one I am sure is eager to play in the future. I can assure you that TWAS — and its affiliated organizations, including the Inter-Academy Panel — are eager to join you in this noble campaign.

On this note and on behalf of the African Academy of Sciences and TWAS, I would conclude by congratulating the Royal Academy of Overseas Sciences on the occasion of its 75th Anniversary.

TWAS, which will celebrate its 20th Anniversary in Beijing next week, is pleased to have established close links with the Royal Academy in the past few years, highlighted by the signing of a Memorandum of Understanding in 1999 that provides a framework for cooperation that I am sure will grow even more fruitful in the years ahead.

I wish the Royal Academy of Overseas Sciences the greatest success in the next 75 years and beyond.

International Symposium

Science and Technology for Development and the Role of the Academies

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Message de l'Unesco

by

Walter ERDELEN *

C'est avec grand plaisir que j'adresse ce message à l'Académie Royale des Sciences d'Outre-Mer à l'occasion de ses soixante-quinze ans d'existence.

Pour cet anniversaire vous avez choisi de débattre des nouveaux défis posés aux Académies dans un monde qui change : l'élimination de la pauvreté et de l'ignorance, le respect de la biodiversité et de la diversité culturelle, les inégalités éducatives, économiques et sociales. Par leur contribution à l'avancement des connaissances, les Académies ont joué, depuis leur création, un rôle crucial dans ces domaines. Dans un monde de plus en plus complexe, où l'apport des différentes disciplines sera indispensable pour la compréhension et la résolution des problèmes, les Académies sont destinées à être les acteurs privilégiés du progrès du savoir.

Dans les sciences, rien n'est possible sans la coopération et le partage ; c'est pourquoi je vous félicite pour vos actions de coopération avec les pays en voie de développement. Ce sont là des actions par lesquelles les frontières géographiques et idéologiques sont dépassées pour atteindre ensemble un objectif commun: la création et le partage de la connaissance et des savoirs. Par le développement des relations académiques internationales, vous veillez à stimuler les échanges scientifiques. Cela signifie s'ouvrir vers le monde.

Je me réjouis de la coopération entre l'UNESCO et l'Académie Royale des Sciences d'Outre-Mer. Votre attachement aux valeurs de la connais-

* Sous-Directeur général pour les sciences exactes et naturelles, UNESCO, Paris (France).

sance, votre apport intellectuel pour s'attaquer aux problèmes de la planète, votre engagement éthique pour une science partagée sont précieux pour le travail de l'UNESCO, et je suis convaincu que nos efforts communs sont essentiels pour mettre en œuvre les idéaux de nos institutions.

Un anniversaire est une occasion à la fois d'une commémoration et d'un souhait. Celui que je formulerai est que l'Académie Royale des Sciences d'Outre-Mer puisse encore longtemps continuer son précieux travail.

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Supporting Young Scientists in Developing Countries. The IFS Model

by

Bruno MESSERLI * & Michael STAHL **

The Development Context

The international community has committed itself to try to reduce global poverty by half during the period 2000-2015. Development experts and policy makers often give priority to short-term projects trying to alleviate the immediate symptoms of poverty. In this context, science is often considered to be a luxury not deserving priority in the poor countries.

This paper claims the contrary — there will be no long-term sustainable development in the poor regions of the world without a considerable investment in science. Our point of departure is that knowledge is the basis of human progress. Accumulated knowledge is embodied in science and technology. Scientific research is the motor of knowledge accumulation.

This holds true also for the poor regions of the world. Examples can be taken from sub-Saharan Africa. Development indicators in this subcontinent paint a gravely worrying picture. Poverty and malnutrition are on their way up while life expectancy is on its way down. Moreover, global climate change impacts on Africa. More frequent and erratic episodes of heat and water stress, jeopardizing agricultural production, have been recorded. Food insecurity is expanding. It is assumed that the agricultural sector in the region must grow by 6 % per annum by 2015 to counter

* Chair IFS (International Foundation for Science), Stockholm (Sweden).
** Director IFS (International Foundation for Science), Stockholm (Sweden).

food insecurity. Climate change in Africa is even less understood than elsewhere. How the global changes will impact in various regions in Africa must be studied in the regions themselves.

Considering the above, it is no longer possible to rely on traditional farming systems and husbandry methods. The development challenges facing Africa cannot be addressed without a scientific understanding of the root causes of the problems and development of appropriate technology to address the issues.

The Scientific Landscape in Less Developed Countries

In the 1980s and 1990s most low income countries suffered from general economic decline while at the same time vastly growing cohorts of secondary school-leavers put pressure on the universities. Undergraduate training was prioritized while research dwindled. Research institutes saw their budgets severely cut. The number of research positions and scholarships were restricted. Researchers left their institutions and moved overseas or into consultancy and business.

As a result, the recruitment of research students went down and became wholly dependent on project funding from external donors. As the low income countries, and notably sub-Saharan Africa, enter the 21st century there is a glaring deficit of researchers in the age 25-35. In many African academic institutions most staff members are above the age of 40 and the majority above 50. Hence, African universities and research institutes are moving towards a generation shift. The present population of professors and senior researchers are a "greying" lot. The average age is high and many are close to retirement.

Who is going to generate the knowledge needed for development ? Sometimes it is claimed that poor countries should rely on expertise from centres of excellence in the North. We claim that Northern expertise can play a role, but it is limited. The scientific foundations for future sustainable development must be built, nurtured and reproduced in national institutions. The case can therefore be made for a general renewal of postgraduate research and research training at national institutions.

The Need for Research Funding

Studies undertaken by IFS have shown that the major complaint by scientists in developing countries is non-functioning laboratories and lack of scientific equipment, which reflect the general problem of the lack of research funding. Without having access to the tools of science, researchers tend to be motivated to leave their home institutions. Hence, the great challenge is to provide an enabling and meaningful environment for the young generation of university graduates in the less developed countries. If given the right support the new generation of scientists could provide the scientific underpinnings for sustainable development technologies while at the same time narrowing the global scientific gap.

The critical factor is to provide opportunities for funding for researchers in their early and mid-career, who are yet to become established. Unfortunately, national science councils and universities have very scarce funds for this category. There is thus a gap to be filled by international organizations devoted to scientific capacity building.

The IFS Model for Supporting Young Scientists in Less Developed Countries

IFS is an international non-profit organization founded in 1974. Its Secretariat is located in Stockholm, Sweden, and it is supported by twenty governmental and non-governmental donors. The IFS mandate is to strengthen the capacity of developing countries to conduct relevant and high-quality research.

IFS has thirty years of internationally recognized experience in operating a competitive research grant scheme for promising young scientists in more than 100 developing countries. Three thousand five hundred scientists, at the start of their research careers, have had the opportunity to pursue laboratory and field work in their home countries, in a research environment made more conducive for the young researcher through the support provided by IFS. This includes the research grant used to buy equipment and supplies required to carry out the project, as well as other types of support. A major outcome of this support is that researchers are given an opportunity to contribute to development-oriented research without having to move to academic institutions in the North.

