United Nations
Educational, Scientific and
Cultural Organization

UNESCO Forum on Higher Education, Research and Knowledge

Research and Higher Education Policies for Transforming Societies: Perspectives from Latin America and the Caribbean

Selected Proceedings

Editors
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2nd Regional Research Seminar for Latin America and the Caribbean
19th – 20th July 2007

Published by the United Nations Educational,
Scientific and Cultural Organization
7, place de Fontenoy
75352 Paris 07 SP
France

Regional Research Seminar coordinated by
The Secretariat of the UNESCO Forum on
Higher Education, Research and Knowledge

Printed in France

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The Editors

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Foreword

The UNESCO Forum on Higher Education, Knowledge and Research is pleased to present this publication, entitled "Research and Higher Education policies for transforming societies: perspectives from Latin America and the Caribbean". This volume emanates from the 2nd Regional Research Seminar of the Forum's Regional Scientific Committee for Latin America and the Caribbean which was held in Port of Spain, Trinidad and Tobago, 19-20 July 2007. The Seminar was co-organized with the Ministry of Science, Technology and Tertiary Education and hosted by the Trinidad and Tobago National Commission for UNESCO of the Ministry of Education in cooperation with the UNESCO Office in Kingston, Jamaica.

At the outset, it is appropriate to situate this publication in relation to the aims of the UNESCO Forum and, thus, to contextualize the specific issues related to higher education in the Latin America and Caribbean Region today. The UNESCO Forum focuses on the role and status of national research systems and international trends in this domain in relation to the challenges posed by the knowledge-based societies of the twenty-first century. Located at UNESCO and supported by the Swedish International Development Agency (Sida), the UNESCO Forum provides a platform for researchers, policy-makers and relevant stakeholders to engage critically with the key elements underpinning research systems: (i) policy trends; (ii) infrastructure; (iii) human capital and (iv) investment. This project has assured follow-up action for two major UNESCO world conferences, the 1998 World Conference on Higher Education, "Higher Education in the twenty-first century" and the 1999 World Conference on Science, "Science for the twenty-first century" and is closely linked up with the Management of Social Transformations (MOST) intergovernmental programme of the UNESCO Social and Human Sciences Sector.

Since 2001, the UNESCO Forum has consolidated its efforts to bridge research and policy in a number of ways through facilitating and broadening the space for critical debate and through revisiting the established and dominant views so as to reconceptualize future directions. To date, its various components for attaining these goals: (i) mobilizing experts; (ii) stimulating global and regional debate; (iii) producing and disseminating research; (iv) promoting strategic partnerships; (v) facilitating communication and (vi) strengthening the systemic

approach, have yielded creditable results. The UNESCO Forum believes that it is central to reaffirm the importance of research at the current moment given the rapid developments since year 2000 in knowledge production and management and their ramifications for social change and progress. The Forum's focus on 'research on research' has become, therefore, even more crucial and is now well recognized as a major field of enquiry for international organizations, charged with advising their Member States about the questions involved. In this regard, the World Bank (WB) and the Organisation for Economic Co-operation and Development (OECD) are key partners of the UNESCO Forum.

The UNESCO Forum pursues a systemic approach to the analysis of research so as to address strengths and weaknesses, as well as specific issues and concerns, in a critical manner. This work will embrace research in both industrialized and emerging contexts, as well as researchers whether reputed or at the start of their careers. The central objective is to promote ongoing research and to place significant results before the public eye. Consequently, research may be more original, innovative and effective, thus leading towards more sustainable human development.

Today, unprecedented emphasis is being placed on research as a key motor for advancing the Knowledge Society and its offspring, the Knowledge Economy. Consequently, 'research on the state of research' is now higher up on the priority agendas for governments, their specialized agencies and bodies devoted to this area, and for higher education institutions. Thus, it becomes essential to map and analyze systems to acquire an understanding of their functioning and of their future requirements.

This systemic approach necessitates the study of specific issues arising from the various areas involved. In this regard, key challenges facing the Latin America and Caribbean Region and the contribution of research systems in addressing these, merit serious actual and forward-looking analysis. The present publication focuses on the major thematic areas of the seminar: (a) building research capacity; (b) enhancing research productivity, and (c) ensuring the relevance and utility of research. The experts contributing in this volume present a strong case for renewing higher education and science systems to meet the challenges of knowledge-based societies, as well as the United Nations Millennium Development Goals (MDGs). The MDGs now orient the efforts of Member States to overcome the most pressing problems resulting from poverty and exclusion so as to promote more equitable social progress. Against

this background, higher education and science systems today must seek flexibility and innovation, while still maintaining their traditional commitments to quality and relevance. As this research seminar reiterated, "higher education, through its mission to promote research generating advanced knowledge has a unique and invaluable contribution to make to this systemic renewal".

The UNESCO Forum expresses its gratitude to the Regional Scientific Committee for Latin America and the Caribbean for their dedicated efforts to conceptualize and organize the Seminar and to ensure a very rich and thoughtful Report. In this regard, we express special appreciation to Dr Michèle Monteil, Chair of the Organizing Committee, to Ms Susan Shurland, Secretary-General of the Trinidad and Tobago National Commission for UNESCO, for the successful management of the activity and to Dr Kwame Boafo, Director Kingston UNESCO, for the strong support provided by this office. We also thank Professor Hebe Vessuri, Chair of the Programme Committee, Professors Marcela Mollis and Miguel Nussbaum Voehl who both acted as General Rapporteurs, and Professor Ana Lucia Gazzola, Director of UNESCO's International Institute for Higher Education in Latin America and the Caribbean (IESALC) for her participation in the debates.

The outcomes of this research seminar are intended to provide fresh insights for policy-makers, the higher education community and scientific researchers alike as they address the main issues facing the Latin America and Caribbean Region in the knowledge-based societies of the twenty-first century.

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Introduction

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On 19 and 20 July 2007, the Second Regional Research Seminar for Latin America and the Caribbean organized by the UNESCO Forum on Higher Education, Research and Knowledge was held in the city of Port of Spain in Trinidad and Tobago. Both days were productive and saw a useful exchange of ideas between public policy-makers, university chancellors and administrations, researchers and teachers of higher education institutions in Latin America and the English-speaking Caribbean.

The meeting proved beneficial to one and all, for the presentations encouraged dialogue between researchers and institutional decision-makers in an atmosphere of intercultural debate and discussion. Citation of models of higher education in Spanish-speaking Latin America and the models, reforms and challenges currently facing the English-speaking Caribbean was the frame of reference for historical comparisons and debate on individual and common characteristics.

One of the purposes of this publication is to provide readers with the outcomes of a forum seeking to build an academic bridge between the makers of higher education public policy and the results of research on the theme. To this end, we have organized the presentations made along two major lines: (i) public policies on higher education and universities, and (ii) research policies for improving the scientific capacity of universities in Latin America and the Caribbean.

1. Public policies on higher education and universities

1.1 Universities, tertiary institutions and secondary schools: from citizenship training to the qualification of globalized human resources

Public universities in Latin America and the Caribbean have played a key role in constructing and consolidating active citizenship through the forging of national identity and political socialization. One of the consequences in our Region of the educational reforms that have followed the modernizing agenda of the World Bank and other international organizations has been neglect of the social function of universities. Hence it is now urgent to strengthen the inherent connection between universities and the rest of the education system. In this sense, the university training for teachers of disciplines taught at tertiary and secondary level is the most simple and effective link between the different levels of education systems. In what we call the knowledge-based society, the social function of the university in citizenship leads us to the question of "whose knowledge and knowledge for whom?" It is this context that determines and limits the real social function of universities in dependent societies with weakened, impoverished or highly unequal economies. Universities must incorporate the cultural and historical dimension in order to strengthen national and local identity and, consequently, promote new lines of work specific to individual, local and regional contexts.

In her presentation, Professor Ana Lucia Gazzola, current Director of IESALC (UNESCO International Institute for Higher Education in Latin America and the Caribbean), praised the importance of building strategic networks and academic bridges between multilateral organizations such as UNESCO and the democratic purposes of Latin American and Caribbean societies, insofar as "Higher education is state policy, as well as an instrument for citizenship and national sovereignty" to bridge the existing chasm.

Using a different line of argument, Professor Patrick Kendall developed a range of questions on the policies that should be applied in Trinidad and Tobago's tertiary education system in order to meet the demands of international markets and labour force profiles required in a global economy.

In turn, Professor Marcela Mollis presented the quantitative trends among university teachers in Argentina over the last five years. She summarized the results of a qualitative and comparative study of university training for teachers of Mathematics, Spanish and History considering the three disciplines as the 'core' curriculum for forming a national identity and a sense of citizenship. Professor Mollis concluded by saying that the most direct impact of universities on the Region's education systems was in the training of teachers for other levels of the education systems.

1.2 Increasing demand towards higher education: government, business leaders and society

Assessment policies for higher education institutions bring such establishments into contact with the outside world, the business environment and society at large. In some Latin American countries, higher education assessment policies were developed by governments to increase the system's credibility in the eyes of civil society. The concept of accountability (defined in Spanish as social responsibility) compels public higher education institutions to provide society with a return on investment for the tax contributions it makes. On the other hand, universities that are funded in part by companies or large corporations cultivate technological knowledge in favour of economic growth in the private sector for the most part. However, public financing for science is vital for the development of sustainable research in the pursuit of greater social and educational equity.

Professor Nigel Harris outlined the collaboration that must exist between governments, universities and the business community given that successful research depends on the time that researchers can devote to their projects, time that is 'protected' from their usual work responsibilities.

The paper presented by Professor Francisco López-Segrera, Professor Carlos Tünnermann Bernheim and Professor Crista Weise Vargas, gives an analysis of the social and political contexts of Cuba, Nicaragua and Bolivia which have given rise to unique university policies and dynamics that exemplify good practices for institutions in terms of satisfying diverse social demands.

1.3 Assessment and quality-assurance policies

This aspect of higher education public policies takes into account the need for evaluation of the university quality of academic programmes, training for professionals and the diplomas or degrees awarded by institutions. In a context of increasing globalization of university education as seen in the European Community via the ERASMUS exchange programme [*European Community Action Scheme for the Mobility of University Students]*, and the recent MERCOSUR *[Southern Common Market]* the validation of academic qualifications and regional accreditation of institutions are two mechanisms worth taking into consideration in assessment policies, which must be improved and enhanced.

2. Public research policies: universities with research capacity

In this dialogue between English- and Spanish-speaking Regions, there is recognition of the cultural dimensions that influence institutional models so that quality assessment can contribute to creating a critical mass that matches local profiles and international standards alike. In turn, these cultural dimensions must be present in order to establish priorities. Institutions wishing to build and develop their research capacity depend mainly on their own academic community, that is to say the research capacity of their teachers and appropriate postgraduate training for students who choose the path of creating original and innovative knowledge.

Human resources, backed by the necessary material resources, must be used to help quality control policies. The virtuous circle that comes about through assessment and quality assurance stemming from evaluation policies places research-oriented universities at the forefront of international knowledge.

As a result of the application of such policies fostering the production of quality knowledge, new human capacities are developed and expressed in the form of patents and the dissemination of new knowledge and academic papers.

The presentation made by Professor Hebe Vessuri is fundamental in this sense, for it posits the need to generate social, political and economic contexts favourable to the development of research capacity and which help to optimize and apply results, particularly in economically disadvantaged regions. It also warns of the need to create mechanisms for compensation from global poles possessing qualified personnel who leave our Regions at their stage of greatest scientific productivity.

Professor Clarisa Eckert Baeta Neves continued in the same vein, underlining the importance of postgraduate training in the Region, with specific reference to Brazil. She stated that academic competence was essential for institutionalizing research and increasing both training of qualified human resources and development of scientific initiation programmes for undergraduates.

From a more organizational perspective, Professor Jorge Yutronic provided a number of keys to successful development of research capacity in universities, stressing such matters as the importance of university administration, organization of the institution based on outcome and

performance indicators, and the selection and evaluation of Research and Development (R&D) initiatives to build a successful portfolio.

3. The anglophone Caribbean's perspective

In his keynote address, Professor Errol Miller introduced the problems of 'nation-state' and the identity forged by the historical political model of the English-speaking Caribbean, in the light of forces dynamically transforming the global identity of the present looking towards the future.

Countries in the English-speaking Caribbean gained independence late, and with varying consequences – one of which is the belated training of local human resources. Demographic and historical analyses are conclusive in recognizing the problem of regional identity and the challenges of globalization in the light of local needs.

While higher education institutions cultivated the resources needed in the English-speaking Caribbean, they frequently promoted migration abroad which resulted in a source of foreign currency income for resident families.

According to the keynote speaker, the future lies in the integration of the English-speaking Caribbean and differential insertion in the global economy, with competitiveness and distinctive identity. This will require research that is sustainable in time and transcends the Region, for a critical mass contributes to qualitative development of the socio-economical model.

On the other hand, an anglophone Caribbean alliance will enable resources to be revised. Building Centres of Excellence to empower the various actors will not only advance research but also guarantee all dimensions of academic quality. To achieve this, it is necessary to implement validation mechanisms, harmonize pedagogic and academic criteria, and make local regulations more flexible so as to help build Centres of Excellence that foster the requisite academic mobility.

Introducción

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Entre el 19 y 20 de Julio de 2007 se llevo a cabo en la ciudad de Port of Spain, Trinidad & Tobago, el Segundo Seminario Regional para América Latina y el Caribe del Foro de la UNESCO sobre Educación Superior, Investigación y Conocimiento. Fueron dos jornadas productivas en las que se realizo un rico intercambio de ideas entre hacedores de políticas públicas, rectores y autoridades universitarias, investigadores y profesores de las instituciones de educación superior de América Latina y el Caribe angloparlante.

El encuentro fue provechoso para unos y otros, ya que las ponencias pusieron en dialogo a los investigadores y tomadores de decisiones institucionales en un contexto de debate y discusión intercultural. Las referencias a los modelos de educación superior de América Latina hispano parlante y los modelos, reformas y desafíos que enfrenta el Caribe angloparlante en el presente, constituyeron el marco de referencia para la comparación histórica y las reflexiones sobre rasgos particulares y comunes.

Uno de los propósitos de esta publicación es acercar a los lectores, los resultados de un espacio que aspira construir un puente académico entre los hacedores de políticas públicas sobre la educación superior y los resultados de las investigaciones sobre el campo. Con esta finalidad, hemos organizado el conjunto de ponencias presentadas en torno a dos ejes fundamentales: (i) las políticas públicas para la educación superior y las universidades por un lado, y por el otro, (ii) las políticas de investigación para el mejoramiento de la capacidad científica de las universidades de América Latina y el Caribe.

1. Políticas públicas de educación superior y las universidades

1.1 Universidades, instituciones terciarias y escuelas secundarias: entre la formación ciudadana y la capacitación de los recursos humanos globalizados

Las universidades públicas en América Latina y el Caribe, han cumplido un papel clave en la construcción y consolidación de la ciudadanía activa por la identidad nacional que fortalecían y la socialización política que brindaban. Una de las consecuencias de las reformas educativas en nuestra región que han seguido la agenda modernizadora del Banco Mundial u otros organismos internacionales, ha sido el descuido de esta función social de las universidades. Es por esta razón que resulta prioritario fortalecer la natural articulación de la universidad y el resto del sistema educativo. En este sentido la formación universitaria de los profesores de las disciplinas que enseñan en el nivel terciario y secundario, constituye la articulación mas simple y efectiva entre los distintos niveles de los sistemas educativos. En la llamada sociedad del conocimiento, la función social de la universidad para la ciudadanía nos lleva a preguntarnos, ¿conocimiento de quien y para quien?. Este es el contexto que condiciona y limita la real función social de las universidades en sociedades dependientes con economías debilitadas, empobrecidas o severamente desiguales. Las universidades deben incluir la dimensión cultural e histórica para encontrar su identidad nacional y local fortalecida y consecuentemente promover nuevas profesiones particulares, locales, regionales.

En su presentación la actual Directora de la IESALC, el Profesor Ana Lucia Gazzola, exalta el valor de la construcción de redes y puentes académicos como dispositivos estratégicos, entre los organismos multilaterales como la UNESCO y los fines democráticos de las sociedades latinoamericanas y del Caribe, en la medida que “la Educación Superior es política de Estado, instrumento de ciudadanía y de soberanía nacional” para superar las profundas desigualdades que se plantean.

Con una argumentación diferente, el Profesor Patrick Kendall desarrolla en su ponencia un conjunto de preguntas sobre las políticas que deberán aplicarse al nivel terciario educativo en Trinidad & Tobago, para satisfacer las demandas de los mercados internacionales y los perfiles laborales de la globalización.

Por su lado, el Profesor Marcela Mollis presentan las tendencias cuantitativas censales de los profesores universitarios argentinos en los últimos cinco años. Se sintetizan los resultados de una investigación cualitativa y comparada sobre la formación universitaria de los profesores de matemáticas, castellano e historia por considerar a las tres disciplinas el corazón ('core') curricular para la formación de la identidad nacional y ciudadana. Se concluye que el impacto más directo de la universidad sobre los sistemas educativos de la región, se produce a través de la formación de los profesores para los otros niveles de los sistemas educativos.

1.2 Las demandas crecientes hacia la educación superior: el gobierno, los empresarios y la sociedad

Las políticas de evaluación de las instituciones de educación superior ponen en contacto a las instituciones con el ambiente externo, el medio empresario y la sociedad. En algunos países de América Latina, las políticas de evaluación de la educación superior fueron desarrolladas por lo gobiernos para dar mayor credibilidad del sistema ante la sociedad civil. El concepto de accountability (definido en español como responsabilidad social) deja a las instituciones de educación superior públicas, en la obligación de devolver a la sociedad lo que ella invierte a través de sus contribuciones tributarias. Por otra parte, las universidades que reciben parte de su financiamiento de las empresas o grandes corporaciones, desarrollan conocimientos tecnológicos al servicio del crecimiento económico en relación a la esfera privada fundamentalmente. Sin embargo, el financiamiento público de la actividad científica resulta irremplazable para poder desarrollar la investigación sustentable en busca de una mayor equidad social y educativa.

