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CARIBBEAN SURVIVAL: CRITICAL RELEVANCE OF SCIENCE AND TECHNOLOGY.

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1. INTRODUCTION

The 1979 Physics Nobel Laureate Abdus Salam, who spent the latter part of his life traveling from country to country in the developing world trying to convince leaders of the need to invest in Science and technology said: **“This globe of ours is inhabited by two species of humans. According to the UNDP count of 1983, one quarter of mankind some 1.1 billion are developed. They inhabit 2/5 of the land area of the earth and control 4/5 of the world’s natural resources while 3.6 billions developing humans – Les Miserables and the Mustazeffin (deprived ones) live on the remaining 3/5 of the globe. What distinguishes one species of humans from the other is the ambition, the power, the élan which basically stems from their differing mastery of present day Science and Technology (S&T)”** That was in 1983! Today 24 years later the situation has not improved. In fact, what we are witnessing is the ever-widening gap between the haves and have nots both internationally and within national boundaries described by someone as the savage inequalities. The world population now stands at 6 billion of which 80% lives in the developing world. Of these 3 billion or one half of the world’s population live below the poverty line on less than \$2 U.S a day. Nearly 2.4 billion lack access to basic sanitation, 1.5 billion lack access to clean water and each year about 11 million children under age 5 die from preventable causes.

The obvious question is whether Science and Technology can be harnessed to address a situation that is certainly untenable. More specifically is S&T critically relevant to Caribbean survival?

2. THE ERA OF SCIENCE AND TECHNOLOGY

Today we live in a world shaped by S&T. Scientific knowledge has given rise to applications that have been of tremendous benefit to mankind. We have witnessed in the last century a revolution in telecommunications, vastly improved health care and the Green Revolution. Life expectancy has increased, infant mortality rates have decreased and many of the dreaded diseases of the past have almost been eliminated. We have come a long way since Rousseau wrote in 1762; **“Half of all children will die by age eight. This is an immutable figure. Do not try to change it”**. We cannot but marvel at the spectacular achievements in every major scientific field and associated technology particularly information and biotechnology. We have witnessed what can be described as the exponential march of science in the last century –S & T is changing the entire world much the way the Industrial Revolution did but at an accelerated pace. The change from an agricultural to an industrial society took approximately 100 years while the change from an industrial to an information society took just 20 years. What can one expect from S&T in the new century? The revolution in biotechnology and information technology will continue but in addition we will see the mushrooming of nanotechnology. There is a growing optimism that a better understanding of how genes function would revolutionize medicine especially in the areas of cancer and degenerative diseases such as Alzheimer and Parkinson.

However, while S&T is changing the world, it has left the world of many untouched.

3. SCIENCE, TECHNOLOGY AND DEVELOPMENT

Science and Technology has always been the great divider. What has changed though in recent times is that economies are being driven by intellect intensive knowledge – based societies rather than societies with natural resources. The sub-arctic island of Iceland once a remote fishing centre is now a high tech haven. It has a population of 290,000 and ranks amongst the world’s fifth richest countries on a per capita basis. It is referred to as the *Miracle on Ice* [Keenan, 2005]. Iceland is a global leader in population genetics. The company DE CODE is the epicenter of genetic discovery – identifying genes involved in many of world’s most common diseases. In Ireland, the so called *Irish Uprising* [

Keenan, 2005] is clearly driven by technology- they leap frogged from a largely agrarian society to a post industrial world creating new age jobs like software, electronics and health care. They invested heavily in education. Their success is due to a partnership involving government, business and academia and the diaspora. Closer to home Costa Rica and Cuba are examples of what is possible. Increasing its allocation to Research and Development (R & D) from .2% to 1.25% of its GDP, Costa Rica exports of high tech products is 44% of its total export and it has a Human Development Index Ranking of 41 out of 162 countries. Cuba allocated 1% to R&D, derives 10% of its income from biotech exports and arguably has the best health system in the developing world. In the year 2000 no country in the region spent more then .2% of GDP on R&D with at least one country allocating absolutely nothing. The percentage recommended by international organizations for developing countries is 1%. Trinidad and Tobago must be commended for its recent increase in expenditure towards R&D and tertiary education. It recently established the University of Trinidad and Tobago focusing initially on S&T. In comparison USA and Japan spent 2.8%, India 1% and China 1.2%. The amount spent on R&D in all of Latin America and the Caribbean was equivalent to what South Korea spent. A 2005 OAS publication has confirmed a strong correlation between investment R&D and the economy. (Fig. 1). The South Korean Case is depicted in Fig. 2.