IFS achieves its mission by identifying, through a careful selection process, promising young scientists from developing countries with potentials to become science leaders and leaders of science. To qualify for support, researchers should preferably be younger than 40 and should be citizens of a developing country and undertake their research in a developing country.

IFS thus functions as an international research council with Scientific Advisory Committees covering eight thematic areas (see below). Research applications are received at the IFS Secretariat throughout the year. They are then pre-screened by IFS scientific staff, assessed by the IFS network of some 1,000 international Scientific Advisers, and prioritized by the Scientific Advisory Committees for final approval by the IFS Director. Decisions on funding are taken twice a year, in June and December.

In addition to the research grants, the grantees also have access to other services designed to assist them with their research. Selected grantees receive travel support every year to attend scientific meetings or for training visits to other institutions. Over the last 30 years some 200 scientific workshops and training courses have been organized for grantees. For the last five years, new grantees have had access to literature searches. A large proportion of grantees have benefited from a service to purchase and deliver equipment and supplies to their institution.

Knowledge accumulated from the IFS Impact Studies since 2000 (GAILLARD 2000, GAILLARD & FURO TULLBERG 2001, GAILLARD *et al.* 2001) shows that the IFS capacity building model, *i.e.* providing support to well-targeted young scientists at the beginning of their research careers, has proved to be successful in retaining them as active and productive members of their national scientific communities, thus reducing the likelihood of brain drain. Amongst the positive outcomes reported is the significant impact that IFS has had on the career development of many grantees; the fact that IFS grantees publish more frequently and more often in mainstream scientific journals; the internationalization of many grantee's careers; increased collaboration with other scientists; and more success in accessing additional research funding. Tanzania provides an example, where many of the 55 former IFS grantees have risen to positions such as Vice-Chancellor, Dean of Faculty, Head of Research Institute, Minister in the Government, Director General, General Manager, etc.

Historically, IFS has primarily supported scientists working in applied areas of the natural sciences (crop science, animal science, aquatic resources, forestry, food science and natural products chemistry). However, as of 2002, IFS has expanded its mandate to include research on water resources, and social science research related to the conservation, management and sustainable utilization of biological resources. The research areas are continuously changing according to scientific and social developments. Emphasis is placed on integrated solutions relating interdisciplinary and participatory research to social needs in developing countries and on research areas of emerging importance such as water resources, biodiversity and global change. The widely different scientific capacities of individual developing countries is considered and IFS places the greatest emphasis on directing resources to those recipient countries with vulnerable research infrastructure.

As researchers in these institutions typically have less access to the Internet and are relatively marginalized from the international scientific discourse, they face difficulties when competing with researchers from developing countries with relatively strong scientific infrastructure. IFS has therefore initiated a series of supporting activities to enhance the competence of applicants from marginalized academic environments. Among these are workshops to conceptualize and prepare research proposals as well as different types of mentorship.

Many former grantees participate in IFS as Scientific Advisers and ambassadors for the IFS programme. IFS grantees have trained a new generation of scientists in southern universities, produced high-quality knowledge of relevance for the needs of developing countries and achieved senior national and international scientific and policy-making positions. Former grantees in the scientifically strong developing countries increasingly take on functions as mentors and advisors for their younger colleagues from neighbouring less developed countries.

IFS acts in collaboration with 126 affiliated organizations and other national, regional and international institutions, utilizing the complementary strengths of such partnerships. Examples of such collaborative partners include the Third World Academy of Sciences (TWAS), the African Academy of Sciences (AAS), the United Nations University (UNU) and the Organisation of Islamic Conference Standing Committee and Technological Cooperation (COMSTECH), and the Council for the Development of Social Science Research in Africa (CODESRIA).

In the coming years IFS will increasingly work in partnerships with regional scientific networks and national science authorities to facilitate improved research environments for young scientists doing research for development.

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Nuclear Cooperation for Development

by

Ana María CETTO *

The Role and Responsibilities of the International Atomic Energy Agency

The IAEA is an independent intergovernmental, science- and technology-based organization that reports regularly to the UN General Assembly. The sphere of IAEA's work extends to three core competencies: technology, safety, and verification. At present the Agency has 137 member states and employs 2,173 professional and support staff in six departments: Nuclear Energy, Nuclear Security, Safeguards, Nuclear Sciences and Applications, Technical Cooperation, and Management. The Agency also has three international laboratories and research centres and 132 active co-ordinated research projects involving over 2,000 research contracts and agreements; 54 intergovernmental and non-governmental organizations worldwide have formal agreements and arrangements with the Agency.

The IAEA serves as a global forum for scientific and technical cooperation for the peaceful use of nuclear technology. Its annual budget is about US$ 353 million, of which 23 % is used by the Department of Technical Cooperation (TC). For over 40 years it has supported technology transfer activities to help build capacity in developing countries to use nuclear science and technology. The TC fund has US$ 73 million at its disposal for about 800 projects in 100 member states, both national and regional, of which 21 % are human health related, 18 % safety rela-

* Deputy Director General, International Atomic Energy Agency, Department of Technical Co-operation, IAEA, Vienna (Austria).

ted and 17 % in the area of food and agriculture. The remaining 44 % is in the fields of physical and chemical applications, water resources, human resource development and capacity building, nuclear science, nuclear power, nuclear fuel cycle and radioactive waste management technologies, and security of nuclear material.

The national projects are linked to national development priorities and require a clear government commitment for their approval. Priority is given to those national projects that produce a tangible and sustainable socio-economic impact and support an enabling environment for the use of nuclear technologies. Member states are encouraged to enhance strategic planning for the nuclear sector, and their institutions are encouraged to develop "markets" or "clients" for their products and services.

Regional projects aim to develop a regional base for expert services and host institutions, to support centres of reference for technical and managerial leadership, and to foster South-South cooperation by — inter alia — concluding formal agreements with local institutions to implement regional activities. Intergovernmental agreements [1]* — for which the IAEA acts as technical secretariat — cover research, development and training and provide opportunities for cooperation among counterpart organizations.

The centres of reference — Regional Resource Units or Centres (RRCs) — are science and technology institutions with comparative advantages in experience, expertise or infrastructure, which exercise a leadership role for projects in given thematic areas and provide technical and management services to other institutions in the region at a nominal fee. In Asia there are for example the Bone Bank at Singapore National University for training of instructors on the distance learning package in tissue banking; the Marine Science Institute in Manila, Philippines, on harmful algae bloom toxins; the Analytical Laboratory in PINSTECH, Pakistan, for analysis of environmental samples; and the Malaysian Institute of Nuclear Research & Technology (MINT) for fellowship training of pre-disposal treatment of solid and liquid low-level radioactive materials.