El Profesor Nigel Harris, por su parte, destaca la necesaria colaboración que debe existir entre los gobiernos, las universidades y la comunidad empresaria ya que el éxito de la investigación depende del tiempo que los investigadores puedan dedicarle a sus proyectos, un "tiempo protegido" de sus responsabilidades laborales.

En el capitulo, el Profesor Francisco López Segrera, el Profesor Tünnermann Bernheim y el Profesor Weise Vargas , se analizan los contextos sociales y políticos de Cuba, Nicaragua y Bolivia que dan como resultado políticas y dinámicas universitarias particulares que ejemplifican buenas practicas institucionales desde el punto de vista de la satisfacción de las demandas sociales diferenciadas.

1.3 Las políticas de evaluación y el aseguramiento de la calidad

Esta dimensión de las políticas públicas de educación superior tiene en cuenta la necesidad de la evaluación de la calidad universitaria de los programas académicos, la formación de los profesionales y los diplomas o títulos que las instituciones otorgan. En un contexto de internacionalización universitaria cada vez más generalizado como lo muestra la comunidad europea a través del programa ERASMUS *[Plan de Acción de la Comunidad Europea para la Movilidad de Estudiantes Universitarios]* y el reciente MERCOSUR *[Mercado Común del Sur],* la homologación de títulos y la acreditación regional de las instituciones constituyen dos dispositivos a tener en cuenta dentro de las políticas de evaluación que hay que mejorar y profundizar.

2. Políticas publicas para el desarrollo de la investigación: las universidades con capacidad de investigación

En este dialogo entre regiones de habla inglesa y española, existe un reconocimiento a las dimensiones culturales que inciden en los modelos institucionales para que la evaluación de la calidad contribuya a la conformación de una masa crítica que responda al perfil local y a los estándares internacionales. A su vez, estas dimensiones culturales deben estar presentes para establecer las prioridades. Las instituciones que desean construir y desarrollar su capacidad de investigación dependen prioritariamente de su comunidad académica, es decir de la capacidad de investigación de sus profesores conjuntamente con la adecuada formación de postgrado de los estudiantes que se orienten a la producción de conocimiento original e innovador.

Los recursos humanos, apoyados con los recursos materiales necesarios, deben ponerse al servicio de las políticas de control de la calidad. El circulo virtuoso que promueve la evaluación y el aseguramiento de la calidad a la luz de las políticas de evaluación, ponen a las universidades orientadas a la investigación en la frontera del conocimiento internacional.

Como consecuencia de la aplicación de estas políticas que alientan la producción de conocimiento de calidad, se obtienen nuevas capacidades humanas, que se expresan a través de patentes y la circulación de nuevos conocimientos y ponencias académicas.

La presentación de el ProfesorHebe Vessuri es fundamental en este sentido, ya que plantea la necesidad de generar contextos sociales, políticos y económicos favorables al desarrollo de la capacidad de investigación, que ayuden a optimizar y aplicar los resultados, especialmente en las regiones económicamente desfavorables. También advierte acerca de la necesidad de producir mecanismos compensatorios con respecto a los centros mundiales que cuentan con personal calificado que emigra de nuestras regiones en su etapa de mayor productividad científica.

En esta misma dirección el Profesor Clarisa Eckert Baeta Neves, destaca el valor de la formación de postgrado en la región, haciendo referencia al caso de Brasil. La autora señala que la competencia académica es fundamental para institucionalizar la investigación y ampliar la formación de los recursos humanos calificados conjuntamente con el desarrollo de programas de iniciación científica para los estudiantes de grado.

Desde una perspectiva más organizacional, el Profesor Jorge Yutronic, brinda algunos elementos clave para alcanzar con éxito el desarrollo de la capacidad de investigación en las universidades. Entre los elementos que menciona, destaca la importancia del sector que administra o el gerenciamiento de la universidad, la organización institucional en función de indicadores de resultado y desempeño, la selección y la evaluación de iniciativas de investigación y desarrollo para construir un portafolio exitoso, etc.

3. La perspectiva del Caribe Angloparlante

El Profesor Errol Millar en su conferencia inaugural, introduce el problema del Estado nación y el de la identidad que el modelo histórico político del Caribe Angloparlante representa, a la luz de las fuerzas que dinamizan y transforman la identidad global del presente mirando al futuro.

Los países del Caribe angloparlante se independizaron en forma tardía, con diferentes consecuencias. Una de ellas es la formación tardía de los recursos humanos locales. Los

análisis demográfico e histórico son decisivos a la hora de reconocer el problema de la identidad regional y los desafíos de la globalización a la luz de las necesidades locales.

Las instituciones educativas de nivel superior, fueron desarrollando los recursos que el Caribe anglo parlante necesitaba, y en muchas ocasiones, promovieron migraciones hacia el extranjero que derivaron en un ingreso de divisas para las familias residentes.

Para el conferencista, el futuro radica en la integración del Caribe Angloparlante y la inserción diferencial en el mundo global, con competitividad e identidad. Para ello habrá que desarrollar la investigación sustentable en el tiempo que trascienda la región, ya que una masa crítica contribuye al desarrollo cualitativo del modelo social y económico.

Por otro lado, una asociación del Caribe Angloparlante permitirá una reutilización de recursos. La construcción de centros de excelencia que potencien los distintos actores permitirá no solo desarrollar la investigación sino también asegurar la calidad universitaria en todas sus dimensiones. Para esto resulta necesario implementar mecanismos de homologación, unificar criterios en las distintas dimensiones pedagógicas y académicas y flexibilizar las distintas regulaciones locales que ayuden a la construcción de centros de excelencia que favorezcan la movilidad académica necesaria.

Enhancing research productivity in the Caribbean: University of the West Indies (UWI) perspective

by
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I. INTRODUCTION

For many centuries, Universities have been centres of learning and discovery. This has been made possible by the frequent assembly of societies' greatest thinkers and investigators with generations of students into the walls of these entities. In recent times, with the proliferation of post-secondary institutions providing only instruction, sometimes for-profit, the role of research and the creation of 'true learning assemblies' was often forgotten even by policy-makers. However, it is clear that in a global environment where knowledge and creativity are the vital ingredients of growth and competitiveness, the preservation and enhancement of universities in which research, innovation and translation of their products into industry and policy are important imperatives.

The founders and early leaders of the University of the West Indies (UWI) recognized from its beginning, nearly sixty years ago, that research and discovery directed at social and economic issues and at societal growth would be important. Hence, the Institute of Social and Economic Research (ISER) [now the Sir Arthur Lewis Institute for Social and Economic Studies (SALISES)] and the Tropical Metabolism Research Unit [now the Tropical Medicine Research Institute (TMRI)] were initiated in the earliest years of the University. These Centres went on to produce ground-breaking work in social and economic studies (SALISES) and in medicine (TMRI) (particularly in areas of malnutrition and child development over many decades). Today, the University of the West Indies has more than fifty Centres and Institutes conducting first-rate research in a broad array of subjects, many relevant to the growth and development of the Caribbean, as well as to small island and developing states worldwide.

The University of the West Indies is one of two Regional Universities in the world (the other being the University of South Pacific (USP)) serving fifteen countries in the English-speaking

Caribbean. In the last five years, the University's undergraduate and graduate student enrolment has increased to nearly 40,000 with an academic staff in excess of 2,000. There are hundreds of undergraduate and graduate programmes offered in Faculties of Social Sciences, Pure and Applied Sciences, Humanities and Education, Medicine, Engineering, Law and Agriculture. More than 90 per cent of scholarly publications in journals and books emanating from the English-speaking Caribbean are produced by academics at the University of the West Indies.

Despite the above data, representation of UWI internationally in the world of published scholarship, research and policy development is in need of enhancement. There are several challenges to increased productivity including:

- Rapid enrolment increase.
- Inadequate support for graduate students conducting full-time research.
- Inadequate facilities and materials for competitive research.
- Absence of sizeable Research Funding and Venture Capital to support research.
- Insufficient translation of research findings into innovative products or into recommendations that may drive business competitiveness and provision of informed policy advice.

Each of the above problems will need to be assessed, if the full potential of universities in the Caribbean is to be realized.

1. Enrolment growth and loss of academic time for research

Given the demands of both governments, students and their families for tertiary education as a means of fostering societal and individual growth and competitiveness, the demand for post-secondary education has and will continue to increase. However, as the enrolment of students grow the quality of the education-learning experience and the quality of research can suffer.

Balancing enrolment growth with threats to quality and research productivity is challenging. One approach is to broaden the educational interests of secondary school

students beyond traditional universities. Increasing the capacity for Technical Colleges and Vocational Schools to absorb some of the growing need for post-secondary education is one useful approach. Sustainable growth depends not only on traditional University graduates but on technologists in areas such as energy (biogas, fuel crop production, and solar energy), informatics, forestry, soil conservation, animal husbandry, maintenance of equipment and so on. Students and their parents should be persuaded that opportunities for employment, wealth and intellectual growth are distinctly possible with appropriate technical and vocational skills, imagination and a sense of entrepreneurship.

Thus, expansion of opportunities for post-secondary students to include Technical and Vocational Institutions will free time and resources in traditional universities for research and quality graduate programmes. It would be important in these circumstances to ensure that there is not a two-tier system of Tertiary Education (University versus Technical College). All students, regardless of placement should be imbued with attributes of life-long learning. They should learn for productivity and learn for employability (UNESCO, 1996) whatever the Tertiary Institution in which they are enrolled.

Increasingly, even within traditional universities, it is recognized that few academics can be great teachers, great researchers and great providers of service to their communities. There are academics who are gifted teachers, but not as productive in research. Provision of enhanced opportunities for those academics who wish to teach primarily and who can provide excellent teaching should be recognized as an avenue for promotion within the university. On the other hand, there should be in every faculty, department, centre and unit of a university, some group of able researchers provided ‘protected time’ for research and innovation.

Formation of research teams or centres is also a means of not only ‘protecting researchers’ but of building collaboration, critical mass and cross disciplinary thinking necessary to address thematic areas of importance.

2. Expansion of research graduate programmes

Over the past decade, the University of the West Indies has initiated a large number of 'Taught' postgraduate degree and diploma programmes designed to provide professional and employment advancement opportunities for working adults with first degrees. The University also provides opportunities in several disciplines for students to pursue postgraduate research degrees at the Masters (Master of Philosophy [M.Phil.]) and Doctorate (Doctor of Philosophy [Ph.D.]) levels. While student enrolment in Taught Masters degree programmes has expanded markedly, the expansion of students doing Research Degrees have been modest. In addition, the latter suffer from high attrition rates and slow progress to final degree.

The challenges of postgraduate research degree programmes are multiple but significant ones are lack of funding for full-time research students, poor employment opportunities post graduation and, in some cases, inadequate supervision. These problems must be addressed and the University is exploring the waiver of fees for postgraduate students doing research degrees. They should also be provided stipends to meet modest living expenses. To ensure that scarce resources are effectively utilized to support postgraduate students doing research degrees, they should be rigorously screened to ensure that they are talented and sufficiently committed to completing their degrees. Supervisors of these students should also be carefully selected to ensure that individuals doing creditable research with good supervisory skills are selected. Workshops to train supervisors, use of supervisors from other international institutions, or options for students to do part of their training at reputable international institutions should be explored.

While rigorous research is often the province of students seeking postgraduate degrees, <u>all students</u> at the undergraduate and graduate levels should understand the principles of empirical research and should be involved in some form of research during their undergraduate years in which data gathering, analysis and evidence-based conclusions are involved.

3. Inadequate facilities and materials for research

Inadequacy of facilities and lack of materials (or lack of a system to supply materials in a timely fashion) are important hindrances to first-rate research, particularly in the sciences,

technology, medicine and engineering. Access to complex and expensive infrastructure and materials to conduct cutting edge research is limited in the Caribbean. However, if any society is to compete in the current global environment, some investment must be made in the infrastructure, materials and individuals to conduct cutting edge research in specific niche areas. Policy-makers should establish priority areas for research that will impact competitiveness, growth and sustained development, and facilities and materials provided for research in those areas.

It should be emphasized that there are areas of research in the social sciences, communications, culture and the arts and in health where expensive infrastructure is not required. These areas require primarily an active and creative intellect, attributes that can be nurtured in appropriate learning and research environments.

4. Sizeable funding for research

Availability of an adequate Fund for Research is a necessary requirement for promotion of competitive and innovative discovery particularly in the sciences, technology, medicine and engineering. Models of Funding Agencies supporting research exist in all developed countries. Examples in the US include the National Science Foundation (NSF) and National Institute of Health (NIH). Governments of countries with these agencies often allocate substantial funds on an annual basis for awards to the most competitive researchers in defined disciplines. Decisions about who should receive grant awards are made by *ad hoc* teams of experts in the given discipline who often make their decisions based on carefully crafted and objective criteria. Research proposals are scored, proposals are ranked. Usually, there is also a Policy Board overseeing the Agency, and it is this body that ultimately decides which Proposals will be funded based on "its score, its rank and perceived relevance to defined National and Regional Needs".

We have long argued for the establishment of a Regional Research Fund (possibly named a 'Competitiveness and Development Fund' to ensure better support from the private sector and policy-makers). This would be run by an administrative group such as ones described above, operating out of CARICOM. In the setting of the Caribbean, Applied Research should be given priority over *Basic Research* and might include alternative energy, biotechnology,

agriculture, fisheries, the environment, Information and Communication Technologies (ICTs), health, creative approaches to mathematics and science education and others.

Even with well-funded agencies offering grant awards, there will be insufficient interest unless academics are motivated to compete. Since in the Caribbean, salaries are not usually dependent on receipt of grant awards, other incentives such as special community recognition for recipients, credits for promotion and monetary incentives might be useful strategies to stimulate interest in applying for awards.

5. Translation of research into 'Applicable Products'

Academic researchers invariably establish the directions and goals of their research on individual rather than societal interests. In addition, they would prefer to work alone rather than in teams or other collaborative formations. Both attributes tend to limit the potential to conduct research relevant to societal growth and even when such work is being done, there is often inadequate translation into innovative products or to promote informed policy development. Some approaches to address this limitation include funding Centres and Institutes that address specific societal development needs. This enables multidisciplinary teams of researchers to direct their research at specific social and developmental issues. Another approach to translation of research into meaningful product is creation of databases of researchers and the work they are doing so that these are accessible to government and business communities who can capitalize on research findings. A third approach to translation of research findings is popularization of significant research achievements in the lay press so that stakeholders can become aware of new findings and how they might be put to productive use.

Governments and businesses are also often not as aggressive as they might be in exploring the University as a potential source of innovative ideas and of appropriate policy advice. Increasing the interactions of these sectors with the University through symposia, meetings and organized visits to each other's institutions are ways to promote 'information flow between gown and town'.

II. SUMMARY

Societies that have fostered a robust research enterprise have often done so by promoting excellent collaboration between government, universities and the business community. For universities to succeed in the conduct of research, at least some of their academics must be afforded 'protected time' to conduct research. Building research postgraduate programmes, where the most talented students are provided with support to do full-time research and where good supervision of these students by able and productive academics is provided, is important. Provision of opportunities for employment for individuals with postgraduate research degrees is also necessary to attract students to research careers. It should be added that all undergraduate students should understand the principles of empirical research and be given opportunities to get practical experience in research as part of their degree programmes.

Competitive research also requires good facilities, adequate materials and access, and funding support. The creation of a Research Funding Agency to disburse funds competitively, based on good peer review of applications, is important. The need for researchers to be given incentives to compete for awards will encourage them to apply for grant awards.

Research brings value to societies and avenues should be created for translation of research findings into innovative products and informed policy-making. Creation of Centres around themes important to societal growth, research databases available to the public and communication of exciting findings in the media and in public for are often modalities available to translate research into 'usable products'.

Scarce human and material resources should not limit meaningful research. The presence of universities committed not only to teaching but to research can boost creativity and innovation even in developing countries and are necessary ingredients for competitive growth and development.

* * *

Selected Reading

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Biography: Professor Eon Nigel Harris

Professor Eon Nigel Harris assumed office at the University of the West Indies (UWI) as Vice- Chancellor on 1 October, 2004. Professor Harris was previously Dean and Senior Vice-President for Academic Affairs at Morehouse School of Medicine in Atlanta, US. He brings to the high office of Vice-Chancellor of the University of the West Indies, a wealth of experience both as an administrator, academician and researcher

Globalization and human resource development in the Caribbean

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INTRODUCTION

As from the time when Barro (1991) inserted education variables into his growth model and found them significant, education has become a standard inclusion in empirical models explaining growth performance (i.e. Easterly and Rebelo, 1993). In the empirical literature, education generally has had a significant impact on growth. In analyses of the outstanding economic achievements of the East Asian Newly Industrializing Economies (NIEs), education receives a prominent place. The theoretical and empirical literature, of course, goes beyond the growth impact to include certain externalities such as a more stable society, improved family health, associated particularly with the education of women, reduced fertility of women because of the increased opportunity costs of child bearing and hence less population pressure etc. Accordingly, in growth and development literature, the question no longer is whether to educate or not but "How many to educate, in what areas, within what time and at what cost?"

Given the foregoing and the recent economic performance of the Caribbean, the time is opportune for an evaluation, in this paper, of the education sector in an attempt to find answers to the above question.

Section I: Reviews the performance of the sector *vis-à-vis* other developing and developed countries, given the consensus that education is, in the knowledge-based economy of today, a major determinant of competitiveness.

Section II: Reviews the issue of the skills upgrading of the labour force and the redefinition of core skills, an issue which countries such as, for example, Australia and Singapore, are currently addressing.

Section III: Looks at the important issue of technological development and the contribution of education.

Section IV: Analyses the important role of Information and Communication Technologies (ICTs) in education.

Section V: Explores the funding and other related issues with regard to the new thrust in education.

Section VI: Sets out some Conclusions

SECTION I: THE PERFORMANCE OF CARIBBEAN EDUCATION *VIS-À-VIS* A GROUP OF COMPARATOR COUNTRIES

The critical question is: "Where does the Caribbean Region stand in relation to other countries as regards the performance of its education sector?" To a significant degree, the answer determines the growth and development performance of the Region *vis-à-vis* other countries. The analysis in this section compares the performance of Caribbean education with that of the East Asian Newly Industrializing Economies (NIEs), Hong Kong, the Republic of Korea, Singapore, and Taiwan, the Four New Asian Tigers; or *emerging* East Asian Newly Industrializing Economies (NIEs), (Indonesia, Malaysia, the Philippines and Thailand), Japan, the United Kingdom (UK) and the United States (US). The Caribbean countries chosen for this analysis are Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Suriname and Trinidad and Tobago.