Fig. 1 Expenditures on Research and Development (R&D) in Selected Countries, 2000

Country	%GDP	Origin of Expenditures, %				
		Government	Business	Education	NGOs	Foreign
United States	2.68	27.1	68.4	2.3	3.2	0
Canada	1.81	22.7	42.6	16.4	. 2.6	15.8
Brazil	1.05	60.2	38.2	1.6	0	0
Chile	0.56	70.3	23.0	0	1.9	4.7
Argentina	0.42	N/A	N/A	N/ A-	N/A	N/A
Mexico	0.40	59.1	24.3	10.8	0.1	5.6
Panama	0.40	34.4	0.6	0.4	0.7	64.1
Uruguay	0.24	20.3	39.3	35.7	N/A	4.8
Colombia	0.18	16.6	48.4	33.6	1.4	N/A
Peru	0.11	N/A	N/A	N/A	N/A	N/A
Honduras	0.05	N/A	N/A	N/A	N/A	N/A

Fig. 2 Growth of Science and Technology Community in Korea

	1963	1970	1980	1990	2002
GERD (US\$, Million)	4	33	428	4,679	14,433
Gov't vs. Private	97 : 3	71 : 29	64 : 36	19 : 81	26 : 74
R&D / GDP	0.25*	0.38*	0.77*	1.87	2.53
Researchers (Persons)		5,628	18,434	70,503	189,888 (FTE: 141,917)

Source: Ministry of Science and Technology

*R&D /GNP

The message is clear - develop and embrace S & T or be left behind. It is the *sine qua non* for development. The region today faces many challenges. We need to deal with the problem of poverty (three of the poorest countries in Latin America and the Caribbean are from the CARICOM region) the problem of food security, (high food import bill) the problem of energy security (only 2% of our energy comes from renewable resources). S & T has a role to play in each of these areas, and moreover in just about all of the UN Millennium Development Goals. If we are to survive in this highly globalized sometimes hostile arena, we must adopt a regional approach to some of the challenges that confront us. The successful economic integration of the region must be accompanied by integration and strengthening of S & T capacities based on our common needs. It is against this background that we organized a major historic CARICOM Conference in May 2006 in Trinidad and Tobago on "Harnessing Science and Technology for Caribbean Development". Historic, because for the first time we were able to mount a CARICOM Ministerial Round Table in which six Ministers participated. Historic, because for the first time we were able to bring together key players including academia, the private sector, selected scientists from the region, a non-governmental organization, CARISCIENCE and UNESCO representing the international scientific committee. Emanating out of this meeting was a Plan of Action and the setting up of a Steering Committee to oversee its implementation. This Committee is to report twice yearly to the Rt. The Honorable K. Mitchell, Prime Minister responsible for S&T in CARICOM. Further to this meeting UNESCO was approached with a request to provide a consultant to assist with

the implementation of the Plan of Action and to assess the status of S&T. The Consultant visited the region in December, 2006 and has completed his assignment. His report will be available shortly.

What this signifies is that there is a group of concerned individuals who felt that something needed to be done to invigorate the contribution of S&T to the development of the region.

4. THE CARIBBEAN LANDSCAPE

All Caribbean nations, individually and through CARICOM, recognize that they have to make major progress at learning and applying S & T to be able to achieve better living conditions for their people. Little attention has been paid as to how this might be done or to the roles played by different levels of scientific research activity: curiosity driven versus application-targeted basic research and applied research directed toward problem-solving. There seems to be no mechanism for setting research goals and priorities, judging whether any research goals have been met or evaluating research results from within and outside the Caribbean for potential beneficial impact on lives and economies of the region. This is a very serious policy and management deficiency, which must be corrected quickly in order for scientific and technological innovation to be entrenched in the Caribbean culture and for the productivity of its science enterprise to grow to optimal levels. [Kawha and Ramkissoon, 2005]. Because of lack of a conceptual framework for understanding and evaluating science and technology innovation in the region many research programmes have been established and maintained without performance evaluation or the infrastructure, financial and human resources needed to achieve their mission. For these reasons, alumina, banana, sugar, tropical rainforests and other resources of vital economic interest to the region have remained poorly understood and their diverse potential is largely unexplored. What is most distressing is that there are significant earnings from economic activity in these areas but there is no endogenous research and development capacity to sustain them. There are of course, bright spots of excellent achievement in research in the region, but this is largely as a result of determined individual effort and initiative rather than a planned and sustained cultural movement towards regional or national science excellence in the economically vital fields.

In addition Research and Development is grossly underfunded. Apart from Trinidad and Tobago there is virtually no funding to support fulltime Postgraduate Studies. According to a Report [Mokhele, 2007], “This fact alone makes the most potent statement regarding the value and priority that the

region assigns to science, technology and innovation. It is no wonder therefore that there is not much research emanating from the higher education sector in the region given that research anywhere else in the world is driven by the creativity of postgraduate students and postdoctoral fellows under the able guidance of mature researchers and scholars. The Caribbean region has completely missed the plot pertaining to basic prerequisites needed to development”.