Technical cooperation works under a two-year programming cycle requiring efficient rules and procedures, and timeliness and relevance of project outputs. The main modalities of delivery are four: expert services, training, fellowships, and equipment. The Agency's strategic directions are aimed at :

* The number in brackets [ ] refers to the note, p. 55.

— Strengthening of self-reliance and sustainability of counterpart organizations ;
— Building partnerships with development organizations ;
— Result-based tangible benefits for targeted population groups ;
— Developing competence in the technology marketplace ;
— Fostering technical cooperation among developing countries.

Moving from Technology Transfer to Knowledge Transfer and Sharing

While the more developed countries play a leading role in the social-political-economic shift associated with globalization, the developing countries are facing a watershed of challenges in this new era of global integration and economic restructuring, which in many cases is overwhelming the capacities of their institutions. The knowledge intensive nature of national development in the 21st century requires governments to invest heavily in research and development. It also requires national authorities to work differently by integrating the resources of the public sector, private sector, academic sector and non-governmental organizations.

In the past few years there have been numerous discussions about knowledge management, with increasing emphasis on the extent to which an organization captures, utilizes and transfers its knowledge and experience and the direct impact it has on national development.

Preserving the intellectual capital, transferring knowledge and experience, and encouraging continual learning are the essential activities for technology- and science-based organizations in the coming decades. For organizations like the IAEA, this means that we must be capable of fostering and sharing intellectual capital to stimulate innovative new ideas and approaches to underpin the competitive sustainability of the national nuclear institutions.

Recent experience at IAEA substantiates that most project and programme objectives are better achieved by developing capacity to create knowledge than by just developing technical skills. In other words, the competencies required for expected performance call for more stable institutions and a pool of human resources with broader or more in-depth understanding than can be realistically expected from training. If longer-term programme objectives are adopted, it follows that longer-term strategies for training and learning are required. For the IAEA, this has implications on the duration, scope, nature and setting for technical cooperation activities. For instance, isotope hydrology is gaining prominence as a long-term TC programme priority. Conventional training in isotope hydrology techniques may provide the skill to sample, analyse or even model the results of data collection, but not necessarily the understanding needed to meet national water resource management requirements that call for judgement on matters of data relevance or the exploitation of cognitive opportunities. In these instances, understanding the broader context of isotope analysis and possessing the competence to judge options requires a more holistic approach of longer duration or intensity.

How Can the Agency Support the Role of Academies as Science Brokers for Development ?

Within the framework of our technical cooperation activities, we are now actively collaborating with over 1,930 national counterpart institutes and other institutions involved in research, education and training, or providing host support for fellows or scientific visitors in the various nuclear-related fields. In the next few years we plan to undertake a global survey to register and assess the scientific and technical competencies and capacities of such institutions existing in developing countries. One expected outcome of this assessment that might be of common purpose for scientific academies is the identification of institutes that are not just interested receivers but capable of advancing science and technology for development by assuming greater technical and management responsibility for key applications of nuclear science and technology in human health and nutrition, natural resource management, environmental management, soil fertility and animal production, to name but a few.

Conclusion

Globalization and the market economy present increasing difficulties for national scientific and technical organizations as they attempt to make choices about how to respond and allocate their scarce resources. This challenge is particularly acute for scientific and technical institutes in developing countries that need to face "options" as to what actions and strategies are appropriate for their particular objectives. As mentioned before, knowledge networks are gaining importance as key actors for national development and as an essential element of international cooperation — this is particularly so in the nuclear sciences. The academic and scientific communities around the world are also under increasing pressure to better meet the demands of this new knowledge and information-intensive global community.

There is a need for a new approach to cooperation that takes into account the current transformations and that is grounded in a systemic analysis of local realities, including the knowledge, education and learning requirements for the information age. Scientific academies can play an important and vital role in facilitating this new knowledge-based approach to international cooperation for development by helping to bridge between the various stakeholders of today's globalized but fragmented knowledge society.

NOTE

[1] African Regional Agreement for Research, Development and Training related to Nuclear Science and Technology among African member states (AFRA) ; Regional Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL) ; Regional Agreement (RCA) for East Asia and the Pacific ; Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology (ARASIA).

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Global Environmental Protection

by

Klaus TOPFER *

UNEP is now 31 years old. We are the result of the first global environment conference, held in 1972 in Stockholm under the title "The United Nations Conference on the Human Environment". The main consideration of the conference was that the impacts of consumption and production could no longer be confined to the borders of individual states. This thinking was based on the insight that negative consequences could pose costs on others, which could result in tensions and conflicts.

The classical mission of the United Nations was addressed: to make possible peace policy. But not peace policy in terms of solving existing conflicts by deploying blue helmets, but preventive peace policy, which consists of the early identification and common treatment of possible reasons of conflict.

In 1972, when it was decided to locate the UNEP headquarter in Nairobi, many people criticized this decision as a sign that environmental policy was not taken seriously in developed countries.

After six years in office, I can tell you that Nairobi is an excellent location. It became apparent that tensions can easily arise between the use of environmental resources and economic development, particularly in developing countries. "Let's be rich first and clean up later !". In many countries economic development followed exactly this path. Today many developing countries argue : it is not fair that you (the developed countries) first shifted the costs of economic development on the environment, and now you want to keep us from doing the same. Many developing

* Executive Director United Nations Environment Programme (UNEP), Nairobi (Kenya).

countries are afraid that developed countries might use environmental protection as a means to restrain the economic growth of developing countries.

Many people believe that the protection of biodiversity is a privilege of those who have no other problems. But there is an interrelation between biodiversity and cultural diversity. Where biodiversity is lost, culture is lost too. Providing for biodiversity therefore also means providing for stability. This has also important economic consequences ! The provision of biodiversity and stable environmental conditions are a prerequisite for the alleviation of poverty. On the other side, poverty is also responsible for the overuse of the environment, although the main sources of environmental degradation are the production and consumption patterns of the developed countries.

I was once on a business trip to Columbia. After a meeting, I went to the Sierra Nevada de Santa Marta with a couple of Environment Ministers. This region is the home of the people of the Kogi-Indians, who live untouched by civilization. We found these Indians in big despair, since they thought they would have offended their gods. What was the background ? These people, although absolutely poor, lived in an intact and functioning environment. But in recent times, the weather had changed and the rainfalls did not come sufficiently anymore. When we told them that the likely reason for this phenomenon was climate change, they did not understand what we said.

I term such a situation "ecological aggression". We have many of these ecological aggressions. By encumbering other people with the things we cannot handle, we attack them. I do understand all those who use the argument of competitiveness. But in the end we have to ask ourselves: what dangerous consequences for world peace does our behaviour imply ? That is why I mentioned the Kogi-Indians. They could not understand the interconnections, but they were the victims !