The approach in this section is to review the performance of the Caribbean *vis-à-vis* the comparator countries using several education and education-related indicators. These are:

(i) Ratio of total public sector expenditure on education to GDP.

(ii) Total public sector expenditure on education as a proportion of total government expenditure.

(iii) Percentage expenditure of *per capita* income at the primary, secondary and tertiary levels.

(iv) Average gross enrolment at the secondary and tertiary levels.

(v) Average net enrolment at the secondary and tertiary levels; and

(vi) Review of the composition of the labour force in terms of education attainment at the primary, secondary and tertiary levels.

There are clearly gaps in the data which for reasons of availability focuses mainly on the period 1999 to 2004. Nevertheless, the data is adequate enough to permit a fairly good picture of where the Caribbean Region stands in relation to the comparator countries.

The average expenditure on education as a percentage of GDP for the period 1999 to 2004 for this group of Caribbean countries was 6.5 per cent of gross domestic product (GDP). If one excludes St Vincent and the Grenadines in which expenditure estimates during the period can be considered surprisingly large, the average was 5.6 per cent. This was larger than the average (4.1 per cent) for three East Asian NIEs (Hong Kong, Republic of Korea, Singapore) and for the developed countries (4.6 per cent) but somewhat smaller than the average for Malaysia and Thailand. In the absence of data on private sector spending, the conclusion can be that, given the public sector expenditure levels of comparator countries, Caribbean public sector spending on the education sector has been adequate, all other things being equal. This issue is discussed in greater depth in *Section V* on education funding and the experience of the high-performing Asian economies.

Interestingly enough, however, the ratio of public spending on education to total Government expenditure, which can be interpreted as an indicator of the importance governments attach to education, was lower in the Caribbean than all the comparator countries except the group of developed countries.

Similarly instructive is comparison of the percentage expenditure of *per capita* income on students at the primary, secondary and tertiary levels, particularly the latter two. In the case of primary school expenditure, average Caribbean expenditure as a percentage of *per capita* income at 17 per cent was more than all the other comparator countries except the group of developed countries. Caribbean expenditure per student at the secondary level also compared quite favourably. At an average of 20.1 per cent, it was higher than the average for Hong Kong, the Republic of Korea and Malaysia and also close to the More Developed Countries (MDCs) average of 20.5 per cent. The average for Malaysia and Thailand was approximately one percentage point below that of the Caribbean. At the tertiary level, where the data is particularly sketchy, the Caribbean average of 123.5 per cent for the five countries (Barbados, Belize, Guyana, Jamaica, Trinidad and Tobago) for which data is available, was substantially higher than that of the East Asian NIEs, Malaysia and Thailand and also the group of developed countries. Without Belize, which had the highest figures for the Caribbean group,

the estimate for the tertiary level falls to 70 per cent, somewhat above the average for Thailand and Malaysia and still significantly above the average of the East Asian NIEs and the More Developed Countries (MDCs). Once again, the analysis suggests that from the point of view of international comparability, the problem of Caribbean education lies not in the level of public sector expenditure.

It is in the area of enrolment that one begins to witness some divergence between the Caribbean and the comparator countries. The average gross enrolment at the secondary level for thirteen Caribbean countries for the period 1999-2004 was 88.9 per cent. This is comparable to the average for three East Asian Newly Industrializing Economies (NIEs) – Hong Kong, the Republic of Korea and Singapore. It is significantly above the average for Malaysia and Thailand but far below the average of 116.9 per cent for the three MDCs.

As regards net enrolment, the Caribbean performance was relatively weaker. The average of 72.7 per cent was substantially below the average of Hong Kong and South Korea although it should be pointed out that the Caribbean average was close to that of Hong Kong and that it was the high enrolment ratio of South Korea that made a significant difference. In the case of the MDCs, the average collectively and individually was substantially above that of the Caribbean. Only the Barbadian, Dominican and St Kitts net enrolments approximated those of the More Developed Countries (MDCs) implying that in several Caribbean countries, enrolment levels will have to rise further in order to reach what are now emerging as the international norms.

It is at the tertiary level that the difference between the Caribbean and the comparator countries looms very large. For the period 1999 to 2004, gross tertiary enrolment for seven Caribbean countries averaged 9.3 per cent compared with an average of 30.6 per cent for Hong Kong and 80.8 per cent for South Korea. In Malaysia and Thailand, the averages were 27.4 per cent and 37.5 per cent, nearly three and four times that for the Caribbean. Japan, UK and the US averaged 49.7 per cent, 60.4 per cent and 76.4 per cent respectively.

Emerging from the analysis is a twofold challenge for the Caribbean:

(i) Need to achieve higher enrolment (and throughput levels) at the secondary and tertiary levels, and particularly the latter; and

(ii) Need to achieve education sector reform to deliver the increased output without significant increases in expenditure, given fiscal constraints.

The strategies in comparator countries that permitted significantly higher out-turns at the secondary and tertiary levels with comparable levels of public sector resource use, as in the Caribbean, are worthy of consideration.

The output of the education system in the various countries clearly has had an impact on the skills mix of the labour force and on the ability of countries to compete internationally. In this regard, a review of the education levels of the labour force in the Caribbean and in comparator countries is very instructive. For example, on the one hand, in the three Caribbean countries for which data are available (St Lucia, St Vincent and the Grenadines and Trinidad and Tobago), an average of 53.8 per cent of the labour force had only primary education, ranging from 41.7 per cent for Trinidad and Tobago for the period 1991-99 to 66.9 per cent for St Lucia. On the other hand, the averages for South Korea and Singapore for the period 1991 to 2001 were substantially less, 16.2 per cent and 24.0 per cent respectively. For Japan and the UK, the averages were 20.1 per cent and 20.9 per cent (1994-2001) respectively.

As regards secondary education, the Region fared somewhat better with an average of 41 per cent (1991-99) compared with 42.6 per cent and 28.8 per cent for South Korea and Singapore (1991-2001) respectively. For Japan and the UK, the averages were 49.1 per cent and 46.5 per cent (1994-2001). The international norm for secondary level training at this time, at least for the successful countries, seems to hover between 40 per cent and 50 per cent.

At the tertiary level, one sees again a significant divergence between the performance of the Caribbean and the comparator countries. For the Caribbean, the average of the labour force with tertiary level training during 1991-99 was 10.5 per cent. This was approximately half that of the South Korean average of 20.2 per cent and approximately one third of the Singapore average of 33.0 per cent (1991-2001). In the case of the UK and Japan, the averages were 24.1 per cent and 30.8 per cent (1994-2001).

The foregoing comparative estimates help to define the position of the Caribbean in terms of the international competitiveness of the labour force, and indicate the need to embark on strategies to close the gaps in labour force skills particularly at the secondary and tertiary

levels. The Caribbean needs to change the structure of the labour force by training a significant portion beyond the primary to the secondary level, an estimated 20.0 per cent, so as to approximate the norms of more successful countries in terms of the proportion of the labour force trained up to the primary level. It also has to make comparable attempts to close the gap at the tertiary level. Indications are that the Caribbean will need eventually to at least treble the level of output at the tertiary level. A sustained effort over the next decade can lead to a substantial change in the skills profile of the labour force, an absolute necessity if the Caribbean is to regain some of its competitiveness. These are major challenges and will require additional resources and a significant reordering of current spending priorities in the education sector.

While the data above indicate the direction which the Caribbean should take in terms of upgrading the labour force, recent developments in labour force training also indicate movement towards greater focus on specific skills, both technical and behavioural, needed for increased productivity and international competitiveness. In the literature, these are generally referred to as ‘critical enabling skills’ or ‘core competencies’. Technical skills by themselves are no longer considered adequate. The workplace also requires certain behavioural skills deemed necessary for effective and efficient fulfilment of a task. If the Caribbean is to close the performance gap, this implies retraining of the current labour force and new perspectives and strategies of training at the primary, secondary and tertiary levels.

SECTION II. SKILLS UPGRADING OF THE CARIBBEAN LABOUR FORCE

A skilled workforce is necessary to enhance innovation activity in the Region together with adoption and adaptation of new technologies, critical to increased regional competitiveness and improved economic performance. It is a prerequisite for regional competitiveness in markets that require products of increasingly higher quality. Increased training of the labour force would make the Caribbean Region more competitive as a place for international investment through reduced start-up costs and improved availability of skills. It would also enhance the flexibility of the workforce, facilitating quicker movement from sunset to sunrise industries, thereby reducing the economic and social costs of adjustment.

Efforts to improve the skills of the labour force within the Region, however, must include certain vital components.

• ***Firstly,*** the new training initiatives must focus substantially on the issue of relevance if efforts are to be effective and resources not wasted. (i) Increased training must be informed by market demand to ensure employability and minimize resource wastage and leakage of skilled labour to other economies. This means being constantly aware of the skills requirements of the economy. (ii) Policy-makers, educators, the private sector and members of the workforce must be able to update themselves constantly on the changing demands of the market place. (iii) Initiatives in this regard must be institutionalized with the inclusion of important stakeholders (government, private sector, unions) to ensure that this is so. (iv) Collaboration in the establishment of a regional labour market information system, of regional institutions for evaluating and monitoring labour force training must be critical components of the Region's response to globalization.

• ***Secondly***, just as important will be an environment that is conducive to increased investment by all stakeholders in the upgrading of the labour force. In this regard, government policies (provision of subsidies, tax credit to companies for training etc.) and legislation (for example, minimum mandatory training of members of the labour force) have a very important role to play. This, of course, is in addition to the need for economic policies that lead to increased demand and rewards for the additional training.

• ***Thirdly***, the training system must be dynamic, that is, flexible enough to respond to the changing demands of the marketplace since old jobs are being displaced and new job opportunities are being created continuously. This will imply, for example, a change in emphasis within current modes of training towards a more activist approach to human resource development (HRD). For example, greater emphasis on short courses geared towards development of specific sectors, such as the informatics industry or other niches in the outsourcing industry, may become increasingly necessary. In this regard community colleges, polytechnics and other institutions will likely have a much more significant role to play as has been the case in East Asia.

Additionally, enhanced flexibility requires that the labour force has an education base that enables it to be internationally competitive and also facilitates quick movement into new types of work as opportunities emerge. Towards this end, the Caribbean Region will have to define key competencies or critical enabling skills. Among these would be a high level of competence in the use of Information and Communication Technologies (ICTs), given its

centrality in the new economic environment. Beneficial participation in the new international economy also requires greater knowledge of mathematics, science and technology. These subject areas therefore must be more fully integrated into the education curricula at all levels and greater numbers of students must gain mastery in the relevant disciplines.

The above-mentioned core competencies of current and future graduates of the education system apply with added force to those who are already in the labour force. The broader definition of core business competencies, of course, goes beyond technical skills to include behavioural characteristics such as interpersonal and leadership skills, innovativeness, sensitivity to customer concerns, self-confidence, the ability to think analytically, etc.

Of course, in the attempt to upgrade and broaden current skill levels, the Region also needs to institute legal and other initiatives to ensure that all members of the labour force have equitable access to the increased training available so as to minimize the possibility of further marginalization of vulnerable groups (women, youth, disabled, poor, unemployed etc.) with the deepening of the globalization process. Also, the resources required for the upgrading of skills will, more than likely, be enormous and require substantial support of all stakeholders and also external resource inflows. In addition to an expanded availability of resources, increased cost effectiveness will be of extreme importance. In this regard, regional collaboration in various areas can make a significant difference.

SECTION III. THE IMPORTANCE OF TECHNOLOGY AND THE ROLE OF EDUCATION

Given the importance of technology in the current globalization process and specifically its contribution to enhanced competitiveness, it is vital that the Caribbean be fully aware of its competitive position technologically *vis-à-vis* other countries. In order to facilitate this analysis, the study uses the approach of Lall (2000, 2001). In his study of the comparative technological development of countries, Lall (2000) focused on the export sector and specifically, the level of manufactured and high-technology exports. Lall argued, quite correctly, that export structures have implications for growth and development. In his review of the pattern of world trade over the period 1985 to 1998, he found that growth in low-technology, low-skill, labour-intensive products (such as, for example, textiles, clothing, footwear, toys, sports and travel goods) was the lowest and that growth in high-technology

products (for example, electronics, pharmaceuticals, semi-conductors, precision instruments) was the highest. The latter, he found, explained to a large extent the dynamic growth of the East Asian NIEs. Lall argued that the dynamism of manufactured exports is an indicator of the strength and transformative power of the industrial sector. In the context of this discussion on globalization, however, one of the most important points is that technology plays a significant role in determining comparative advantage and the pattern of trade, a substantial departure from traditional trade theory in which technology plays no part.

During 1985 to 1998, East Asia accounted for almost 70 per cent of manufactured exports which grew at almost thrice the rate of primary products. Within manufactures, the high-technology component grew fastest. Of the latter, electronics registered the fastest growth. East Asia in 1998 accounted for nearly 90 per cent of all high technology manufacture exports.

As in *Section I*, the comparator countries used are the East Asian NIEs, the New Tigers, Japan, UK and the US. Reflecting a general lack of competitiveness and of dynamism, the average of manufacture exports as a percentage of merchandise exports declined for the fourteen Caribbean countries during 1990-2005 from 46.1 per cent in 1990 to 41.8 per cent in 2005. On the other hand, the average for the two NIEs for which data is available, showed a gradual upward trend over the period, rising from 81.8 per cent to 88.5 per cent. By comparison, the performance of the New East Asian Tigers was even more distinct. While the average for the Caribbean declined, the average level of manufactured exports for the New Tigers climbed steeply, reaching 71.9 per cent in 2005 from an average of 47.6 per cent in 1990. In the case of the group of developed countries the average for the period was more than 80 per cent and quite stable.

The performance of the Caribbean, *vis-à-vis* the comparator countries with respect to high technology exports, is even starker. On the one hand, the Caribbean average was less than 10 per cent and, for the most part, trended downwards. On the other hand, the average for the NIEs for which data is available (Hong Kong and Singapore) was substantially higher, generally more than six times that of the Caribbean, and trended upwards. In the case of the New Tigers also the technology gap with the Caribbean, as defined by the average level of high-technology exports, has been substantial, and has widened with the continuing expansion in the former countries. In the case of the group of developed countries, the percentage of

high-technology exports remained fairly constant over the period, hovering between 25 per cent and 30 per cent.

Two important conclusions emerge from the foregoing analysis. The *first* is that, using manufacturing exports and specifically the level of high-technology manufacturing exports as an indicator, the technological gap between the Caribbean and other countries in the sample widened during the sample period. There are essentially two reasons for this – the relative stagnation in technology development in the Region and the continuing rapid technological development in the comparator countries. The *second* important conclusion is that Caribbean manufacture export performance will decline further unless the Region is willing to make the technological upgrades (human and material) necessary to remain competitive.

1. Key elements of a technology development strategy for the Caribbean

Given the foregoing discussion, there is little doubt about the need for the Caribbean Region to forge ahead with the development of a robust technology policy if it is not to remain on the margins of world economic growth and development. Lall (1993) gives a very clear and persuasive exposition of the importance of technological development in the context of globalization.

> "Competitive advantage in world markets only to a minor extent is determined by factor endowments (in the neoclassical sense of given stocks of labour and capital.) Other factors, related to technological leads and lags, economies-of-scale and product differentiation and the location decisions of transnational corporations have a far more powerful impact; much of the empirical research on trade patterns supports the neo-technology version of comparative advantage theory" (Lall, 1993, p. 104).

These are views shared by others such as, for example, Chang and Tsai (2000) and Mytelka (2000). According to Mytelka (2000), "comparative advantage is based less on the static of comparative advantage than on the dynamics of innovation". (Mytelka, 2000, p.16). This is a view that dates as far back as the German economist, Frederich List (1841) who placed technology at the centre of the strategy for catching up with the then leader of the industrial world, England.

First, this does not imply immediately embarking on massive R&D expenditures in order to develop cutting edge technologies, but rather becoming aggressively engaged in the mundane tasks of incremental innovations in current industries and gradual development of regional innovative capability. Innovation here is defined very broadly to include improvement in product quality and processes (including changes in management) across all sectors (agriculture, manufacture, services) rather than exclusively the generation of new products or processes. This incremental process of technological development together with a considerable amount of adaptation and imitation was very much a contributor to the growth of the NIEs in the early stages of their phenomenal economic growth (Mytelka, 2004, p. 390).

Secondly, the Region at this time needs to pursue effective and cost efficient *technology transfer* strategies – [as Wade (2003) notes, however, because of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and the Agreement on Trade-Related Investment Measures (TRIMS), *technology transfer* has been made more costly and difficult; some countries are addressing this issue through the development of R&D partnerships] – that can enhance indigenous technological capability here defined as "the total of technical, managerial and institutional skills and infrastructure enabling the efficient use, adaptation, enhancement and creation of new technology both at the firm and national levels". (Wie, 2005. p 215). This can, in part, be achieved through careful selection of imported technologies and modes of transfer (foreign direct investment, equity participation of Multinational Corporations (MNCs), licensing, joint ventures, management contracts, international subcontracting, technical consultancies etc.). The preferred method of transfer will depend, among other things, on government's technology policy, the sophistication of the imported technology, the speed of technological change and domestic/regional technological capabilities such as, for example, the local supplier and technical service network. For a more comprehensive discussion of the variables impacting on the mode of technology transfer, see Lall (1993).

Thirdly, development of indigenous technology capability will require, as part of a system of innovation, a number of key institutions. These include training and industrial institutions, technology extension services, laboratories, research centres, quality control centres, especially for Micro and Small Enterprises (MSEs), given their predominance in the Region and their limited capabilities. For purposes of cost effectiveness, the spreading of risks and

the boosting of innovation activity, this may require in some cases the development of regional rather than separate national capabilities.

A review of the adequacy of the institutional infrastructure at the regional and domestic levels is clearly warranted.