5. THE WAY FORWARD

According to an Inter Academy Council Report [IAC, 2004] “A vicious cycle is at work whereby the developing nations fall farther behind the industrialized nations that have the resources – in financial as well as human-development terms – to apply scientific advances and new technology even more intensively and actively. The current disparity is likely to grow even wider as the industrialized nations continue to master the tools of science and inventions, vastly outspend the developing nations in R&D, and even capture some of the developing nations’ most precious human resources for their own use”. In the Caribbean with generally weak and fragile service, Mercantile and generally declining Mining and Agriculture economies, it cannot be business as usual . According to Prime Minister Owen Arthur [Arthur, 2006], “There must be a shift in the outlook, the thinking and actions by Caribbean politicians, private sector, the academic community and the entire civil society”. In short there must be a new vision, a paradigm shift to position the Caribbean, not only to survive but to compete in this highly competitive sometimes hostile globalized world. We have made the case for embracing S&T. The question now is how do we proceed?

We need to understand that in order to compete we must become a member of the Club – creating an R&D culture, investing more on R&D, producing more researchers, attracting more private sector funding and bridging the digital divide. The figure below illustrates the challenge ahead.

Fig 3: Comparative Snapshot: Key Data

	International Benchmark	LAC Region
R&D as % of GDP	2 to 3 %	LAC .6% Brazil 1 %
Investigators per 1000	6 to 10	LAC . 7 Argentina 1.6
Private Sector in R&D	60 to 75 %	LAC 37 %
Teledensity	60%	LAC 12%

Fig 4: Researchers by Sector and Field

SECTOR	Field of S&T					
	All Fields	Natural Sciences	Agriculture Sciences	Engineering And Technology	Medical Sciences	Social Sciences And Humanities
	(1)	(2)	(3)	(4)	(5)	(6)
All Sectors	547	232	121	95	46	53
Higher Education*	379	175	53	79	39	33
Research and S&T Institutions	66	32	7	14	0	13
Government	76	15	47	0	7	7
State Enterprises	24	9	14	1	0	0
Public Utilities	2	1	0	1	0	0

The reform of the higher education sector which is the cornerstone of an S&T system is critical. According to a report [Mokhele, 2007], “The higher education system of the Caribbean region is its main Achilles’ Heel created by the major failure of both political and Higher Education Leadership”. The post-independence role of universities in developing countries was to support nation building, training civil servants and professionals. Today the role must be changed to creating knowledge, community development and greater interaction with the production sector. It must also produce graduates who are trained to create enterprises and so generate jobs and contribute to the economy. “Collective efforts will be needed to reform curricula by replacing outmoded sections with new approaches that encourage creativity, enquiry and entrepreneurship,” [Juma, 2007].

EARTH University in Costa Rica is a pioneering example of curricula reform. Its Curriculum is designed to match the realities of the agribusiness, [Juma, 2007]. The University dedicates itself to producing a new generation of young people trained specifically to focus on changing the human condition through entrepreneurial activities. [Zaglul and Sherrard, 2005].

We also need to strengthen our ICT infrastructure, determine possible niches, exploit international connections and like India, China, Iceland and others, make use of our diaspora. A formal association of Scientists from the Diaspora will be launched later this year.

The challenges ahead are summarized below most of which have been identified by others [Cehelsky, 2006].

Challenges: S&T and Innovation in the Caribbean

- ❖ Recognize that S&T & Innovation as strategic national economic planning issue; Primary science official is Minister of Economy/Finance
- ❖ Provide sustained, significant development of S&T capacity: links to strategic economic and social directions
- ❖ Human Resources: Skilled S&Es, mobility, careers, basic & secondary foundation, technical training
- ❖ ICT infrastructure
- ❖ Business R&D: supporting policies, e.g. tax policy, IPR, university/industry linkages

❖ Curriculum Reform.

6. CONCLUSION

While over the past 50 years the region has produced intellectuals, good institutions, some outstanding scientists and technologists, the harsh reality is that the Caribbean region has not developed a strong capacity in S & T and is thus not well positioned to compete in the new global market and make a major contribution to sustainable regional development. Vice Chancellor E.N. Harris of the University of the West Indies was very much spot on when he said at his installation address; “If we do not invest in S&T we shall not cross the ramparts into the field of sustainable development and even run the risk of perishing in the trenches of underdevelopment”.

We therefore need to act and act with a sense of urgency. Time is against us. We must think not in terms of incremental measures but quantum leaps and leap-frogging. So much can be achieved by nurturing our human resources and building our S & T capacities – that is what once impoverished countries like Singapore, Ireland and Iceland did.

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