Of course this includes a very important ethical component, because the world's poorest people have to carry the burden of the world's richest people. It also implies an ethical component because the world's poorest, in practical terms, do not carry responsibility for these problems. For this reason, I am convinced that we have to identify and tackle these ecological aggressions. The United Nations should not limit its activities to the deployment of blue helmets in cases where conflicts already exist, but it should employ green helmets before conflicts actually arise.

Many people talk about water conflicts. But water is not a question of resources, but a matter of investment and administration. With more investment it would be possible to ease tensions in those areas where people have diverging opinions on how to use available water resources.

We know that climate change is not the forecast of some nervous environment politicians, but that climate change is happening now. In Switzerland the glaciers have diminished over the last 100 years by 25 %. Over the years, the pace of climate change has increased.

So we have to act now. First of all, we have to identify the responsible factors. We know them: the climate-impacting factors, the gases, the CO_2 that originates from any incineration of fossil fuels, such as mineral oil, coal and gas. The second step is: we oblige the most developed states to reduce these emissions. The *per capita* use in the US is 20 tonnes per year, in India only 0.9 tonnes, and in Germany 9 tonnes or so.

This is exactly the starting point of the Kyoto Protocol. But it has to be ratified in order to come into force. The crucial point is that the parties who ratify the protocol have to include industrialized countries accounting for at least 55 % of the CO_2 emissions in 1990. Without the US and Russia, the Protocol cannot come into force.

The developing countries blame the industrialized countries for not achieving the mitigation of emissions. But climate change is taking place. Therefore, you have to help us at least with the adaptation. I experienced the meaning of this when we recently presented a concrete example.

For example, climate change changes snowfall. Today, skiing resorts, in order to have sufficient snowfall, have to be located in a height of 1,500 to 1,800 metres, instead of 1,200 in earlier times. This has enormous economic impacts. In general, skiing resorts cannot achieve *mitigation.* Therefore, they ask for *adaptation.* The adaptation in question is the snow-canon. These are the adaptation processes we are taking for granted. We increasingly substitute nature with technique.

There is one good and correct saying: nature is the wealth of the poor. Where an intact environment is lost, the rich have the technological means to adapt to this situation. We have to understand that this is not a matter of alms and charity. It is much more a matter of "debt for debt". If we cancel debts of developing countries, we do so not only to be nice, but we do so because we are in the debt of developing countries. We owe them something.

Many young people in the developing world say: it is necessary to work together, because the sources of the problems are partly in our realm, but problems are also caused and aggravated by others. By working together it is possible to start development processes, which do not follow the same path that we have taken.

When we went to Johannesburg, the third conference after Stockholm and Rio, we were looking for a slogan like "responsible wealth for all". It must not be "wealth for all", but *responsible* wealth for all, taking into account both sides of the spectrum. We have to identify the costs as such, and use them as the basis of our work, our actions and our research.

We are doing exactly this in the area of waste. I do not want to discuss with you the deposit system on cans, but it was obvious that we had to introduce a cycle. By introducing a "life-cycle-economy" we shifted the costs of waste to the relevant decision-making levels. You will not believe how drastically this impacted the behaviour with respect to the treatment of waste. Ghandi once said: "We have enough for everyone's need, but not for everyone's greed". We have to build upon the notion that, in times of increasing demand, limited resources reward those who know best how to deal with them. This is a very important challenge.

But these questions not only affect us. I am a member of the China Council, an advisory council of the Chinese government. Three months or so ago, this council adopted a policy that called for the quadrupling of the Chinese GNP until 2020. But without a major change in consumption and production patterns, can we even image this ? If we transfer our patterns of consumption to China, we might face a nightmare. Therefore, we have to look for ways to change existing consumption and production patterns in order to make economic growth possible without catastrophic consequences for the globe as a whole. That is not a question that the Chinese pose on us, but rather something they are asking themselves. And it is fascinating to see that the Chinese see this a great chance to overtake us as regards the quality of development.

This all implies that we have to make use of the still most abundant resource in the world: the capital in the heads and minds of young people. We have to raise their awareness of the bottlenecks and limits of the future.

When we began to desulphurize coal-power plants in order to mitigate forest degradation, the cost calculations were exorbitant, because there was nobody who had developed the relevant technology so far. No market existed. With the fixing of sulphur limits, a corresponding market has developed. Today the costs are by far lower. By raising the awareness for the limits of certain resources, we can change the employment patterns with respect to these limited but important resources.

We can solve these environmental problems, if we analyse them, identify them, take them seriously and include the economic responsibility of those who are responsible for them. We can thereby solve developmental problems and make possible the economic development of those countries that need it today. We have to cooperate in order to find ways to make possible economic growth without damaging the environment in the long run. And Germany, a leading country in terms of technology, is invoked to do so.

What are we doing in the area of energy ? It is good that we will have a world conference next year in Bonn on renewable energies. I have to mention in this context, that for developing countries, renewable energies are not primarily wind and solar energies, but biomass and water. We have to consider how to make better use of these resources.

You cannot tell an African to use wind and solar power for environmental reasons, because these techniques are still the most expensive ones. The Africans will tell you to do it yourself. We can respond them that it would enable them to preserve the life of people in rural areas. Because as a matter of fact: if electricity does not come to the people, the people will go to electricity.

We have to raise energy efficiency worldwide. Why do we not set ourselves a target ? The Japanese did something similar when they decided to increase their energy efficiency by 50 % until 2020. We also have to work on that, because the changing of behaviour and the identification of scarcity create chances for people who are in urgent need to overcome their poverty. It is not a stable world, in which 20 % of people consume 54 % of energy, while 80 % of the people consume 46 %. It is not a stable world, in which the gap between poor and rich is so big that it unavoidably leads to conflicts. The young people in developing countries are eager to contribute with their skills and expertise.

Environment is the wealth of the poor. We should be cautious not to contribute to the destruction also of this wealth. Instead, we should use this wealth in order to facilitate the peaceful development of the world as a whole.

Round Table Forum

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Pierre DE MARET *

Our Academy is a unique assemblage of scientists of all disciplines with a rare expertise, a unique knowledge of global past and present realities (memories of the vanished past with at the same time a very good knowledge of present problems).

I would like to stress the fact that the Academy is very autonomous, very independent and that it has no vested interests, which is becoming less and less usual in this world. We, as rectors of universities, all know for example that the University has more and more vested interests. We are not any more in an ivory tower because we are devoted to research and to teaching but also to delivering service to society. Throughout the world, universities have to become more entrepreneurial. In doing so they lose credibility.

In my opinion, the Academies, in general, are the epitome of the place where we are free from the struggle for life and the struggle for funding. And this gives us a unique credibility in the long term.

Speaking on behalf of the Section of Moral and Political Sciences, I would like to respond to some of the most interesting presentations of yesterday. There is a growing concern for the social and cultural factors. There is also more and more interaction between people but unfortunately, probably less and less understanding between them. The so-called communication age is one of the greatest paradoxes of our time: we have a lot of interaction, a lot of information and a lot of misunderstandings. The various identity crises around the world, are also a major challenge for our disciplines.