Fourthly, the Region will require formulation of appropriate policies (macroeconomic, domestic competition regime, labour markets, industrial, trade, and other policies) to provide the necessary incentive framework for technology development. For example, a stable high-growth economy provides substantial impetus to technological investments. So does a competitive environment.

Effective public policy will, very importantly, at times require judicious interventions in cases of market failure (such as a lack of required skills, of venture capital, high uncertainty, risk etc). [For interesting examples of successful government intervention supporting technological development through the establishment of venture capital, see Weiss, 2006, pp. 93-94].

Also, in the context of resource scarcity, this will likely require targeting the development of specific industries as the East Asian NIEs have done so successfully. To facilitate this, several countries (i.e. Singapore, UK) have engaged in fore sighting (essentially a brainstorming process) to enable identification of the sectors to be targeted for further development. Generally, this exercise has involved a wide cross section of stakeholders (representatives of industry, government, universities etc.), an important strategy for ensuring consensus and buy-in as regards the implementation process.

Fifthly and very importantly, the targeting of specific industries for development (as for example, the semiconductor industry in Taiwan, the steel, shipping and electronics industries in the Republic of Korea or the robotics and computer industries in Japan) implies targeted development of the required skills within the education system to ensure their availability in the implementation process. Two very important facts have emerged from the Japanese and East Asian NIE approach to skills and technology development. First, there has been a substantial emphasis in all of these countries on vocational training. Second, increasingly, tertiary education in science and engineering became the focus, given its importance to

research and development, to the maintenance and further enhancement of their competitive position. These are paths that clearly the Region will have to follow if it is to even consider closing the technological gap between itself and these high performers in the world economy. This will require quite a significant reorientation in post secondary and tertiary education policy. Without this new science and technology focus, serious efforts at regional technological development will likely be severely constrained. The university-industry link in particular is regarded as one of the major contributors to technological development. See Mytelka (2004) and Saad and Zawdee (2005). For example, the National Chiao-Tung University has since 1964 made semiconductor technology the main focus of its curriculum. Today, the semiconductor industry is well established in Taiwan and is one of its most competitive exporters (Chang and Tsai, 2000).

Even more important is the general establishment of a close link between national technology policy and industrial and educational policy. According to Mytelka (2000), "education and training are the foundation upon which local competencies are built and R&D provides the basis for continuous innovation". (Mytelka, 2000. p. 27).

SECTION IV. USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTs) IN HUMAN RESOURCE DEVELOPMENT (HRD) IN THE REGION

1. Advantages of ICT-based training

In this section, ICTs are defined to include radio, television (old ICTs), fixed and mobile telephone, fax, computers, CD-ROMs satellites and the Internet (new ICTs). This is a definition used by the Department For International Development (DFID) and UNESCO. (See Sanyal, 2001. p. 10; DFID, 2001. p. 13). The question may be asked quite rightly, "Why the topic of ICTs in HRD?" This can be answered simply by the numerous advantages associated with the use of ICTs. These include the possibility of accelerating the pace of training through the ability to reach simultaneously large numbers of students. A very good example of this is *Telesecundaria* in Mexico which is largely television-based but is migrating towards the use of some of the new ICTs. (Sanyal, 2001, p. 14; DFID, 2001, p. 16).

The broad outreach of ICTs is evidently an important consideration for the Caribbean where substantial numbers of the population at the secondary and tertiary level have to be trained if

the Region is to close the skills gap with the comparator countries' economies. Also, there is the substantial issue of the re-training of the labour force, a major and continuous undertaking. Time savings and cost effectiveness, flexibility in the learning process with respect to time and place, the possibility for group and institutional collaboration across countries and continents, increased access to information, the establishment of school networks for the sharing of information, of teaching best practices, teacher training and facilitation of learning by the disabled are additional and important advantages which use of ICTs offers. For a discussion of some of the considerable cost savings and other advantages of E-learning, in particular, see Capper (2001) and Moses (2001).

ICTs offer the possibility of increased effectiveness in the training process as a result of the potential for increased teacher creativity in the use of multimedia (text, sound, images, and video) which provide a varied and effective learning experience. ICTs are also being used effectively for distance vocational training, for the training of unemployed youth and for adult education (nonformal education; lifelong learning) as, for example, in India. Given the foregoing attributes of ICT-based training, and the substantial challenges facing the Region, much greater use of ICT-based training is an option which clearly the Region must explore and pursue where appropriate.

2. Issues with respect to the use of ICTs for HRD

2.1 High infrastructure costs

While ICT technology has significant advantages, it also has disadvantages of which the Region must be aware. For example, there is the problem of high infrastructure and other costs, particularly in the case of the new ICTs (cost of computers, broad band infrastructure, payments to Internet service providers, training, operations, maintenance and service costs). This is an important consideration particularly in the context of the stringent fiscal circumstances facing several Caribbean countries because of high debt. However, the likelihood is that in the not too distant future, due to several initiatives such as the SIMPUTER (Simple Inexpensive Multilingual People's Computer) in India, the cost per computer for use in schools will fall perhaps drastically. So also will the cost of broadband technology even as its capability increases. Additionally, governments worldwide have been able to obtain substantial resources from the donor community and also from the international private sector. Furthermore, while within the context of the need to train the workforce in the

use of the new technologies, it would be preferable for the Region to use as early, and as much as possible, the new ICTs, for example, radio and television are still the cheapest of the ICTs (DFID, 2001, p. 13; Ruth and Shi, 2001, p. 36).

The Region can make greater use of both of these old generation ICTs, at least initially, and over time migrate to the newer technologies as many countries such as, for example, India and the Republic of Korea, have done. The issue is not one of old versus new technologies but rather one of appropriateness, given the specific circumstances. While there is a choice of technology, there is not much choice with respect to the training responsibilities and to time.

2.2 Resistance of teachers

Another major issue which the Region will likely have to confront in the attempt to expand use of ICTs is the possible resistance of the teaching profession (professors, head teachers, teachers etc.) who, because of the productivity of the new technology, may be afraid of becoming redundant (Adria and Rose, 2004, p. 54).

The experience so far in countries that have embarked substantially on ICT-based training, is that redundancy has not become an issue. In fact, countries are attempting to train as many teaching staff as possible at all levels, primary to tertiary, in the use of the new technologies, so as to enhance teaching effectiveness. What is emerging is that over time, the role of the teacher is likely to change from one of being responsible for the 'passing on of knowledge' to one of 'facilitation and mentoring', giving students the tools and helping them to learn.

2.3 The digital divide

An important issue which the Region will have to address in the process of using the new technology, is the possibility of increasing the digital divide (urban-rural; high-income – low-income; male-female; able-disabled). In many countries that have embarked on ICT-based training, there is substantial concern about the possibility of leaving some students behind because of inadequate access to the new technology. This is very much a policy matter and will have to be addressed in the roll out of the new technologies. Countries in the Region will have to explore options specific to their circumstances.

3. The importance of the training of teachers and others

The discussion here focuses on the use of the new ICTs on the assumption that the Region is familiar enough with the use of radio and television for education purposes. Clearly, of great importance is the availability of the necessary infrastructure (computers, access to broadband, printers, telephones, etc.) which has been discussed above. Increasingly, however, the realization is emerging that while the physical infrastructure is important, even more important is the training of teachers and of trainers of teachers – faculty in teacher-training colleges – in the use of the new technologies. The disappointments that have so far emerged in attempting the use of the new ICTs almost invariably reflect the inabilities of teachers to use the new technologies because of inadequate training. Professional development of teaching staff at all levels is critical to success. Increasingly, ministries of education are requiring training in ICTs for teacher certification. (i.e. Australia, Holland, India, Japan, Malaysia, the Philippines, Singapore, South Korea and the US).

There can be regional ICT-based training initiatives (Distance Learning – pre- and in-service) for teachers to accelerate substantially the training of qualified teachers regionally. Distance Training (in-service) for teachers has the very important advantage of reaching very large numbers (scale economies) and reducing the cost of training by leaving the teacher in the classroom.

Ministries of education have realized that the training of administrative staff also in the use of ICTs can yield substantial benefits in terms of reduced cost and other efficiencies of administration together with the provision of moral and practical support to teachers (Sanyal, 2001, p. 12).

Additionally, the training of maintenance and service personnel for the new technologies is recognized as an important requirement. In fact, in some cases, teachers themselves are being trained in the maintenance and servicing of the equipment.

4. Production of software

In addition to training inadequacies, an area of significant deficiency in the new technology-based approach to teaching is inadequate production of appropriate, high-quality teaching software. This will require the necessary training and institutional infrastructure to facilitate

the desired results. It is an initiative that the Region for reasons of cost effectiveness, can pursue collectively, since essentially the same curricula are used, for example, at the secondary level.

Increased use of ICTs is critical to accelerating the pace of HRD in the Region. However, to do so successfully, the Region will need to be committed, focused and possessed of a deep sense of direction in order to prevent unnecessary resource waste and policy incoherencies. Regional and national policies can give *coherence and focus* to initiatives. The Region also needs to refocus its education content to ensure relevance. Teaching irrelevant or marginally relevant content cost effectively to large numbers of students is pointless. Finally, increased use of ICT-based training should not be restricted to the education system, but expanded to include every type of training and retraining where possible.

SECTION V. THE STRUCTURE OF FUNDING FOR EDUCATION AND OTHER RELATED ISSUES: WHAT THE CARIBBEAN REGION CAN LEARN FROM HIGH-PERFORMING ASIAN ECONOMIES

Among the most difficult challenges facing Caribbean education is the question of funding. If not properly addressed, regional attempts to confront successfully the challenges of globalization will be less than adequate, impacting economic growth and development for years to come. In this regard therefore, it would be useful to review the best practices of the more successful economies. The experience of the High-Performing Asian Economies (HPAEs) offers a rich menu of options from which the Caribbean can learn. [The HPAEs discussed in this paper are the four East Asian NIEs (Hong Kong, the Republic of Korea, Singapore, Taiwan) and Japan].

One of the important findings in the literature on the HPAEs is the considerable emphasis placed on social expenditure. Rao (1998), for example, in his study of Japan, South Korea, Singapore and Taiwan, noted that the share of social expenditure in public spending in the HPAEs was significantly higher than other Asian countries, and according to Mundle (1998, p. 662) almost twice that of the OECD countries

Rao (1998) noted that allocations to the social sector during 1970-94 generally varied from one quarter to two thirds of government expenditure with education in some cases receiving more than one half. The emphasis on social expenditure is important because it underscores

the priority given not just to the development of skills but also to social welfare (health, housing, community services etc). Social welfare is important as a value in, and of, itself. It is also an important contributor to the productivity of human capital.

The *second* important finding has been the emphasis on the funding of basic education, namely education from primary to lower secondary which comprises nine years – six years in primary and three years in lower secondary. (De Ferranti *et al*., 2003, p. 17, Mingat, 1998, pp. 698-99). In all of the HPAEs, governments have been the dominant provider of basic education which they saw as critical to the provision of skills and increased productivity especially in the early years of their rapid economic growth. In fact, in China, Hong Kong, Japan and Taiwan, and the majority of East Asian countries, basic education is compulsory (Tilak, 2002, p. 23; UNESCO, 2007, p. 6).

The *third* notable feature of education funding among the High-Performing Asian Economies (HPAEs) was the significant 'dilution' of government involvement beyond basic education. In many countries, with the exclusion of Singapore, the private sector, including the household sector, became a much larger provider of education funding if not the major provider. In Taiwan, private schools account for the majority of training at the secondary and tertiary levels. For instance, in 1986, close to 60 per cent of students in senior secondary attended private schools and almost 80 per cent attended private junior colleges. (Woo, 1991, p. 1035). In Japan in 1993, private funding accounted for 40 per cent of secondary education and 60 per cent of higher education. It is important to note two facts, however. The *first* is that in several cases, governments provided subsidies to private schools, though these were significantly less than the subventions given to public schools. *Secondly*, in the interest of equity, the participation of the private sector was buttressed by student scholarships, loans and other measures to ensure access to the poor.

The movement away from government financing of higher education in recent years has accelerated with the new emphasis on privatization and corporatization at the tertiary level. Universities are now increasingly required to manage their financial affairs as corporations while governments reduce their subventions (Mok, 2006, p. E-254). Universities, therefore, now have to pursue innovative forms of financing (selling research output to industries; consultancy services; computer services; training and research contracts; running of commercial establishments etc). (Tilak, 2002, p. 33).

Another important issue in education in the HPAEs and one of substantial relevance to the Caribbean is the emphasis on technical and vocational education. This was clearly one of the priorities of the HPAEs and one of the reasons for their economic success. There has been a proliferation of polytechnic, vocational schools, technical institutes and colleges. Student enrolments in technical and vocational education especially at the senior secondary level, while having declined in recent years, generally varied between 10 per cent and 33 per cent among the HPAEs in the early nineties, substantially higher than in developing and developed countries. (Tilak, 2002, p. 26; Muddle's estimate of 40 per cent for the HPAEs is substantially higher, see Mundle, 1998, p. 664).

In Taiwan, the student allocation to vocational schools, guided by the requirements of the Manpower Development Plans, in some cases reached beyond 50 per cent. This meant, for example, limiting the number of students allowed into universities (Woo, 1991, pp. 1033, 1041). The Republic of Korea under its Vocational Training Act of 1976 made it compulsory for companies to finance vocational training programmes. In Japan, trans-national corporations have also provided financing through skills upgrading of their own employees. In the Caribbean while there is still a sizeable manufacturing sector and complaints about the lack of skills at all levels and/or about the quality of skills, the Region continues to pay inadequate attention to the development of technical and vocational education which is critical to the survival and advancement of industry.

With respect to the quality of education, there is little doubt that the HPAEs have done very well, ranking among the top five to ten countries in international competitions of their students with respect to mathematics and the sciences, and outranking many of the developed countries (Lall, 2001, p. 28).

While some may argue that this is by no means fully representative of the quality of education output in these economies, the fact is that internationally, these economies have been able to compete very effectively over the last three decades as indicated by the steep rise in exports from the Region and particularly the rise in high technology exports. There can be little doubt therefore about the quality of skills. There is, however, some conflict in the literature as to how the HPAEs have attained such high levels and quality of educational output.

There are two hypotheses, both of which arguably, have some validity. Generally, low student/teacher ratios are accepted as an indicator, albeit somewhat crude, of the quality of education. UNESCO (2003) reports, for example, that in East Asia, student/teacher ratios in the primary sector at 21:1 are almost half that of South and West Asia. (UNESCO, 2003, pp. 61-62).

Tilak (2002) also supports the hypothesis that low student/teacher ratios have been an important contributor to the quality of education in the HPAEs. However, he further notes the importance of teacher training, of significant expenditure on good teaching and learning materials (textbooks, audio visual materials etc.). Mundle (1998), on the other hand, while conceding that low student/teacher ratios in recent years have been an important contributor to the quality of education, has argued that student/teacher ratios in the earlier decades averaged more than 40 at the primary level and close to 30 at the secondary level. He argues that at that time quality was maintained by high teacher salaries relative to average incomes, facilitating the attraction of high quality personnel to the teaching profession, the maintenance of quality output despite high student/teacher ratios and the lowering of cost per student (Mundle, 1998, pp. 665-66).

Two additional issues which the High-Performing Asian Economies (HPAEs) have had to confront as part of educational funding policy are *equity and efficiency*. As regards equity, to a large extent governments have addressed the issue through the use of government funding of basic education (primary and lower secondary). At the higher levels, while there has been a lessening of public expenditure, the issue of equity has been addressed essentially through the use of merit- and means-based scholarships, grants and loans.

In the discussion of the financing of the education sector, there has also been substantial concern about efficiency, an issue to which the Caribbean needs to pay substantial attention especially within the context of fiscal stringency. Generally, there are two indicators of efficiency that have been used, the: (i) social returns to investment in the sector; and (ii) cost per unit of output.

The *first* is used to explain the emphasis of government spending in the HPAEs on primary and lower secondary education where the social returns empirically have been found to be high relative to expenditure on senior secondary and tertiary education. This argument has been used also to explain governments' greater willingness to allow private financing at the

higher levels where the private returns are high but where the social returns are generally lower. Estimates of social returns to investment have also been used to explain the emphasis on vocational and technical education as opposed to tertiary education (Tilak, 2002, p. 26). From the point of view of allocative efficiency, governments of the HPAEs are considered to be quite successful in terms of the structure of expenditure on education.

As regards the *second* criterion, that of per unit costs, the claim to efficiency is somewhat more muted. It is generally agreed that the private sector in terms of per unit cost has been more efficient in the delivery of education output. This has to some extent been countered by concerns about lower quality at private as compared with public institutions. In this regard, there is clearly an important policy conclusion – that the private sector can be used to enhance cost efficiency. However, private sector involvement needs to be accompanied by adequate monitoring to ensure the delivery of quality.

For the Caribbean, another very important lesson to note is the fiscally conservative framework within which the HPAEs were able to achieve high quantities and quality of training. Overall budgetary balances were low, resulting in very low levels of public sector debt. In addition to private sector financing, an important strategy for achieving this outcome was expenditure constraint. The governments of high-performing Asian economies were able to achieve this through considerable pressure on wages, salaries and other forms of public sector consumption. This permitted the generation of substantial current account savings which governments used to finance capital expenditure. For example, current account savings in Japan averaged 9.3 per cent of GDP during 1970-92 and more than 10 per cent of GDP in Singapore during 1980-92. (Rao, 1998, p. 678, p. 683). Fiscal stringency was central to the goal of macroeconomic stability which was seen as critical to economic growth. Price stability facilitated growth in savings and investment and kept exports competitive, a strategy central to the economic success of the HPAEs.

SECTION VI. CONCLUSION

The foregoing discussion focused on the requirements of the education sector's response to the challenges of globalization. Of course, the sector does not exist in a vacuum. It impacts on, and is impacted by, what goes on in the macroeconomy. Of great importance, demand for human resource development (HRD) will to a large extent depend on domestic and regional absorptive capacity. Accordingly, it is crucial that training targets do not take place in a vacuum but rather keep pace with economic demand.

The insertion of greater quantity and quality of skills will impact economic growth and in so doing in turn impact the level of demand for skills. Perhaps one of the great lessons, if not the greatest lesson of the East Asian Miracle, is exactly this: "That these countries through emphasis on upgrading their human resource base, initiated a dynamic virtuous circle from which they have benefited for decades".

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NB: Paper presented at the UNESCO Forum on Higher Education, Research and Knowledge. 2nd Regional Research Seminar of the Scientific Committee for Latin America and the Caribbean, Port of Spain, Trinidad and Tobago, 19-20 July 2007.

[Disclaimer: The views expressed in this Working Paper are those of the author and do not necessarily represent those of the Caribbean Development Bank (CDB) or its policy].

Keynote Address

Research and higher education policies for transforming societies: perspectives from the Anglophone Caribbean

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I. INTRODUCTION

Honourable Hazel Manning, Minister of Education, Honourable Mustapha Abdul-Hamid, Minister of Science, Technology and Tertiary Education, Mr Kwame Boafo, Director of UNESCO, Caribbean, Professor Hebe Vessuri and Distinguish Colleagues All, the organizers of this Research Seminar have afforded me the signal honour and privilege of delivering the opening address at this august Conference at which all participants are stars in their own constellation. As one who has recently retired after thirty-four years in the Higher Education, Research and Policy Arenas this is certainly one of the last occasions where one can still speak while being mildly relevant. However, I must confess that there is a freedom that comes from having no institutional connections and this is becoming a source of enjoyment.

My letter of Invitation stated that this is the second time around for the discussion of this Theme, the first being in Brazil in September 2004. It further stated that hosting the Conference in Trinidad and Tobago was to ensure increased participation by Representatives from the Anglophone Caribbean. Therefore, with only slight apology I have adjusted the title of this address to 'Research and Higher Education Policies for Transforming Societies: Perspectives from the Anglophone Caribbean', being assured that the Latin American perspective would have been fully aired in the first Conference. The Anglophone Caribbean is often invisible in reports and conclaves under the rubric of Latin America and the Caribbean; hence there is justification in invoking the concept of 'home advantage' in making this adjustment.

Alfred North Whitehead (British mathematician, logician and great philosopher of both science and education) in his book 'Conceptual Activity', declared that if you wanted to know

where any system of electrons would be in the future you needed to know two things about that system. *First*, you needed to know the previous history of that system of electrons and *second*, the dynamics forces that were operative on the system at the current time. From these two vectors it is possible to plot its future course. This general principle seems to have validly not only for the movement of sub-atomic particles but also for plotting the future of social systems. If we are to follow Whitehead's dictum then the task of this address, and the Conference, is to:

1. ***Take*** careful note of the historical development of higher education and research in the Anglophone Caribbean.
2. ***Identify*** the dynamic forces demanding transformation in contemporary Anglophone Caribbean societies.
3. ***Identify*** the mix of policies that should guide higher education and research if they are to contribute constructively to the transformation of these societies.

II. THE HISTORICAL DEVELOPMENT OF HIGHER EDUCATION IN THE ANGLOPHONE CARIBBEAN WITH CONTRASTS TO THE HEMISPHERE

The first university to be established in the Americas was the University of Santo Domingo [*Universidad Autónoma de Santo Domingo* (UASD)] in 1538 when the Vatican issued the Charter to train priests from Spain to engage in the evangelization of the Americas. By the end of the eighteenth century seven other universities had been established in Latin America. Between 1821 and 1833 ten additional universities were established.

The North American and Caribbean colonies of Britain were started around the same time in the second and third decades of the seventeenth century. In the North American colonies nine universities were founded before the Declaration of American independence in 1776. However, up to the end of the eighteenth century not a single college had been established in the West Indian Colonies.

It was not until 1830, nearly three hundred years after the founding of the University of Santo Domingo and nearly two hundred years after the founding of Harvard in the US, when the first college, Codrington in Barbados, was established in the Anglophone Caribbean. Its mission was to train Anglican priests. Between 1830 when Codrington College was established, and 1948 when the University of the West Indies (UWI) was founded, there were

ten small colleges training teachers, five even smaller colleges training ministers of religion, a few schools of nursing and two colleges training agriculturalists. This very meagre provision constituted the entire tertiary level capacity in the sub-region.

Heuman (1981) explained the lethargy in building an indigenous capacity for higher education in Jamaica, and the very modest capacity that was built, on the grounds that by restricting its size and structure, the colonial administrators justified the recruitment of British officials, technocrats and professionals into the Region. Put another way, it created a dependence on overseas recruitment of top managers, technocrats and professionals and consigned to those born and brought up in the colonies the lesser positions in the society. In addition, the recruitment of Europeans was seen by the local planter and administrative elite as one means of bolstering the declining numbers of Whites in the colonies.

It was adult suffrage, representative government and political independence in the second half of the twentieth century that provided both the impetus and need for expansion and diversification of higher education in the Anglophone Caribbean. The first response was the establishment in 1948 of the University of the West Indies (UWI) as a teaching and research institution, through regional cooperation. The thinking at that time was that no country could afford to establish a university on its own. Hence regional cooperation was used as the means of establishing a University while national governments expanded or established single or multi-disciplinary colleges to address the functional needs of the countries for teachers, technicians, agriculturalists, nurses, medical technicians, and various business related occupations. Until 1995 the only country that departed from this general pattern in Anglophone Caribbean was Guyana, which established the University of Guyana (UG), Georgetown, Guyana in 1963.

While Governments were following a policy of financing a single regional university and a variety of national colleges funded from the public purse, a new dimension was added to the Caribbean landscape when the Parliament of Grenada in July 1976 passed the Act allowing for the St George's University School of Medicine, Grenada, West Indies, which opened its doors in January 1977. Through a similar arrangement the Ross University School of Medicine began operating in Dominica in 1979. Since then other such institutions, labelled 'off-shore' universities have been established in Belize, St Kitts and Nevis and other countries across the region. The main features of these universities are that they:

- Are physically located in the Anglophone Caribbean.
- Derive their status as universities from Acts of the Parliament of the country in which they are located.
- Are privately owned and funded and are intended to provide profit to their owners.
- Draw the vast majority of the students and staff from outside the Caribbean.
- Are engaged mainly in instruction and only marginally in research.

Given the fact that these institutions are physically located in the Caribbean and derive university status from Acts of Caribbean Parliaments make them 'on-shore' institutions. Ownership, staff and students are essentially 'off-shore'. With the establishment of the Caribbean Accreditation Authority for Education in Medicine and other Health Professions (CAAM-HP) which will accredit these institutions, a strong case can be made that these 'off-shore' institutions are now definitely 'on-shore' and very much a part of the landscape of higher education institutions in the Anglophone Caribbean.

Within the last twenty years another group of universities have started to operate in the Anglophone Caribbean and there was to be no question that they are 'off-shore'. The defining features of these institutions are as follows. They:

- Are universities that are established outside the Caribbean.
- Operate store-fronts in the sub-region or use existing tertiary institutions as sites of their operations.
- Offer programmes to Caribbean students on a fee-paying basis in the countries in which they operate.
- Are subject to very little regulation.

One recent visitor to the Caribbean, commenting on this sub-sector, said that its operations are not far removed from the days of the pirates and the buccaneers.

Over the last decade and a half the Anglophone Caribbean has seen the establishment of several national universities, two faith-based universities, and several public and private university colleges. These include the University of Technology (UTech), Jamaica, 1995, Northern Caribbean University (NCU) 1999, the University of Belize (UB) 2000, the University of Trinidad and Tobago (UTT) 2004, University of the Southern Caribbean (USC)

2006, the College of the Bahamas (COB), University College of the Caribbean (UCC) and the Mico University College (MUC).

The history of higher education in the Anglophone Caribbean has left the sub-region with a mixed bag of legacies. Briefly these legacies can be listed as follows:

1. Apart from the University of the West Indies and the University of Guyana, all other universities serving Caribbean populations are less than fifteen years old. Furthermore, a significant number of the other tertiary institutions are small single-discipline institutions with enrolments of less than 1,000 students each.
2. The Anglophone Caribbean lags behind the rest of the world with respect to its indigenous capacity to provide its population with higher education. Measures to significantly expand higher education capacity within the sub-region are just over a decade in their implementation. In 1995 the Heads of Government agreed to reach a target of 15 per cent of the 18-24 years age cohort with tertiary education, which has not been achieved and itself is well below world norms.
3. The higher education capacity while being limited in quantum, has consistently offered good quality education such that its graduates are internationally competitive.
4. Inability to satisfy the strong demand for higher education within the sub-region. Thirteen of the eighteen countries of the sub-region provide their populations with universal primary and secondary education, while the other five countries offer universal primary education plus upwards of 70 per cent of the school age population with five years of secondary schooling. Accordingly, the Anglophone Caribbean is a fertile recruiting ground for higher education institutions in North America.
5. Long external relationship between high schooling in the sub-region and international matriculation standards, has enabled large numbers of Caribbean nationals to access higher education abroad. This is by no means new. Braithwaite (1971) in his study of colonial Creole society in Jamaica showed that between 1770 and 1820, 229 Jamaicans went to Oxford and Cambridge. The Jamaican practice mirrored a common pattern throughout the West Indian Colonies.
6. Regional cooperation in higher education as manifested by having one of only two regional universities in the world.
7. Heavy reliance on public institutions to provide higher education and relatively weak private sector.

8. Uneven regulatory mechanisms in different countries that only marginally relate to each other thus resulting in weak sub-regional regulation of higher education.

III. THE DEVELOPMENT OF RESEARCH CAPACITY IN THE SUB-REGION

The genesis of research activity in the Anglophone Caribbean can be traced to the establishment of the St Vincent Botanical Gardens in 1765 and the Bath Botanical Gardens in Jamaica in 1779. The mandate to the curators of these gardens to collect, classify and describe native plants and find out their medicinal and other values. Several such botanical gardens were established in other Caribbean Colonies, essentially as one-botanist operations.

The next step in the development of research capacity was the establishment of the Imperial College of Tropical Agriculture, Trinidad and the Farm School, Jamaica in the first two decades of the twentieth century. The staffs of these institutions carried out research into a variety of issues related to agriculture.

However, the establishment of a higher education institution mandated to carry out research over a wide variety of areas dates to the establishment of the University College of the West Indies in 1948 and then the University of the West Indies in 1963. Indeed, the Imperial College of Tropical Agriculture was incorporated into the University of the West Indies as the Faculty of Agriculture.

While the University of the West Indies (UWI) over its nearly sixty years of existence has developed for itself a reasonably good reputation as a research university, the bulk of that research consists of students' projects, thesis, and dissertations and research and publications of staff produced to meet the University's criteria for appointment and promotion. Research conducted by teams of researchers commissioned by public or private entities constitutes a small proportion of the research conducted by the University each year.

The critical observation is that the Anglophone Caribbean has long depended on knowledge generated in metropolitan centres of the Anglophone world that is adopted and adapted to Caribbean circumstances. The generation of knowledge for its own purposes and consumption is relatively recent and the capacity to carry out this research is located largely in a single institution, the University of the West Indies (UWI).

IV. IMPERATIVES DRIVING CARIBBEAN TRANSFORMATION

The Prime Minister of Barbados, the Honourable Owen Arthur, Chairman of the Caribbean Community (CARICOM) in his keynote address entitled 'The Caribbean in the Twenty-first Century' delivered at the Conference on the Caribbean in Washington DC on 19-21 June, 2007 concisely set out the dynamic forces that are literally demanding the transformation of Caribbean societies, the areas which must be transformed and the context in which this transformation is to take place (Arthur, 2007). Let me therefore precise Prime Minister Arthur's presentation.

Prime Minister Arthur listed seven areas in which Caribbean societies needed to be transformed. These were:

1. ***Reorient*** their production systems away from dependence on trade preferences to areas of specialization where there is growing international demand and where our human and institutional capacities allow us to tap into such demand
2. ***Reorient*** their fiscal system to reduce dependence on taxes on trade in an age in which trade liberalization will undermine import duties as a source of revenue.
3. ***Build*** enterprises to world standards from the outset and cause them to look to competition rather than protection as the basis of viability.
4. ***Reorient*** the state so that it becomes more entrepreneurial looking to public/private partnerships to ensure that priority economic and social development take place without worsening the debt profiles of the courses. In so doing it must bring societies fully into the information age; expand investment in education and training; increase investment in health and environment protection; and apply a global focus on the way it conceives its human resource development strategies.
5. ***Engage*** in development strategies deliberately designed to raise the ratio of both exports and private capital flows to GDP. Patterns of resource use of land and labour which have enjoyed the sanction of long usage must now be revised in the context of new and contemporary realities.
6. ***Create*** and sustain an enterprise culture which facilities capital formation for the establishment of new enterprises and the expansion of existing ones.
7. ***Rely*** on open rather than closed systems at both the economic and social levels to generate new opportunities to bring the marginalized into the mainstream of society.

Prime Minister Arthur was at pains to describe the context in which Caribbean transformation has to take place. He listed the contextual factors as follows, the:

- Harsh and confining international environment.
- Relatively short time in which these adjustments must be made.
- HIV/AID scourge.
- Rising crime and violence in several societies.
- Global warming and its impact on costal societies which are highly dependent on tourism.
- Decline in multilateral development finance and donor assistance to the sub-region.
- Profound changes in the global economy and the geopolitical consequences.
- War on terrorism and the new risks to tourism which is so dependent on international travel and the escalating expenditure on security related matters.
- High debt to GDP ratio. Seven of the ten most indebted countries of the world are located in the Caribbean.

V. RESEARCH AND HIGHER EDUCATION POLICIES FOR TRANSFORMATION

When the magnitude and scale of the transformation that is required is placed within the context outlined by Prime Minister Arthur then the awesome nature of the challenge posed by the Theme of this Conference is fully revealed. The situation is heightened even further when account is taken of the current status of research and higher education in the Anglophone Caribbean, as previously outlined.

To put it bluntly, in light of the current state of research and higher education in the Anglophone Caribbean, the scope and scale of the societal transformation that is required and the context in which it has to occur, it is difficult to see any logical and linear relationship between research and higher education policies and the transformation of Anglophone Caribbean societies. There are too many uncontrollable factors in the context and too many facets to the transformation contemplated to allow any deductive homological process to render any valid answers. The logic of physics and mathematics does not seem appropriate here. Research and higher education policies are not conditions prior to societal transformation. Rather it is the pattern logic of biology that may be more appropriate.

Research and higher education should be conceived as part of the fabric of transformation that is required. Put another way, transformation of research and higher education in the Caribbean is an integral and inextricably part of the societal transformation that must take place in constructing Caribbean society of the future.

The critical question then becomes: "What policies are needed to transform research and higher education in the Anglophone Caribbean so that research and higher education can in turn assist in speeding up and enhancing the achievement of the desired transformation?" This is the task of the Conference and certainly not of this opening address. Whatever are the specific policies that may be recommended, there are at least five perspectives that each policy must embrace and address if they are to be appropriate to the task. These are (i) process and timeframe considerations; (ii) demographic factors; (iii) the Anglophone Caribbean as place and people; (iv) regional cooperation; and (v) Caribbean integration and the Caribbean Single Market and Economy (CSME). Each of these requires some elaboration.

1. Process and timeframe considerations

The perspective of process and timeframe is best established by way of reference to the University of Technology (UTech), Jamaica, the only technological university in the sub-region. In 1957 the Government of Jamaica established the College of Arts, Science and Technology (CAST) to produce some of the manpower needs of the developing bauxite, tourism, light-manufacturing industries. The College offered two year-Certificate and three-year Diploma courses in a wide range of technology-related areas. In 1995 the institution was upgraded to a technology university but actually received its Charter in 1999. Among the policies adopted by the University was the requirement that all Faculties engage in research and that all full-time staff members conduct research and publish in refereed sources.

The Septennial Review of the University UTech in 2007 identified the major accomplishments of the University in the first decade of its existence as follows, the:

1. *Upgrading* of Academic Staff so that 96 per cent now have Degrees at the Master's level or higher.
2. *Establishment* of the Academic structure of the University replete with Academic Board, Faculties, Schools, Departments, quality assurance mechanisms and the making of all these structures fully operational.

3. *Introduction* and growth of first degree programmes in all Faculties and the introduction of master's degrees and doctoral programmes in some Faculties.
4. *Outsourcing* by way of franchise of almost all of its certificate, diploma and associate degree programmes to other tertiary institutions.
5. *Expansion* of student enrolment to over 8,000 students in response to the mandate of the Montego Bay Accord issued by CARICOM Heads of Government to expand tertiary enrolment to at least 15 per cent of the 18-24 years age cohort by 2005.
6. *Obtaining* of accreditation for most of its degree programmes.

The Report highly commended the University for its achievements within the first ten years of being upgraded to university status. Certainly successful efforts that resulted in substantially improving staff quality, that shifted programmes from certificate and diplomas to first degrees, that established quality assurance mechanisms that resulted in the ready acceptance of graduates by employers and the academic community, while at the same time significantly expanding student enrolment represents substantial achievement.

However, the Septennial Report noted that the policy to establish research as a part of the operations of the University was highly ambitious and quite unrealistic because it did not take account of the stage of development of the institution (Miller, 2007). At the same time that the staff was being upgraded, mainly to the master's level, bachelor degree programmes were being designed, developed and implemented, certificate and diploma programmes were being franchized and outsourced, student enrolment was being expanded and there was no real increase in Government subvention, Research was being required as an activity in which all faculties and all academic staff should become engaged. Furthermore, there was no adjustment to staff workload, the number of contact hours of academic staff and the facilities were all focused on teaching, with no specific structural adjustment in the terms and condition of service of staff, or the facilities, to accommodate research.

The UTECH experience is unlikely to be unique among the newly-established universities and university colleges within the Caribbean. The point being made here is that while Governments and Boards or Councils of Universities can formulate very ambitious policies concerning the development of research capacity for newly-established or upgraded institutions, there are essential infrastructure that are required, stages of development that are precursors to succeeding stages in a sequence that needs to take place if the desired outcomes

are to be achieved. These processes and stages include staff development, the conditions of service that facilitates enquiry and creating pools of qualified students. Account needs to be taken in policy formulation of these processes and timeframe if realism is not to be abandoned. The desired transformations are not trivial. They are substantial. Hence, a long-term perspective needs to be applied with appropriate benchmarks that are determined by the stages through which the transformation must of necessity be accomplished. Botched early attempts as a result of poor planning could seriously retard efforts to build research capacity in newly-established or newly-upgraded universities.