Belgium in many ways has a very specific and special responsibility for a huge part of the world, which is of course Central Africa. This Academy was founded in this perspective. Over the years, the geogra-

* Member of the Academy ; Rector Université Libre de Bruxelles, Brussels (Belgium).

phical scope of our Academy has become wider. But we still have, as Belgians, a very specific responsibility to this part of the world. May I remind you that there have probably been in Central Africa several million deaths during the last five years.

Actually, the Academy is a wonderful meeting-ground for different generations, and I am glad to see that there are more and more senior and junior scientists side by side in some of our meetings. This is an extremely interesting evolution.

The Academy is also an attractive meeting-ground, sort of a hub between the North and the South : between Africa, Asia, South America and Europe. This has already been elaborated by several speakers during this symposium.

Another important aspect is the fact that there is also, inside Belgium, the North and the South, with its different meanings. The scientific landscape in this country is extraordinarily fragmented as this country itself. For all together a mere ten million citizens, one of the key issues has become the level of fragmentation of this country in many aspects : philosophical, institutional, linguistic, regional, etc. In this context, our Academy has become one of the few places left where everybody meets without any major problems. This is also extremely useful in many ways. In this respect, the Academy plays an important liaison role between the universities (including university cooperation, which is a very specific field and a key issue), the federal institutions and the Administration.

Another significant aspect is the transdisciplinarity of the Academy, not only because of its three Sections, but because these Sections are more and more diversified.

Inside each Section, and probably in the Section of Moral and Political Sciences more than any other, there is a wide scope of disciplines. One of the major challenges of Science today, all over the world, is the need for a good interdisciplinary approach. When dealing with major challenges, like terrorism, AIDS, or sustainable development, we need multidisciplinarity.

Therefore, we have a challenge to take up since the major questions that society and decision-makers alike are asking to scientists cannot be solved with a mono-disciplinary approach. We have to pool various resources, to collect a wide range of expertise. This is one of the pressing issues of the world today that makes an Academy so important.

Another clear aspect is that, through Science in general, the distinction between fundamental and applied research is vanishing, and this is true for the Academy as well. We all start from a very fundamentalistic approach in general and we all end up, owing to the challenges of most of the South, with a very much applied research.

A further point to mention is the connection of pools of disciplines, pools of scientists around the world to create a wider network of Academies, which is also very relevant. If we consider our Academy as a meeting-ground, as a hub or as a team, of course there are plenty of opportunities for our society.

A big challenge also, from the Moral and Political Sciences' point of view, is, of course, the cultural, social and identity issue. There is a new wide scope of inequalities inside society and between the North and the South. Around the world there is a strong commitment to significantly increase the percentage of the GNP dedicated to alleviate the poverty issue in the coming years. In this matter the Academy could play a major role in monitoring and advising the decision-makers at different levels.

Finally, we have been dealing with one form of cooperation or another for almost a century if we take the colonial time into account. If we try to assess what we have achieved over that long period, as an anthropologist, I am quite critical : what is still operating on its own ? The result is very meagre, with, of course some significant exceptions. In general, it is due to a lack of consideration for the sociocultural issue. The approach is very often scientific, very technical but not addressing the priorities of the people. The social issue will become a support to some of the ideas of the members of the Academy and I think there are many opportunities today.

To conclude, after 75 years of existence, the Academy, even if its role is evolving, still remains an institution which has a major contribution to make to the sustainable development of the South.

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Ivan BEGHIN *

1. A Changing World

This meeting concerns new challenges for academies including our own, in a changing world. And indeed the world is changing fast: globalization, environmental changes, population growth, etc.

I shall limit myself, however, to considering a few changes that are more immediately relevant to those academies concerned with the developing world such as ours, and focus our interest only on four aspects.

1.1. RESEARCH, AND MORE PARTICULARLY THE MECHANISMS FOR CHOSING RESEARCH TOPICS

While the research cost is generally rising, on the other hand funding from the public sector is declining — at least in comparison with the marked and sustained funding by the private sector :

— Proportionately more research is conducted directly by private companies, in a context of clear and continuous concentration;
— Universities and research institutions are becoming increasingly dependent upon private sources of funds, either through contracts from companies (with sometimes publication restrictions) or through foundation grants. Most foundations are really independent, some are partly independent, but some not at all.

A consequence of this state of the art is that the choice of research topics is increasingly fostered, not by the investigator's scientific interest, but by his/her hope of getting financing. From the researcher's point of view, this means a restriction to his/her independence.

* Member of the Academy ; Hon. Prof. Institute of Tropical Medicine Prince Leopold (Antwerp), Managing Director Nutrition Third World.

While in the North this is by no means a healthy situation, there is even a greater dependency of researchers in the South!

1.2. Publication of Results

The so-called "good" scientific journals (which Professor Bruno Messerli, in his speech at this Symposium, referred to as "mainstream journals") :

— Have become extremely expensive ;
— Are owned by publishing houses with commercial interests ;
— Establish the rules of the game.

We are attending a slow but sustained process of *oligopolisation* of scientific publications by a limited number of journals, with increasing power over research and researchers. In theory there is a self-regulating mechanism offered by the peer-review system. But in practice the decision is made by the journal editor, who sometimes may be very arrogant.

As a consequence :

— For a researcher in the South the chances to have an article published in one of the "mainstream journals" are rather low ;
— Since he/she does not publish in the right place, he/she has less access to funding sources.

The trouble is that to a large extent the journals' reviewers are the same who act as advisors to the sources of research funding. This is but another aspect of the *oligopolisation* mentioned earlier. Needless to say, the problem is worse for the investigators in the South, thereby still widening further the North/South gap in research and research capacity.

To summarize this important point :

— Research is getting more competitive and more expensive than ever ;
— It is increasingly controlled by large companies and/or private foundations;
— Not only the funding of research but also publication tend to become oligopolistic;
— The independence of researchers is threatened.

While in the North we do possess effective defence mechanisms, such as the autonomy of universities, these mechanisms operate much less successfully in the South. Of course there is here a role to play by those academies which benefit from freedom and autonomy.

1.3. The Unprecedented Evolution of Communication

In the coming ten years, or even sooner, the situation will be completely different from what it is now as far as communication is concerned. Information will be widely accessible, overabundant, of extremely different quality, and even sometimes manipulated. This, of course, will also apply to scientific publications.

There is a need for safeguards, *i.e* for mechanisms such as :

— Sieving out unscientific or biased information, assisting people to make free, adequate choices in their readings ;
— Increasing free access to independent information.

Again, this is an area in which, I feel, our academies could play a useful role.

1.4. The "New Accountability"

There is, fortunately enough, a positive trend, which I would call the "new accountability" and which also comes from the Anglo-Saxon world :

— People increasingly require the decision-makers to justify their decisions and the consequences of such decisions ;
— Decision-makers in turn wish their advisors and their information sources to be accountable to them.