2. Demographic dimension

Almost all Anglophone Caribbean populations have baby-boom generations that are somewhere between 20 to 30 years younger than their American counterparts. There are fewer children entering primary and secondary schools than are leaving them each year. The prime age adult population 20 to 49 years old is now significantly larger that the school-age population 5 to 19 years. Most important, the current prime age adult population passed through the school system when the higher education provision was even more inadequate compared to their demands and needs. While many have obtained higher education abroad, the vast majority are still un-served. Indeed, some passed through the school system when there were serious deficits in the quality of primary and secondary education that must now be rectified.

Higher education in the Anglophone Caribbean, therefore, cannot continue to target recent secondary school leavers. The new target must be the entire population of qualified persons who desire education and training at this level. This is not just for equity reasons but as important, this population constitutes the major component of the labour force upon which Anglophone Caribbean economic competitiveness depends. It is investments in their education and training that is likely to bring the most immediate returns in the transformation process.

The practical implication for higher education is that this at-work population cannot be reached principally by full-time on-campus programmes because of their full-time engagement in the workforce. While part-time evening programmes have been a great boon in many institutions, it favours urban residents who are employed in particular occupations and

requires transportation systems that operates in the directions that students must go after courses end at night.

All higher education institutions must therefore develop modalities of delivery of their programmes that include full-time face-to-face, part-time face-to-face, vacation packages and on-line delivery and allow students to move easily between these modalities. What is being implied here is that the rigid boundaries between study and work need to be reviewed on two grounds. What is being implied here is that just as students who are fresh out of school may benefit from some interlude in the world of work during their studies, students who are full-time engaged in the world of work may benefit from some interlude on campus during the course of their studies. Both interludes are conceived as enrichment of the quality of the education offered to either set of students.

3. Anglophone Caribbean both a place and a people

Over the last 150 years education in Anglophone Caribbean has always produced more talent than Caribbean economies have been able to absorb. Accordingly, education in the Anglophone Caribbean has long been integrated into the international labour market. Education has been a principal factor facilitating the migration of Anglophone Caribbean people across the world. This is one of the main reasons why such great emphasis is placed by the mass of the population on examinations that have international currency.

Given this history, investment in higher education in the sub-region cannot be contemplated only in terms of the needs of Anglophone Caribbean economies but also in terms of the needs of the people, wherever they may find economic opportunity. This issue has sparked contending viewpoints. These include:

- ***Loss*** of graduates through emigration constitutes brain-drain and serious loss to the sub-region and its development.
- ***Receiving*** countries should compensate Caribbean countries for the graduates they receive and especially for those that they actively recruit.
- ***Remittances*** from Caribbean emigrants have become a significant element propping up several economies in the Region. Probably careful study of the long returns from remittances may show that in the end the sub-region is the net beneficiary of the investments in these emigrants.

- ***Emigration*** of educated people from the sub-region has been a safety value that has contributed to the social and political stability of the sub-region.

In reality the contending views do not represent an either or situation. Further, Anglophone Caribbean countries cannot close their doors to the emigration of their graduates especially in circumstances where the local and sub-regional economies do not have opportunities in all the areas in which talent is developed. In addition, even in areas in which local opportunities exist, strong international demand pulls from the sub-region persons that are needed locally. What has not happened within the sub-region is that there has never been any systematic programme that Anglophone Caribbean people, who choose to work outside the Region, could take in order to better prepare themselves for their choices and also to provide a framework for their continued relationships with the sub-region and with their Caribbean colleagues in the countries of their choice.

What is clearly emerging from the dialogues that have started up between the Anglophone Caribbean Diaspora and residents in the sub-region is that in the rapidly globalizing world the continued survival of the Anglophone Caribbean as place and people are intricately interrelated. This is not a matter that higher education in the sub-region can ignore.

4. Regional cooperation

Regional cooperation in higher education is one of the strengths of the Anglophone Caribbean. The cooperation that has sustained the University of the West Indies (UWI) over the last nearly sixty years has succeeded in building significant social capital within the sub-region. While UWI bashing is now a common practice in may fora the fact is that almost all the national tertiary and faith-based institutions within the Region have benefited substantially, directly or indirectly, from the operations of the UWI. Indeed, one of the contemporary issues that must be resolved is how to rationalize the relationship between national universities and the regional university such that that latter continues to contribute to the former to create a symbiotic relationship instead of a competitive relationship that jeopardizes the survival of both.

The reality that brought UWI into being has not disappeared with the establishment of national universities. That reality is that no single country can by itself develop and sustain the

critical mass of human and financial resources needed to offer high quality higher-degree programmes in the range of disciplines and multidisciplinary endeavours that are needed by the society or that which is within the capabilities of its people. While the nationalism of each country, enhanced by insularity, will entertain such a notion the harsh realities of implementation and operation will eventually dispel such a notion.

While regional or functional cooperation in the post-war era and second half of the twentieth century resulted in the establishment and operation of single regional institutions, in the twenty-first century the challenge for regional and functional cooperation in higher education is for national institutions to take up the challenge of serving the sub-region. It is mostly likely that initially national institutions concentrate their efforts on their nationals and in the process will unnecessarily duplicate programmes some of which will not be either cost effective or of the desired quality. It is also likely that different institutions will develop Centres of Excellence in particular areas that will become known and patronized sub-regionally. This is most likely to come to the fore in circumstances in which national institutions begin to confront the challenge of creating knowledge and developing talent in areas related to the felt and urgent needs of their societies. Examples of such areas could well be:

- Hurricane and Climate Science.
- Intelligence, Security and Strategic Sciences.
- Sports Performance.
- Forensic Science.
- Homoeopathy, Organic and Herbal Sciences.
- Work, Production and Labour Market Sciences.
- Caribbean Rhythms Industry.
- Mining.
- Nutraceuticals.
- Performing Arts and the Global market place.

However, regional and functional cooperation in higher education and research will need to be a deliberate strategy that is adopted and implemented by the sub-region. At least three entities will need to be created to ensure regional and functional cooperation in higher education and research. These are:

a) A coordinating and regulatory mechanism which would perform three basic functions. *First*, promote exchanges on higher education policies, practices and programmes within the sub-region. *Second*, advise governments and institutions on higher education policies. *Third,* be empowered and mandated as the body to grant approval for the establishment and operation of higher education institutions across the sub-region.

b) A quality assurance mechanism that ensures high standards in all areas of study in higher education institutions. To date a start has been made with two models, both of which are under the aegis of CARICOM. One model is that of a regional accreditation agency that is an umbrella for national accrediting bodies. The other model is that of a regional accrediting agency with accrediting authorities-related specific areas of specialization, the first such area being medicine. It is my view that is it second model that will prevail because none of the twelve independent countries of the Anglophone Caribbean can by itself establish and maintain a credible national accrediting body capable of ensuring standards for all the disciplines offered in higher education. Most national accrediting bodies are likely to be little more than administrative shells convening *ad hoc* technical teams that operate on an events basis. Such a *modus operandi* has little chance of building a community of scholars that accept responsibility to self-regulate standards in their disciplines.

c) A clearing-house which facilitates nationals of one country undertaking study in another in areas agreed by the governments, such that government pay in part, or whole, the economic cost of their students. This clearing-house would bill governments for their students studying in other countries, receive such funds and pay over the funds to the institutions in the various countries. In setting up such a mechanism, careful study needs to be made of the twelve Southern and nineteen Western states of the United States (US) that have successfully operated with such clearing-houses for several years.

5. Caribbean Integration and CSME

The great issue currently on the agenda of Caribbean integration is the Caribbean Single Market and Economy (CSME). The Prime Minister of Barbados in the 30th Anniversary Distinguished Lecture of the Caribbean Community (CARICOM), Bridgetown, Barbados, 23

April 2004 declared that CSME is unquestionably the most complex, most ambitious and most difficult enterprise ever contemplated in the sub-region (Arthur, 2004), and further stated CSME offers the Region the prospect of greater self-reliance, internal economic stability and, therefore, increased capacity to absorb external economic shock and survive. Ann Margaret Lim of the Jamaican Observer, Jamaica, stated that "CSME is a protective hedge against the full force of global market winds".

The candidate countries of the CSME are the twelve independent English-speaking Caribbean countries and Surinam and Haiti. Put another way, these are the fourteen politically independent countries of the Caribbean that are on their own in the world. Political independence freed them from Colonial domination but severed their protection by powerful countries of the world. Further, geographical location, culture and colonial history have excluded them from being part of any powerful or potentially powerful continent bloc of countries. As such these countries are caught in the intersection of the exercise of power in the world. The Anglophone Caribbean, French Creole-speaking Haiti and Dutch-speaking Surinam are now constrained by external imposition to find common cause in constructing their future.

Just in case anyone is in doubt about what is involved let me spell it out in nationalist terms. It is the task of mobilizing Antiguans and Barbudans, Bahamians, Belizeans, Barbadians, Dominicans, Grenadians, Guyanese, Haitians, Kittians and Nevisans, Jamaicans, St Lucians, Surinamese, Vincentians and Grenadineans, Trinidadians and Tobagians to share a common Caribbean identity, accept a shared destiny in the world and develop such bonds of solidarity and belonging that supersede their national conception of themselves so that, by say 2030, there will be free movement of goods, services, capital and people throughout the Region.

Allow me to approach the subject from another direction. In this Western Hemisphere there is North America, Latin America and the Caribbean. North America is a continent, which geographically includes Canada, the United States and Mexico. However, by language, culture and colonial history Mexico is Latin American. The issue related of Mexico's geographical location in North America and historical and cultural location in Latin America is being dramatized daily on American television with respect to Mexicans crossing the border into the US. Goods, capital, and services can cross the border freely but not people. However, North America and Latin America are defined; the Caribbean is not a part of either.

The Caribbean is an addendum in the Western Hemisphere. The Caribbean is a distinct but small and vulnerable sub-region that is caught in the intersection of the exercise of power within the Hemisphere. We would be grossly mistaken if we believe that we can rely on either North America or Latin America to be concerned about our well-being, unless it coincides with some interest of theirs. Furthermore, the Caribbean is inconsequential in the political economy of the rest of the world. It is not clear the extent to which Caribbean people fully comprehend this reality.

The rationale for the Caribbean Single Market and Economy (CSME) resides in the logic that adaptive advantage resides in unity among these small vulnerable countries in the Caribbean. Unity has a higher survival coefficient than bilateral exposure to the economic shocks and political threats that are almost certain to come to each of these countries from the countries holding power in the world. However, this unity will only increase the chances of survival it will not eliminate the shocks and threats.

There is a least one thing of which these fourteen politically independent countries of the Caribbean, that are not part of Latin America, can be sure of for the future. They are going to be beaten, battered and severely bruised by being caught in the middle of power contests and conflicts within the Western Hemisphere and in the wider world. CSME will become a reality not because of the political and other arrangements that have been put in place but rather from grasping the opportunities for increasing the level of Caribbean integration each time the sub-region is beaten, battered and bruised by the external economic and political shocks that are sure to come.

In this scenario the role of higher education and research should be to:

- *Affirm, articulate, refine* and expand the vision of Caribbean integration and to create a conceptual framework within which Caribbean people can understand themselves and the world, the relationships that are required to survive and prosper and cultivate the indomitable spirit necessary to overcome the odds.
- *Be an avenue and path* of upward social mobility through which Caribbean people can access opportunity within the Region and in the world at large and an agent that increases the life chances especially of disadvantages groups within the sub-region.

- *Generate, incubate and support* innovations, inventions and initiatives and foster and encourage the creative imagination such that the talent and genius of Caribbean people are given full reign to expressing themselves in advancing the Caribbean version of humankind civilization.
- *Design, develop and deploy* indicators and instruments that will allow for the monitoring, evaluation, assessment and critique of the progress, or lack of it, in achieving the integration goals over time.
- *Cultivate and foster* in every country of the sub-region, across succeeding generations, cadres of champions of Caribbean integration who can be depended upon in every crisis to seize the opportunities presented to advance the processes of integration.

VI. CONCLUDING COMMENT

In the finite time that was available for this address I did not tackle directly the issues of (i) Information and Communication Technologies (ICTs); (ii) Finance and the Social and Private Rates-of-Return on Investments in Higher Education and Research. I have deliberately made these omissions because I am confident that they will be appropriately and adequately addressed in this Research Seminar.

Allow me, therefore, one final observation. In many areas the ordinary people of the Caribbean, the Folk, have been way ahead of the policies of the intelligentsia and the respected conventions of their times. Looking back we have to salute, the:

- Descendants of ex-slaves who abandoned the plantations to set up their own communities and start to cultivate new crops for exports from which new industries like bananas arose in their times.
- Newly literate men from expanded primary education in the 1880s who ventured to find new opportunities in the building of the railroads in Central America and the Panama Canal and whose remittances created new settlement patterns and re-capitalized the sugar industry at the beginning of the twentieth century.
- Inventors of the steel pan who discovered sweet music from discards from the oil industry leading to a new sound and new genres of musicians.
- Calypsonians and reggae artists whose withering social commentaries have resonated across the world while at the same time evoking joyous movements.

- Hucksters who with little formal education conducted successful inter-regional commerce across language barriers long before there was any conception of free regional trade or a single market.

Hopefully the policies of transformation that are envisaged and proposed at this Research Seminar will help today's and tomorrow's intelligentsias to catch up with and to keep pace with Caribbean Folk.

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Teacher training in Argentine universities at the secondary, tertiary and university levels: Case study comparisons

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Concern about teacher training in Argentine universities is at the heart of recent higher education policy debates at a time when society's demands on the university system are increasing. The public policy agenda includes proposals formulated by different actors to improve the quality of university teacher-training departments and to link tertiary education with university education.

Argentina's universities are part of both the education system and the national science and technology system. Standing at the apex of systematic education, they not only receive secondary school leavers but have responsibilities for, and affect the quality of, the system as a whole. The demands made on universities in relation to the other levels in the system have been increasing in recent years.

Training teachers for the rest of the education system is a priority function of Argentine universities. In Argentina, secondary and tertiary teacher training is split into two subsystems:

(a) *First*, the tertiary subsystem of institutions that train teachers for secondary schools and tertiary institutes (vocational higher education establishments).

(b) *Second*, the university subsystem in which teaching staff are trained for all three levels of the education system (secondary, tertiary and university).

In the diagnostic study we conducted from 2005 to 2006 with financing from BANCO SANTANDER-UNIVERSIA of Argentina, we attempted to analyse the problem of the teacher training overlap between universities and tertiary institutes with the aim of identifying the strengths and weaknesses of these two levels of the education system and their ability to

meet the real needs of secondary education, and of exploring the different forms of linkage that might exist between the university and tertiary levels.

The questions guiding the research:

- *How many teachers graduate from Argentine universities, and what are their characteristics?*
- *How are mathematics, arts and history teachers trained in the Argentine universities which the study included?*
- *Are these university-trained teachers properly prepared to teach at the intermediate and higher education levels*?

The objectives of the diagnostic study are:

- To describe the quantitative profile of teachers trained in tertiary institutes and in national and private universities, using the latest national censuses of the National Institute of Statistics and Census (INDEC) and the Secretariat of University Policies (SPU).
- To characterize teaching staff by age, sex, position and teaching and research workload, broken down by the socio-economic region in which the university is located.
- To characterize the institutional profile of universities.
- To produce a comparative description and analysis of syllabuses and the characteristics of teaching staff from the mathematics, language and history teacher-training departments of the universities studied.

Reasons for the selection of the case studies:

The cases were chosen on the basis of the particular characteristics and contrasting features of the different teacher-training models used in universities in different parts of the country, plus one highly regarded tertiary institute in the province of Córdoba.

Four universities and one tertiary institute were chosen:

The University of Buenos Aires (UBA), founded in 1821. This University was selected because it is the largest free, public and secular university (over 300,000 undergraduate students) and is important from a scientific and academic standpoint.

The National University of Córdoba, founded by the Jesuit Order in 1613. This is the public university with the longest historical tradition in terms of the impact of the 1918 university reform which spread to the rest of Latin America and influenced the French student movement of 'May 1968'.

IPEM No. 149 - Dr Alejandro Carbó in Córdoba: the *Instituto del Profesorado de Enseñanza Media A. Carbó* teacher-training college was founded in 1884. It is a public tertiary institution that is widely known and highly regarded among teacher-training institutions at this level.

The Universidad Nacional de la Patagonia Austral (UNPA), founded in 1991. It was selected because it is part of a wave of new public universities organized along different lines from the reformist tradition and is an important representative of the new modernizing tendencies in higher education during the 1990s.

The USAL Universidad del Salvador, Buenos Aires, founded in 1956. It was selected because it was one of the first private universities. It is a denominational institution owned by the Jesuits and oriented towards teacher training from the outset.

Confining ourselves to the mathematics, language and literature, and history teacher-training departments:

This kept the number of cases down, while allowing us to establish a basis of comparison that was adequate for the purposes of this study. Again, these are three departments that deal with subjects essential to secondary school syllabuses. They are the disciplines that have traditionally accounted for the largest number of teaching hours in secondary education curricula. Mathematics trains students in formal capabilities and logico-formal thinking and prepares them for participation in society and its quantitative representations. Language and literature not only improve the power of expression and comprehension, but contribute to the creative processes made possible by the use of language. History trains the collective "memory", helps students to construct an identity within society and contributes to an

understanding of the present. Lastly, they are an essential part of the core upper secondary teaching syllabus, when *the individual weight of each* is considered. This in no way detracts from the importance of other areas of knowledge.

Training of university teachers in history, mathematics, and language and literature:
The country's universities play an important role in supplying teachers for upper secondary and higher education. There is no database on this training process, however. From the point of view of transfers in the education system or the impact of teachers graduating from the universities, there are no data or prior studies to show the role played by the universities in relation to teaching at the upper secondary and non-university tertiary levels.

This lack of studies and information may be due to different factors. Some of them have to do with differences how the teaching profession operates. The dispersal of teachers as a professional body and the lack of professional organizations or scientific or occupational institutions make it difficult to forecast the real impact of an activity that consumes a large share of university resources.

This deficiency of real knowledge about the university-trained teaching body puts the university system in a weak position when it comes to providing other actors in the education system and society in general with responses to what is perceived as a severe crisis in the secondary education system. Universities respond very differently to their training traditions. Each university expresses and is the product of an academic tradition. Tradition is not only what has happened in the past, but also how different sets of circumstances are addressed. Argentina's universities are still applying a type of syllabus that involves long courses (over six years) with a high degree of socialization in a specialized professional field.

Any syllabus has to serve three kinds of specific purposes. The first and most obvious is the acquisition of a body of knowledge, the second is capacity-building and the third, which ties in with the second, is socialization, which means enabling a student to become integrated into the profession by interacting within a highly specialized field.

One aim of this research is to describe the training principles applied by university teacher-training departments and the extent to which they maintain or depart from the training principles considered acceptable for other professions.

A second aim of this study of university teacher-training departments is to describe the mechanisms for qualifying students as teachers or distributing qualifications. Given what has been said, however, there is a need to examine how far this qualification system is supported by a training system that meets the requirements set forth. To do this, we have looked for answers to the following questions:

- Do syllabuses provide a genuine training in the professional field concerned, or do they operate as qualifying mechanisms?
- How does teacher training tie in with the courses involved?
  Are they independent of each other? Are they coordinated? Are they supplements to a core syllabus?
- How do teacher training syllabuses tie in with the general syllabus structure in a university? Are they intermediate or final options, or alternatives to some other qualification?
- How do they relate to degree courses? Are these a prerequisite or can they be taken in parallel?
- What are the training assumptions involved?

From this perspective, it can be said that the training process is based on three main elements, the: (i) syllabuses, (ii) pedagogical approach, and (iii) academic organization.

(i) *Syllabuses* establish the structure of knowledge in a specific field and the major content, the sequence in which it is to be taught, and graduation profiles.

(ii) *Pedagogical approach* determines the forms of educational interaction and the real opportunities for capacity-building, knowledge acquisition and the constitution of professional identities.

(iii) *Academic organization* establishes the basic structure of the educational experience by laying down the system of rules and standards governing the relationship between teachers, students and the institutions.

The questions prepared to conduct the interviews with the authorities of the institutions analysed were arrived at through comparative analysis of syllabuses and the system of academic organization governing the teacher-training establishments covered.

Brief review of the findings; the cases of the university teacher-training departments and possible linkages with tertiary institutions

The National Institute of Statistics and Census (INDEC) in Argentina provided us with socio-demographic information on the population of the relevant age and with other data specially prepared to obtain a profile of the teachers who are the subject of this research. *Figure 1 of the Annex* shows that among the Argentine population aged 20 and over with a university degree, 49 per cent are women and 51 per cent men; of those aged 20 and over with a tertiary qualification, on the other hand, 74 per cent are women and 26 per cent men, since it is primarily teaching qualifications that are issued by tertiary institutions. This pattern of feminization at the tertiary level contrasts with the situation of almost complete gender equity for university degrees. At the same time, *Figure 2 of the Annex* shows that a majority of university teaching staff are men (54 per cent) and a minority women (46 per cent). Another piece of information that is important to the research is that the bulk of university teaching staff in Argentina, 64 per cent work part-time in universities (equivalent to 12 hours of classes a week), while only 14 per cent work full-time (equivalent to 40 hours of research and teaching a week). The other 22 per cent work on half-time, equivalent to 20 hours a week of research and teaching. These indicators reveal that the bulk of teaching staff are professionals who conduct their professional activity away from the university and give only a few hours of classes a week, while a minority (36 per cent) work mainly in research and teaching.

Again, of all the teaching staff doing research in Argentine universities, 18 per cent (*Figure 3* of *the Annex*) receive research incentives from the Secretariat of University Policies of the Ministry of Education and Culture (SPU/MEC), Buenos Aires. In the case of personnel with the highest academic scores, the incentive received is worth twice the official salary.

In Argentina, graduates of the three teacher-training departments covered are a minority in relation to graduates of other university courses. Women make up the majority of their graduates and dominate the arts and literature course; they mostly find work in public teaching institutions. Women account for the bulk of graduates from non-university tertiary institutions nationwide (between 70 per cent and 80 per cent of the total) and work primarily in public teaching institutions, followed by private teaching institutions. Where university teacher-training departments are concerned, history and arts graduates are in the majority,

while there are more graduates in mathematics than in physics, chemistry, information technology, economics, philosophy and biology.

In the City of Buenos Aires, there were 5,834 teachers with a tertiary qualification working in secondary-level institutions between 1998 and 2004, representing 51.7 per cent of all teachers in the city, while 2,760 teachers, or 24.5 per cent of the total, had a university degree. This indicator shows how important university-trained teachers are for recruitment, since they account for a quarter of all teachers working in secondary schools. We also recognize that the most efficient type of institutional linkage between universities and the secondary level is for universities to train the teachers working at those levels. Whether because of the social responsibility those universities have toward the levels of the education system that precede them, or because of local government teacher-recruitment policies, university teacher-training departments merit special attention.

In the bibliography, two types of 'academic tradition' are represented in relation to the training of university teaching staff: academic traditions that emphasize disciplinary training, and those emphasizing pedagogical training. The two traditions are recognized as visions or ideologies that dominate not only the organization and distribution of curriculum subjects but also the perceptions teachers have of their working practices and the training expectations of future graduates.

In all the cases covered by this research, both positions were given expression in the interviews with course or faculty coordinators and authorities, with teachers in the disciplinary area and with teachers responsible for pedagogical material and teaching practices, while differences emerged within each teacher-training department in particular.

The teacher-training institutions analysed are influenced by different traditions:

- In all five cases, high priority was given to research to maintain academic excellence in the transmission of knowledge; those interviewed in the university teacher-training departments identified the opportunity for both teachers and students to conduct research as an essential difference in favour of university teacher training.
- One shortcoming identified in all five cases was the lack of institutions where teaching could be practised, and the lack of time set aside for this. It was widely admitted that there was a degree of institutional indifference towards teaching practice

arrangements. In the different teacher-training traditions, teaching practice is an area of weakness.

As regards teachers' perception of the function of syllabuses within academic units, there was consistent agreement about the need to do three things: *first*, provide a training different from that offered by other tertiary-level teacher-training institutions; *second*, award a diploma that facilitates the transition to work; *third*, offer an alternative to students not wishing to do the dissertation that is part of the degree. In their perception of their institutions as trainers-of-teachers, university staff emphasized their knowledge-producing capacity, modern approach to disciplinary issues, teaching staff and research (in one case mention was also made of the system for applying for positions by public competition). They feel that these characteristics differentiate them significantly from the tertiary institutions.

As regards perceptions of possible linkages between universities and tertiary institutions, the majority of views can be divided into three attitudes towards the issue:

- One attitude is that the tertiary institutions would 'benefit' from contact with the 'university academic ethos' through courses, seminars, etc. This attitude treats university teacher-training departments as institutions for teaching. We have called this attitude *communication of the academic ethos to tertiary teacher-training institutions*.
- The second (minority) attitude is one that recognizes the strengths of the tertiary institutions in their greater sensitivity towards students, their admission and presence in the institution, and towards the pedagogical processes that ought to impact university thinking. We have described this attitude as *raising awareness of the pedagogical ethos in the university environment*.
- The third attitude is one that recognizes the strengths and weaknesses of both training approaches (university and non-university teacher-training establishments) and proposes that there should be collaborative projects between the two types of institutions on the basis of mutually beneficial agreements. We call this attitude *institutional construction of the cooperative ethos*.

* * *

Quantitative annex

Figure 1. Population aged 20 and over with university degrees and tertiary qualifications

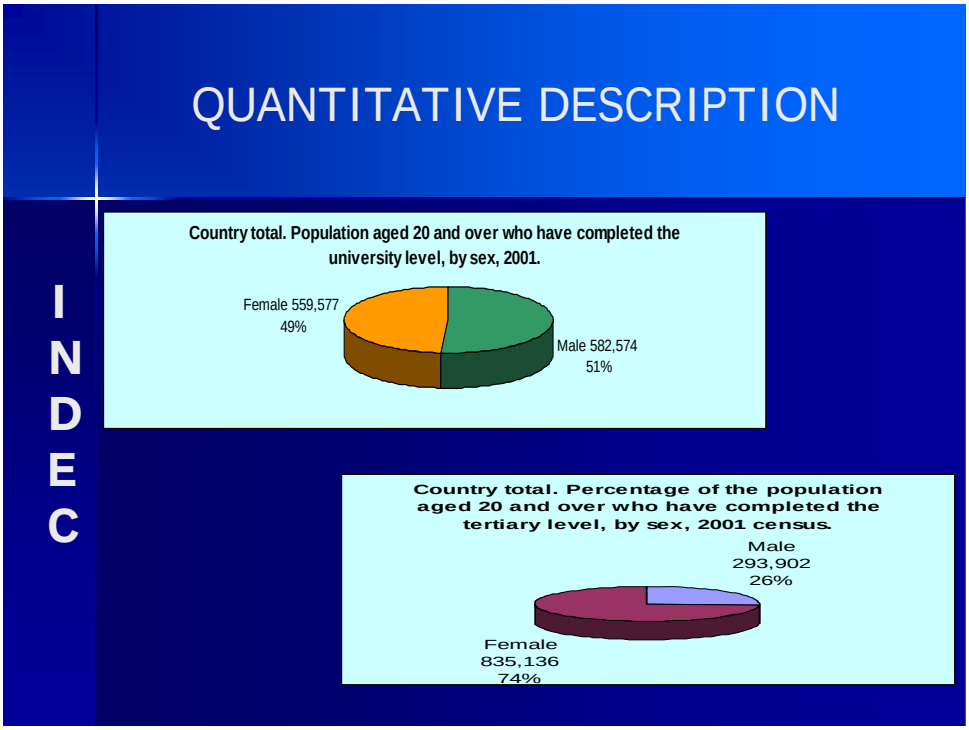


Figure 2. University teaching staff, by gender and workload

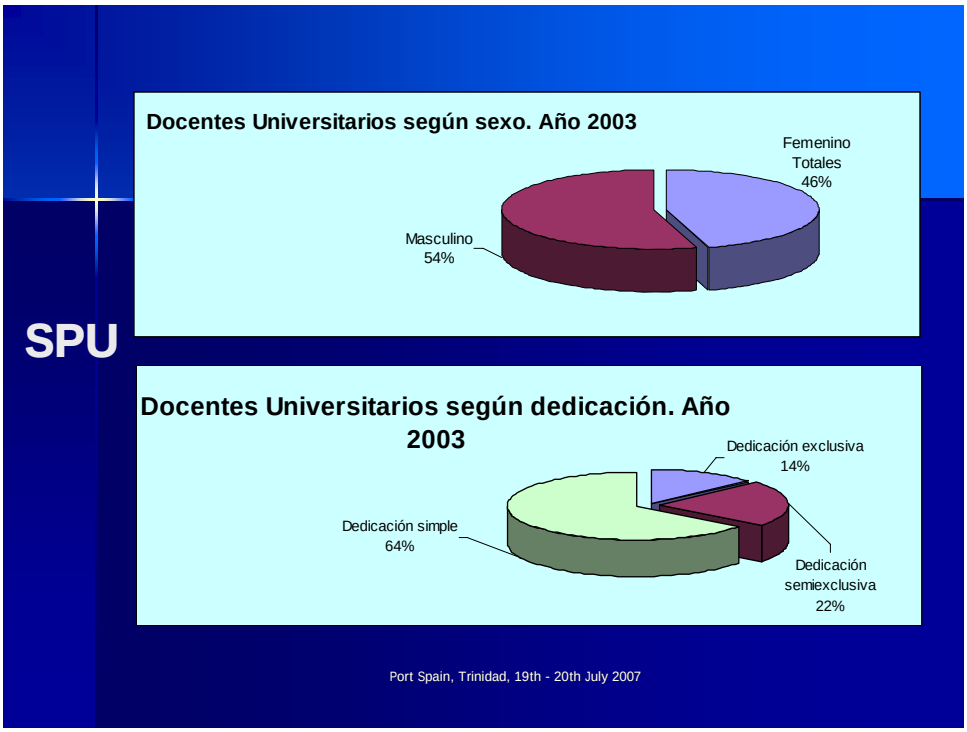
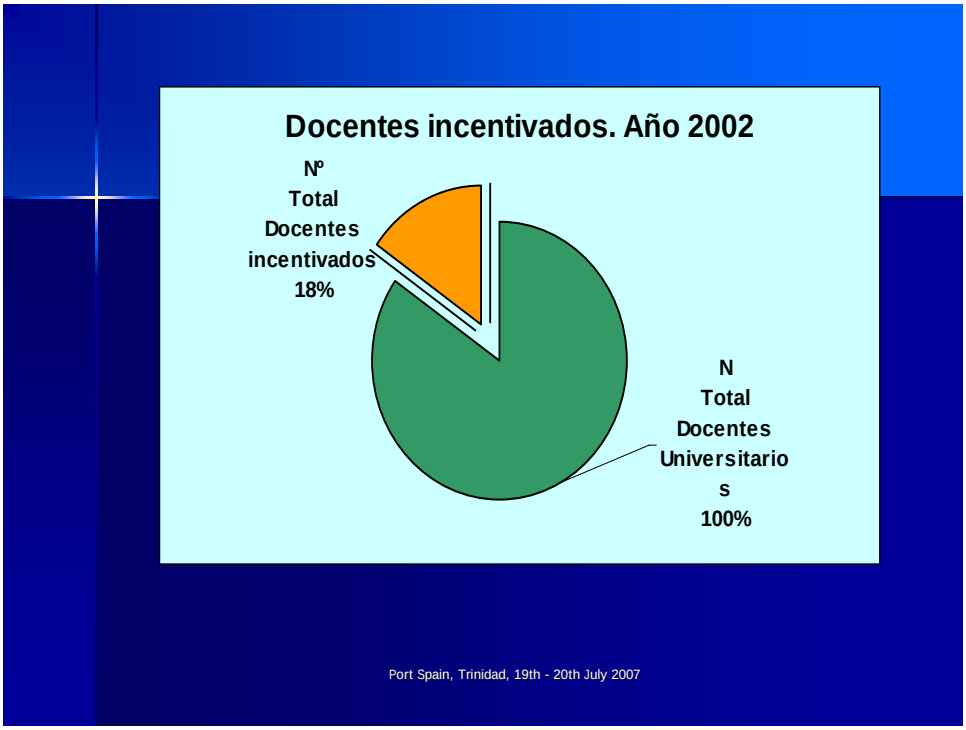


Figure 3:
University teaching staff in receipt of incentive payments



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FORUM svp: None of these Biographical Refs are pinpointed in text./ph

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NB: Paper presented at the UNESCO Forum on Higher Education, Research and Knowledge. 2nd Regional Research Seminar of the Scientific Committee for Latin America and the Caribbean, Port of Spain, Trinidad and Tobago, 19-20 July 2007

Brazilian experiences in building research capacity

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1. INTRODUCTION

Creating a national capacity to produce research and knowledge in a country depends on many factors. Outstanding among them are formulating stable development policies with a view to training human resources (researchers and technical support cadres, as well as managers), constituting an appropriate infrastructure, and the development of projects, especially with long- term prospects and aiming at innovation. An essential condition in this process is also to create institutions with a vocation for scientific and technological research.

The experience of institutionalizing research as an intrinsic activity of the university has been particularly remarkable. At the same time as it transformed the university into a 'mass university', compelled to emphasize professional training, research activity also underwent radical changes, evolving from an isolated activity of scientists to a process of exchanges and work in groups and in networks. However, the growing importance of scientific and technological research for the economic development of countries has led this activity to migrate to public and private non-university institutions. Increasingly, applied but also basic research is performed outside the university, in industry and at research institutes.

However, it should be noted that universities continue to be a privileged locus for the development of research and production of new knowledge, which is the result of several factors:

(a) It is the university that is basically responsible for training new generations of researchers who provide the base of the research system.

(b) Different from the highly specialized institutions (that are not part of a university system), universities are open to the whole range of areas of

knowledge, which allows them to transcend the specific limits of the isolated disciplines and to construct cross disciplinary enquiries and investigations.

(c) Their autonomy and research freedom gives them great flexibility and dynamism, besides the capacity to perform investigations that carry risk, independent of pressures exerted outside the university environment.

(d) The possibility of having multiple financing funds available, including public ones.

The introduction of research in the Brazilian university encountered several problems. Outstanding among them are the need to break down the typical resistances of a higher education that aimed strictly at training professionals and the stresses resulting from challenges that required seeking flexible, effective formulas to organize research activities in a socio-economic context involving public policies for science and technology (S&T), marked by discontinuities.

In the following text, an attempt is made to discuss Brazilian Government policies encouraging training human resources for research since the beginning of the sixties. This was and has certainly been a successful experience, as shown by the results achieved over the years, both in terms of building the national research potential and of the increment, itself, of scientific and technological production. The formulation and implementation of these policies, however, has not been a history immune from criticism and controversy. Despite this, the process reflects the concrete possibility of overcoming conditions typical of developing countries based on the definition of strategic aims and defining the appropriate means to achieve this.

The experience of the university as an institution in Brazil is recent. The first Brazilian universities date from the first half of the twentieth century. The higher education offered was devoted almost exclusively to professional training. It was only in the 1950s, when the Federal Public System of Higher Education was instituted, that a *de facto* policy of valuing higher education and research was implemented. In the same decade, this was helped by the creation of the National Council of Scientific and Technological Development (*CNPq-Conselho Nacional de Desenvolvimento Científico e Tecnológico*) and the Coordination for the Further Training of Staff in Higher Education (*CAPE-Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*). However, despite the efforts of the pioneers in Brazilian

scientific and technological development, research activity was insignificant. The faculty of the HEI was not highly qualified and the activities revolved basically around teaching.

This picture began to change significantly with the reform of higher education in 1968, when, in Brazil, a strong programme to value graduate studies and strengthen the national research capacity was implemented, supported by stable, consistent official policies, to build a material infrastructure for scientific and technological research, especially at public universities (and at a few Catholic universities – PUC-Pontifical Catholic Universities), and for training human resources.