More generally concerning the foregoing topic, doctors, technicians, scholars, scientists, and others are increasingly under pressure to provide justifications about their activity, including the potential and even remote consequences of their research. The French philosopher Edgar Morin sees this aspect as one of the positive side-effects of globalization.

And, of course, this requisite should apply to our academies too (see below).

2. The Challenges

What are the challenges, and what could be the possible answers ? For further discussion I would like to put forward five suggestions which, from my point of view, academies should apply.

2.1. Fighting for their Own Independence

A major asset of an academy is its independence (P. de Maret, previously in this panel, used the term "autonomy"). Our Academy certainly is independent. Then the challenge, for us and for the others, in a fast changing world, is not only to preserve this autonomy, but to *assert* it.

Adequate funding is of course necessary (for organizing meetings, for publishing proceedings and syntheses, for disseminating consensus and guidelines, for inviting guests, etc.). In turn this requires a relevant, credible, and accountable academy.

2.2. Not Doing what Others Can Do Better, but Rather Doing what They themselves Can Do Better

Our academies should not (or not any more) operate as scientific societies — which they definitely are not — but rather be a place for interdisciplinary encounter, capable when needed of proposing consensus on global issues.

In this respect the records of the Belgian Academy of Overseas Sciences are of good quality, but largely deficient in the number and depth of issues it has been dealing with. In recent years the Academy has promoted and/or organized debates on world topics such as global warming, genetically modified organisms, water, tropical forests, etc. Hopefully it will cover in the future other difficult and controversial themes such as sustainable development, demographic growth, urbanization, etc. And it will be given the means to do so.

Why, and what for ? I suggest, in the following order :

— Putting problems and solutions into perspective ;
— Having fundamental and applied research meetings, producing syntheses, proposing consensus ;
— Helping access to adequate *free* information through its own publications and through selecting sound information, perhaps by using its website ;
— Informing and enlightening public and private decision-makers, as well as opinion-makers, and particularly the press.

As a rule I do not think academies should still publish immediate research results. It is not their function, and anyhow fewer and fewer scientists submit their most recent findings to an academy as a first choice. Most probably they are right.

2.3. Further Strengthening Interdisciplinarity

I stress intentionally *inter*disciplinarity, which is more than *pluri* or *multi*disciplinarity. Our Academy in this respect is doing well. Still more can be done, particularly through actively and widely opening up.

2.4. Opening up

I also strongly feel that another challenge to academies such as ours, if their goal is to bring a relevant and credible contribution to our changing world, is to open widely in various directions.

2.4.1. To the South

— Listening more to the South ;
— Improving the North/South balance in membership, publications, meetings (this one being a good example to be repeated), etc. ;
— Being present and active in the South (such as recently at the joint meeting in Bolivia).

2.4.2. To Young People

Not as a matter of age, but because often youngsters are more up to date on specialized matters. We cannot anymore afford to rely almost only on the experience of our senior members. This could be done in a variety of ways : for example more young people could be recruited, or invited to speak at our meetings; or more activities could be specially geared towards younger people, including doctoral fellows.

2.4.3. To the Outside World

I am aware that this is a controversial question, which goes against a long-standing tradition. But this tradition, in my view, has become too conservative and even counterproductive. Would it not be advantageous to our academies :

— To recruit not only academics, professors, scientists, but also civil servants, people from private enterprises and NGOs, from the press, etc. On condition that they meet strict requirements of knowledge, of experience, and above all of commitment towards the South ?
— To organize targeted meetings, in order to dialogue with the civil society — more generally with the outside world ?

2.5. Engaging in Affirmative Action within Society. Being Activists !

Advocacy and lobbying are major aspects of our new role, and we, as academies, should take initiatives such as :

— Stimulating debates, indoors and outdoors, on global issues ;
— Informing public and private decision-makers ;
— Asking — even requiring — accountability from all actors involved in development : scientists first of all, but also sponsors of research (foundations, governments, corporations, etc.), national, regional and international authorities, and lastly opinion-makers.

Our academies themselves should of course be accountable : this will require increased sensitivity to outside observers' opinions, and clearly more transparency.

3. Conclusion

In conclusion, this Symposium has set in motion a questioning and self-analysis process which our Academy, and perhaps sister academies as well, might like to pursue in the immediate future.

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Capacity Building and Technology Transfer in Plant Biotechnology for the Developing Countries

by

Marc VAN MONTAGU *

Last year at the World Summit for Sustainable Development, the International Council for Scientific Unions (ICSU) made a very strong statement on the importance of science and technology for development of the "Third World Countries" (TWCs). I fully support this vision.

Governments of the rich countries, international agencies, charities and foundations active in international cooperation, should give priority not to AID, but to capacity building of these TWCs for them to acquire the know-how for industrialization and improvement of agriculture, health care and environment. Joint R&D efforts with our institutes in the developed world can create the novel plants that can bring value to agriculture and stimulate the establishment of a local seed industry.

The enormous progress in plant genomics and metabolomics makes it possible to construct plants as starting material for the chemical industry (bulk products and fine chemicals). This with the aim of creating an industry that is less dependent on petroleum as starting material. Exploiting together with the TWCs their rich biodiversity, and stimulating the industrial development in the developing countries, can be an important base for initiating economic development. Creating value for tropical agriculture, while taking care that women participate in this economic development, bringing an affordable medicare through drugs produced by plants, remediating industrial pollution with specialized

* Member of the Academy ; emer. Professor, Ghent University, Department of Molecular Genetics, Institute Plant Biotechnology for Developing Countries (IPBO).

plants, all this can be realized through plant gene engineering and associated "smart breeding".

It is imperative that we associate the TWCs with this R&D in life sciences. We have to give them access to the 21st century technology and associate their universities with the capacity building of the developed nations.

The economic progress that will result from such an endeavour can create the financial wealth necessary for allowing favourable society adaptations. At that moment it will be possible to bring the necessary political changes and demonstrate the value of democracy and the value of humanistic principles that helped us to settle disputes in a peaceful way.

1. What are the Technologies of Life Sciences, or Biotechnologies bringing ?

Today one talks about the red (medical), green (agricultural), white (industrial) and blue (environmental) biotechnology. It is important that we, as scientists, as well as the society at large and particularly our leading politicians are aware of the achievements and potentials of these biotechnologies. Only then it will be obvious that we have to implement them in the TWCs without delay.

Most of the important new drugs developed in the last decade were obtained through the "Red Biotechnology". Either the drug itself is produced by a recombinant (gene-engineered) organism or the activity screening was made through recombinant target proteins. The fast progress in medical molecular biology guarantees that this trend will increase. Efficient drugs against the major tropical diseases like malaria, leishmaniasis, Chagas' disease, can be created through gene cloning and transgenic organisms. In fighting cancer the use of therapeutic proteins such as specific monoclonal antibodies is very promising. The production of these proteins through mammalian cell cultures is however very expensive. For developing a medicine affordable by the poor and particularly by the population of the TWCs, alternative production schemes, like production in transgenic plants, will be needed. Very promising *in vitro* results have been obtained in the production of diagnostic and therapeutic proteins in plants. The extensive biosafety tests required by the regulatory agencies are underway, so that commercial production can be expected in the coming years. Plant biodiversity will also be extensively exploited. Major breakthroughs in analytical organic chemistry allow now a display of most of the different metabolites (metabolome) present in a given small amount of tissue. Together with the genomics progress, this can lead to identifying the biosynthetic pathway of a given active compound discovered in a medicinal plant used by aboriginal cultures. The possibility exists to engineer this pathway in a plant easy to cultivate and produce the compound through a specialized high valued agriculture, as such saving many rare and endangered tropical plant species. If the construction and production of these "Pharm" plants is done together with the TWCs, this can be the start of a new economic development. Furthermore, the demonstration that it is becoming possible to identify and capture the value of biodiversity, might convince governments of TWCs that they should protect the major source of biodiversity, the Tropical Rainforest. The present ongoing, nearly systematic, destruction of these forests is highly damaging for our planet. Ecological genocides should be recognized by all as a crime against humanity. Let us hope that this is a point where green activists and biotechnologists will once join and cooperate.

The green biotechnology has already brought some major products of great importance to agriculture of the TWCs. The insect-resistant crops like corn, soya and particularly cotton bring both increased yield and financial return by the use of much less insecticides. They are also environmentally friendly since they do not inflict the "collateral" damage, killing of beneficial insects, as is the case of massive insecticide spray. All cotton-growing countries want access to this GM-cotton. The same principle could be applied to the many crops typically grown by TWCs. Many of them like cowpea and Andian potatoes are very prone to insect attack. The tools to engineer the insect-resistant varieties are available. We should organize networks so that the technology is transferred to the TWCs and that for each area the locally adapted cultivars are transformed and enter improved breeding programmes.

The herbicide-tolerant crops are also an economic and ecological success. Both in the developed world and in the emerging countries where large-scale agriculture is practised. After Argentina, Brazil and South Africa, China, India and the Philippines are now introducing them as well. The use of these types of GM-crops, like the "Round-Up" tolerant corn, soya and wheat produced by Monsanto, does not only procure a higher yield, but it makes a non-tillage agriculture possible and allows the late emerging of weeds (when the "Round-Up" is degraded by the soil microorganisms). In that way insect biodiversity and wildlife can develop better than when conventional herbicides are used.

The irrational but very aggressive opposition against GM-plants, present in Europe, has led to a very complex and expensive legislation. Activists try to export this refusal of GM-crops to the developing countries. The confusion raised these last ten years, has already severely blocked the construction of further beneficial GM-plants.

Nevertheless, the success in fundamental research indicates that it soon will be possible to use plants resistant to nematodes, to some major virus infections and also plants better resistant to some bacterial and fungal attacks. Also improved resistance to abiotic stresses is available in some prototype plants. It concerns the engineering of better drought, salt, heat and cold tolerance. Major crop plants of importance to TWCs, such as rice and cassava, can be engineered for stress resistance. Great efforts are now concentrated on the construction of new materials in plants. This can go from new starches, lipids and improved production of cellulose up to the production of new monomers for producing biodegradable plastics or new textile fibres.

These types of plants will be the base of a sustainable industry in the coming decades. Solar energy replaces the petroleum-based productions and these plants can bring a higher revenue to agriculture. The high diversity of crop plants in TWCs is a great opportunity for these countries to join this effort by developing very novel production schemes for bulk and fine chemicals.

The white biotechnology, mostly focused on production of industrial enzymes, will also be of paramount importance to the TWCs. Industrial production schemes working at lower temperature by using the right catalysts (enzymes) would be an essential asset for energy-poor countries. India has already shown that they can be leading in fermentation technology. Good informatics and microbial experimentation will allow the design of novel enzymes. These are assets of resource-poor countries if we participate in their capacity building. It is indeed very unwise for the developed world not to use 90 % of the brain capacity of our planet, at the moment when the need for a less polluting industry is so high.

The blue technology is only in its starting phase. Mostly because the scientists who have best studied the damage done to our planet, namely the ecologists, are ideologically reluctant to accept gene engineering as a tool in engineering solutions for environmental problems.

Life sciences are best situated to remediate the past and future damage. Until now mostly physical and chemical approaches have been tried to clean and decontaminate polluted sites or waterways. But the financial costs are immense, the scale of application is limited and by proceeding in this way, often waste disposal problems remain, as they are only shifted to another location. Good success has been obtained by engineering microorganisms and plants that can catabolize or concentrate polluting chemicals or heavy metals. Based on these accomplishments, a series of start-up companies specialized in bio- or phytoremediation have been established. TWCs with their ongoing population increase and urbanization into gigantic megalopoles badly need affordable waste treatments and decontamination of industrial sites. The developed countries should take the initiative to support our scientists so that they can bring the necessary know-how and initiate a pollution remediation industry in TWCs.

2. The Urgencies

After World War II we were 2 billion on our planet. A good fifty years later, we were 6 billion. Soon we will be 7 billion and although the population is stabilized in most of the developed countries, which will then represent 10 % of the world population, the increase in the TWCs, particularly among the poorest, is very alarming.

At present more than half of the world population has to live on less than 2 € a day. Out of them an 800,000 live under malnutrition or starvation. To break this vicious circle of poverty and starvation serious investments should be done in bringing technological development to the TWCs. The potentials of the new biotechnologies can create value for their agriculture and stimulate sustainable industrial activities. In many places in rural Europe, particularly in Flanders, people were also living in TWCs' conditions until the first decade of the twentieth century. Technological improvements allowed the workers' organization to negotiate the necessary improvements and in three decades most of Western Europe reached living characteristics for the developed world.

How can such technology transfer to the TWCs be financed ? It is not the leading multinationals based in the developed world which will sponsor this. But once the industrialization starts in the TWCs, they will join and stimulate the trend. For initiating the movement we will have to count on the international cooperation departments of governments, private charities and foundations as well as on initiatives of multilateral international organizations. However, the funds available are very limited, so one will have to depend on the generosity and dedication of individual scientists to start this cooperation.

Let us hope that the discussions concerning the TWCs on the abolishment of the agriculture subsidies in the developed world, subsidies that reach one billion $ a day (375 billion $ a year), will succeed and that part of this money can be used to start a massive effort for capacity building and technology transfer in biotechnology towards the TWCs.

3. What can Academies do ?

Mostly all Academies, learned societies and professional unions of scientists, consider it as their task to explain the importance of the methods of science and the research results to society. They also try to stimulate the younger generations to join this quest for knowledge and to participate in the ongoing attempts to construct fairer and more peaceful societies.

So I believe that these organizations are well placed to explain the molecular life sciences and their applications “the biotechnologies” to our societies. They can play a major role in increasing substantially the public acceptability of these biotechnologies.

The contributions of the Academies can be at many levels. They can stimulate capacity building worldwide, insisting that AID to the developing countries should in priority be aid to acquire the skills to participate in the production process and not a mere gift of food, goods and consumables. The Third World should have access to R&D expertise so that they can be the driver of their economic development. But capacity building includes training in business management, international regulations, compliance to the biosafety tests, and intellectual property management. Worldwide, Academies should explain the potentials and the risk benefit balance of novel sciences to the society at large. They also should take care that all citizens of the planet Earth have access to the evolving knowledge and the resulting technologies. They should stress the importance of protecting our environment and the dynamic equilibrium between living organisms, a challenge for which biotechnology is bringing us the tools. Finally, they should defuse the aggressive nature of the actual misunderstanding around transgenic plants since it is very dangerous for our democracies if governments continue to let action groups destroy field trials of transgenic plants.

On the occasion of their 75th anniversary I would like to congratulate the Royal Academy of Overseas Sciences for having organized this symposium. It is essential that our science community be aware of the needs and potentials of the Third World scientists. It is important to stimulate our scientists to take initiatives for making R&D networks around topics of great urgency for the economic and society development of the Third World.

I hope that further discussions among the participants to this Symposium will create confidence that we have the tools and the know-how, to progress successfully with such network building. If we present a coherent strategic plan to our government authorities, to the Charities and Foundations involved with Global Aid, I am confident that we will obtain the funding for such R&D cooperation. At present the most urgent action however will be explaining to society why such a science and technology action is needed for obtaining a sustainable development.

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Jean BERLAMONT *

Iedereen is het erover eens dat science and technology de basis is voor ontwikkeling, ook in het Zuiden. De universiteiten kunnen en moeten hier een belangrijke rol spelen: door in landen in ontwikkeling de vorming van eigen wetenschappers en technici te ondersteunen zorgen ze er immers voor dat die landen echt onafhankelijk worden van buitenlandse experts, consultants, bedrijven, actiegroepen,... Ze kunnen immers zodoende zelf hun ontwikkeling in handen nemen en met kennis van zaken en recht van spreken tussenkomen in het internationale debat. Ze kunnen dan bv. zelf oordelen over het beheer van hun natuurlijke rijkdommen, biotopen, grondstoffen, gezondheidszorg,... zonder zich de paternalistische wet te moeten laten spellen.

Daarnet is reeds het woord accountability gevallen. Ook wij, universitairen, zijn accountable t.o.v. onze rectoren, faculteiten, departementen. Wij moeten garanderen dat de activiteiten die wij in het kader van „universitaire ontwikkelingssamenwerking" ontwikkelen „van academisch niveau" zijn en terecht in „de tijd van de baas" uitgevoerd worden als onderdeel van onze taak van „universitaire dienstverlening" naast de taken van onderwijs en wetenschappelijk onderzoek. Daarom is de allereerste voorwaarde voor universitaire ontwikkelingsprojecten dat ze van hoog academisch niveau zijn, van goede kwaliteit. Alleen op die manier kunnen wij ze blijvend verantwoorden. Wetenschappelijke kwaliteit is dan ook de allereerste voorwaarde voor ieder universitair ontwikkelingsproject, net als voor ieder andere universitaire activiteit.

Verder is het van groot belang dat we streven naar echte „samen"werkingsprojecten, minstens op de middellange termijn. Het mogen niet alleen projecten van knowledge transfer zijn maar ze moeten leiden tot echte samenwerkingsprojecten waar zowel de universiteit in het zuiden

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* Lid van de Academie ; voorzitter Vlaamse Interuniversitaire Ontwikkelingssamenwerking (UOS).

als onze eigen universiteit beter van worden door uitwisseling in beide richtingen van kennis, ervaring, experimenten,... (science sharing). Alleen op deze wijze kunnen wij ook jongere academici warm maken voor universitaire ontwikkelingsprojecten: ze moeten er als onderzoeker ook iets aan hebben, het moet een win-win situatie worden.

Het is ook belangrijk dat we niet zozeer individuen steunen en vormen maar streven naar „institutionele" samenwerking. We moeten via de vorming van individuen de instellingen, laboratoria ondersteunen om blijven goed onderzoek te doen. Dit is de enige manier om tot een blijvende en duurzame samenwerking te komen. In dit verband is het ook nodig dat we de voorkeur geven aan „multidisciplinaire" samenwerkingsprojecten. De tijd is immers voorbij dat een wetenschapper of een ingenieur zijn project kon uitwerken en nadien kritiekloos uitvoeren. Een project moet niet alleen goed zijn, het moet ook maatschappelijk aanvaard worden, niet in het minst door de lokale (universitaire) overheid en de bevolking. Dit is zo bij ons en niet minder in landen in ontwikkeling. Bij wetenschappelijke projecten moet dan ook de nodige aandacht besteed worden aan maatschappelijke aspecten: exacte wetenschappers moeten daarom samenwerken met (lokale) sociologen, pedagogen, juristen, etc.

Indien de Academies een rol willen spelen in het kader van universitaire ontwikkelingssamenwerking kunnen ze dat daarom doen door bv. een platform te bieden voor het tot stand komen van die interdisciplinaire samenwerking. Academies zijn immers de uitgelezen plaats waar diverse disciplines elkaar ontmoeten en informeel kunnen overleggen en samenwerking vorm geven.

Een andere bijdrage van de Academies zou er m.i. kunnen in bestaan in de verschillende publicaties en op de verschillende fora kansen te bieden aan jonge academici. Ook al is de „impactfactor" en de citation index van de publicaties van de Academie niet zeer groot, toch bieden ze een prestigieus forum: indien onze jonge collega's hier zouden kunnen publiceren of hun projecten voorstellen zou dit motiverend en wervend werken. Ik breek daarom een lans om na te denken hoe we zulke kansen kunnen bieden aan jonge academici actief op het gebied van universitaire ontwikkelingssamenwerking.

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Jean MARCHAL *

Les rôles de l'Académie se situent en amont et en aval des activités universitaires relatives à la coopération au développement dans différentes activités :

— Diffusion : en amont, informer les universités sur les publications et ouvrages nouveaux ; en aval, permettre la diffusion et faire connaître les publications des universités au monde extérieur. Réaliser des congrès ou tables rondes en commun.
— Réflexion : être en amont un hub de réflexion sur les grands enjeux et thèmes qui devraient être prioritaires pour les travaux universitaires ; en aval, faire connaître les réflexions des universitaires dans le domaine de la recherche en appui à la politique de coopération au développement.
— Organe de liaison : l'Académie pourrait être un relais pour introduire les groupes universitaires dans d'autres académies ou organisations internationales ou nationales qui lui sont proches.

* Membre de l'Académie ; président Coopération Universitaire au Développement (CUD).