The reform of higher education in 1968 presented an innovation, when it proposed the inclusion of Master's and Ph.D. programmes in the academic structures of our HEI. This measure was attuned to the disposition of official policies of the military regime intending to give the country a potential which it did not have until that time in the field of scientific and technological research.

Throughout the next decades, plans and official programmes focused on the growth of the graduate education system and on maintaining a daring programme of scholarship's in Brazil and abroad; the implementation of research infrastructure at the university institutions and research centres maintained by the government and the organization of a general system of research development.

Two other initiatives are also important to understand the Brazilian effort in raising capacity for research: the Scientific Initiation Programme which seeks to initiate undergraduate students in scientific investigation, and contribute to the institutionalization of research at Brazilian universities and implementation of the CNPq Directory of Research Groups. Scientific and technological research, previously performed by isolated researchers, is then organized in the form of research groups and academic networks, resulting from institutional cooperation and multidisciplinary teams.

This text seeks to bring to discussion the Brazilian experience which was successful in its capacity to train for research through more relevant programmes, as well as Graduate courses and Scientific Initiation.

II. CONSOLIDATION OF THE GRADUATE EDUCATION SYSTEM

The first outstanding aspect of graduate studies in Brazil is that its development was not the result of a spontaneous process, but of a deliberate state policy. It means that the graduate level grew in a planned and guided form. The successful experience in the expansion and the quality of the system must be also credited to continuous public funding and the institutionalization of a systematic evaluation process.

1. National Plans for Graduate Education

The history of the national policy for graduate education was built based on the National Plans for Graduate Education, which outlined the well-defined directions for its expansion. The structure of graduate studies was already defined by Report (Parecer) 997/65 introducing master and doctorate courses (see Pareceres Reports 977/65, 77/65 and Law 5.540/68.

The I PNPG-*Plano Nacional de Pós Graduação* (1975-1979) was decisive for the institutionalization process of the graduate education system. Three programmes were implemented for this: granting full-time scholarships for students; the extension of the Teacher Training Programme, and faculty admission on a regular programmed basis by the HEI. [The GNPs were integrated in the other plans such as the National Development Plan through the Sectorial Plan for Culture and Education and the Basic Plan for Scientific and Technological Development].

The other plans, II GNP (1982-1985) and III GNP (1986-1989) aimed at the consolidation of the graduate education system; improving course performance; programme evaluation; institutionalization of research at universities to ensure the operation of graduate programmes; and integration with the productive sector. Many recommendations from the IV GNP which was inconclusive were implemented and they subsidized the discussion on topics such as system expansion, the graduate model diversification, changes in the evaluation process and the international insertion of graduate studies, introducing the professionalizing master's degree and the multidisciplinary master's degree.

This graduate education policy was accompanied by a set of initiatives and actions which ensured surprising results. The universities were encouraged to establish Provosts' Offices

(Pró-Reitorias*)* in charge of research and graduate education still in the 1970s. Soon after, this initiative resulted in the creation of the Forum of Graduate and Research Provosts (Pró-Reitores) (FOPROP). The Forum became an active and permanent spokesperson of the departments responsible for fostering policies. National associations of graduate courses *stricto sensu* appeared in different fields of knowledge, seminars and annual meetings held a constant debate on the needs and perspectives of the system that was being formed and helped keep the universities mobilized.

Currently, GNP 2005-2010 is in effect and its objective is to promote fair growth of the national system of graduate education aiming at responding to society's demands for quality in scientific and technological; economic and social development: stability and induction; improving performance; funding and sustainability; diversification by creating new models; international cooperation and evaluation and quality (GNP, 2005, pp. 53-62).

2. Graduate studies model

The present organizational model was based on well-defined procedures. Graduate study *stricto sensu* consists of the master's, professionalizing master's and doctorate courses (Neves, 2002). A minimum set of norms established that the master's and doctorate were to have a minimum duration of one and two years respectively and that, besides the elaboration of the dissertation and thesis, the student should attend a limited number of courses articulated with the respective programme research line. At the same time, an efficient system to advise theses and dissertations was created with constant follow-up by the advisers (Martins, 2002).

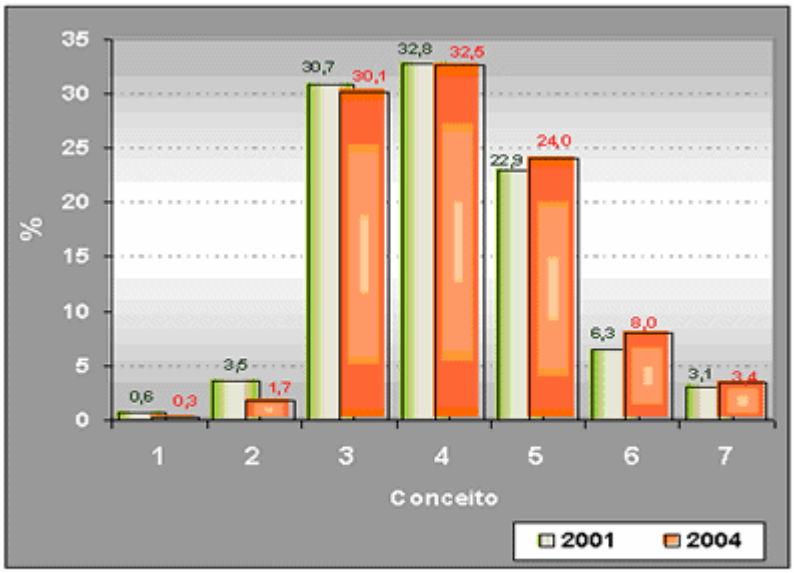
Currently, the challenge to be faced by the graduate programmes involves the graduate studies model flexibility in order to allow system growth: to educate professionals with differentiated profiles aiming at the dynamics of the academic and non-academic sectors; to increase the network used to diminish the regional differences regarding the offer and performance of graduate programmes, and to respond to the fields of knowledge (GNP, 2005-2010 p. 46).

3. Graduate studies evaluation system

In 1976, the implementation of the Graduate Studies Evaluation System, run by CAPES, was especially important and strongly based on the direct participation of the academic community members. This system is a reference for the recognition of the national nature of the graduate courses and programmes, and for the validation of their diploma. The evaluation process is based on the peer review of the annual course report, with grade reviews every three years. In 1998, the scoring scale was changed to a numerical system from 1 to 7 (Martins, 2002).

This evaluation system is still operated as a quality referential and a characteristic of the level of excellence by area and by broad area of knowledge. The large and autonomous participation of the community representatives in forty-four evaluation committees gave legitimacy and security to the process, allowing a continuous and direct dialogue with the university administrations and with the courses which are being evaluated.

Graph 1. Triennial evaluation 2001-2004: percentage of graduate programmes by grade.



	1	2	3	4	5	6	7	Total
2001	0,6	3,5	30,7	32,8	22,9	6,3	3,1	**100,0**
2004	0,3	1,7	30,1	32,5	24,0	8,0	3,4	**100,0**

Source: CAPES/MEC, PGPN, 2005-2010.

The graph above shows the evolution of the graduate programmes scores. It can be observed that in 2004, 56.5 per cent of the courses were between Grades 4 and 5 indicating an adequate consolidation of the Programmes. The effort to discriminate excellence is revealed by Grades 6 and 7 with 11.4 per cent of the programmes in this position.

4. Development and fostering agencies

CAPES has been established as a graduate follow up, evaluation and development agency. Currently it runs several development and fostering programmes, including scholarship support programmes in Brazil and abroad (see *Annexes 1 and 2*). Another major agency is CNPq. The National Council of Scientific and Technological Development (CNPq) is a foundation linked to the Ministry of Science and Technology (MCT) to support Brazilian research. Its mission is to promote and stimulate the scientific and technological development of the country and to contribute to the formulation of national S&T policy. Since it was set up, CNPq has always been one of the major public institutions for the support of Science, Technology and Innovation (ST&I), contributing directly to training researchers – masters, doctors and specialists – in the different fields of knowledge.

The Research and Project Funding Agency/FINEP and the State of São Paulo Research Foundation/FAPESP are also important development programmes.

The funds to support research are obtained from the National Treasury Budget; funds from budgetary and extraordinary sources (such as international loans); and from Sectorial Funds.

The Science and Technology Sectorial Funds, created in 1999, are new funding models seen as project financing instruments for research, development and innovation. There are sixteen Sectorial Funds. These funds originate from contributions according to companies' invoicing and/or from earnings arising from the exploitation of natural resources belonging to the Federal Government. Among the Funds it is worth mentioning one that is directed at university-business cooperation and another at supporting public higher education and the infrastructure of research institutions.

The Funds are assigned to the Funding for Scientific and Technological Development/FNDCT and managed by FINEP, its Executive Secretariat, in partnership with CNPq (except the Sectorial Fund for the Technological Development of Telecommunication, managed by the Ministry of Communication) (www.Finep.gov.br) (see *Annex 3*).

In short, the graduate education system has been consolidated due to the following:

- Integration of graduate programmes into the university system institutionalizing research activity at different institutions.
- Increase in the capacity of the higher education faculty.
- Creation of a large scholarship programme in the country and abroad which has contributed to the qualification and reproduction of faculty and researchers.
- Structuring of a financing support policy for graduate programmes; systematic participation of community academic representatives in the graduate policy formulation process.
- Implementation of a national evaluation system of the programmes performed by peer review.
- Integration of teaching to research establishing a limited number of articulated courses with the respective programme research lines;
- Creation of an efficient dissertation and thesis orientation system;
- Articulation of the national academic community with important centres of the international scientific production.

5. Expansion of graduate studies

Data on the evolution of Brazilian graduate studies show the positive aspect of the official policies and the capacity of the university system to respond to stimuli.

The data presented below indicate a marked growth in the number of doctorate and master's programmes over the years. It is emphasized that the doctorate programmes doubled in a decade. The public segment is responsible for about 80 per cent of the master's programmes and 90 per cent of the doctorates. However, the private segment is also growing constantly. Another important aspect is growth in the courses of all fields of knowledge, but a marked growth in the areas of Multidisciplinary and Teaching, Social and Applied Sciences

programmes. As for the faculty, their qualification is also emphasized as most of them have a Ph.D.

However there is still an uneven distribution of graduate studies among the Brazilian regions with a higher concentration in the South-East region (55 per cent of the master's courses and 66.6 per cent of the doctorates), followed by the South region (19.6 per cent and 17 per cent respectively).

One of the main focuses of the last GNP is to alter the asymmetry among the regions and especially among the states.

Table 1. Brazil: Courses in the graduate programmes, 1976-2004

Degree	1976	1990	1996	2004
Master	490	975	1,083	1,959
Doctorate	490	510	541	1,034
Total	673	1,485	1,624	2,993

Source: CAPES/MEC, 2005.

The number of students has also increased markedly, ranging from 1990 to 2004. Likewise, the number of number of people holding Master's and Doctorates has increased more than three-fold in a decade, revealing a marked and constant growth. In 2003, 8,094 students received their doctoral degrees and 27,630 their Master's.

Table 2. Student enrolment and diploma holders in the master's and doctorate courses, 1990-2004

	Master		Doctorate	
Year	Student enrollment	Diploma holders	Student enrollment	Diploma holders
1990	48,664	55,790	14,003	1,410
2000	92,200	18,373	41,448	5,335
2004	107,860	27,186	48,689	8,856

Source: MCT/CNPq, 2006.

The expansion of graduate studies and the constant growth of the number of new master's and doctorates are the result of major programmes maintained with the support of national and state agencies to the graduate programmes and the scholarship programmes. CAPES and

CNPq data, although presenting some variation in development, show evidence that the concession of scholarships has increased continuously, around 7.6 per cent per year. It should be said that even taking into account the ratio of number of scholarships granted to the overall number of students enrolled, considering the significant growth in enrolments, there has been a drop in this ratio (in 2003, 25 per cent of the students were fellowships in the master's and 36 per cent in the doctorate's).

Table 3. Brazil: Master's and doctorate scholarships in the country funded by federal agencies, 1997-2004

	Total		Capes		CNPq	
Year	Master	Doctorate	Master	Doctorate	Master	Doctorate
1997	21,113	13,291	13,349	8,258	7,764	5,033
1998	19,153	13,449	12,897	8,244	6,256	5,205
1999	17,703	13,137	12,010	7,810	5,693	5,327
2000	16,466	13,484	10,906	7,839	5,560	5,645
2001	16,973	13,950	11,177	8,110	5,796	5,840
2002	16,900	14,211	11,296	8,472	5,604	5,739
2003	17,687	14,417	11,740	8,482	5,947	5,935
2004	18,807	14,322	12,163	7,991	6,644	6,331

Source: MCT/CNPq, 2005.

The number of full doctoral programme scholarships given for studies abroad is being reduced and sandwich doctorates and post-doctorates are being encouraged.

Table 4. Brazil: Scholarships abroad funded by federal agencies according to modalities, 1997-2004

	Capes				CNPq			
Year	Master	Doctorate	Sandwich Doctorate	Post-doc	Master	Doctorate	Sandwich doctorate	Post-doc
1997	37	955	235	177	-	1,119	227	254
1998	18	945	252	134	1	572	80	139
1999	8	848	275	128	-	461	47	87
2000	11	761	309	129	-	308	53	83
2001	19	708	357	197	-	443	102	172
2002	14	688	366	188	-	433	105	206
2003	3	719	426	219	-	341	40	79
2004	4	715	430	231	-	260	111	127

Source: MCT/CNPq, 2005.

6. Where are the diploma holders?

The fate of Master's and Ph.D. holders clearly shows that the system trains people specifically for its own academic life, public and private research.

During 1998 and 2002, a three-step survey was conducted including graduates in fifteen fields of knowledge supported by CAPES and in agreement with UNESCO. It interviewed 9,000 masters and Ph.D.s who have graduated since 1990 from fifteen large institutions, mostly public universities.

The focus was the academic or professional occupations and the relationship between training and work. For this paper, we selected the question: "Where do graduates work?"

Table 5. Where did the Master's and Ph.D.s go to in the 90s?

Type of activities	Masters (%)	PhD (%)
Business and public services	20,7	10,9
Public and private companies	21,1	5,9
Universities	34,5	68,8
Research Institutes	5,4	8,3
Offices/Consulting	12,5	4,5
Others	5,7	1,7

Source: Velloso, J. 2002.

The study findings show that most of the Ph.D.s, 68.8 per cent, are teaching and researching in universities as against only 34.5 per cent of the people who have master's degrees. Most holders of master's degrees work outside academia, such as in companies (mostly private), in public administration or as liberal professionals (Velloso, 2002). The heavy concentration of doctorate holders in academic work involves the fact that most scientific and technological research in Brazil takes place in universities, with less links to industry (Velloso, 2002).

III. SCIENTIFIC INITIATION PROGRAMME

Scientific Initiation (SI) is a strong tool in education and allows introducing promising undergraduate students to scientific research. Through SI, the student comes into contact with the daily scientific activity advised by professors and researchers (Neves, 2002).

Nowadays, this programme is spread all around the universities and has the support of CNPq, regional support foundations for research, and institutional support of the HEI.

The Scientific Initiation Programme produces strong effects on the students' training: contact with scientific methods makes them more aware, critical and productive; experience in the research groups prepares them for teamwork; the participation and presentation of their works at the Scientific Initiation Meeting is already an annual tradition of HEI and a privileged space for the scientific exercise. When they exercise the scientific initiation, they often find their vocation for science and university teaching (UFRGS, 2003).

According to CNPq (2007), the main objectives of scientific initiation are, to:

- *Arouse* scientific vocation and to stimulate potential new talents among undergraduate students;
- *Contribute* to the reduction of the average time needed to obtain a master's or doctoral degree;
- *Provide* the institution with an initiation research policy formulation tool for undergraduate students.
- *Stimulate* a better articulation between the undergraduate and graduate level;
- *Contribute* to human resources training for research.
- *Contribute* decisively to reduce the average length of time the students spend in graduate studies.
- *Stimulate* productive researchers in order to involve the undergraduate students in the scientific, technological and cultural-artistic activities.
- *Provide* the scholarship student, advised by a qualified researcher, with the learning of research techniques and methods, and also to stimulate the development of scientific thinking and creativity resulting from the conditions created by direct contacts with research problems.

The scientific initiation scholarships were established when CNPq was created in 1951, in a small number contemplating only a few fields of knowledge. From 1972 onwards, the number of scholarship increased reaching a total of 2,000 in 1986. However, they only became significant in the 1990s when, over a period of five years, CNPq granted more than 65 per cent of the overall scientific initiation scholarships distributed.

The National Council of Scientific and Technological Development (CNPq) operates the scientific initiation scholarships in two different ways: (i) within the scope of the integrated research project, the scholarships are granted by quotas transferred directly to the project coordinator, after being judged by the CNPq staff of Consultants. The main characteristic of this grant is that the researcher/adviser is responsible for the selection, follow-up and evaluation of the student; (ii) in the Scientific Initiation Scholarship Institutional Programme (PIBIC), in which the quotas are transferred to the institutions of higher education, also responsible for the selection, follow-up and evaluation of the students.

In 1988, the CNPq Deliberative Council was in favour of granting institutional quotas of scientific initiation scholarships initially maintaining 25 per cent of the overall number of scholarships for this purpose. This decision basically aimed at institutional involvement in the scientific initiation when it transferred the task of managing and operating a quota of scholarships which, up to the moment, were managed by CNPq through requests made directly by the researchers.

Gradually, these institutional scholarships began to play a major pedagogical role within the institutions and required a commitment by the university community itself, to define rules and forms of conduct to improve Programme operation.

The first Normative Resolution of the new programme was done in 1993 which defined forms of follow-up and evaluation, and included criteria for the institutions to enter the Programme. Normative Resolution No. 006, after many resolutions and an evaluation process, was approved in 1996 in which several operational procedures were established, i.e. those involving scholar selections, projects and advisers, and those involving the evaluation process. At the same time, the users' manual was released and it has established a conceptual mark for the main guiding aspects of the Programme also creating a common language, enabling easier

interaction between CNPq and the teaching and research institutions involved in the Scientific Initiation Scholarship Institutional Programme (PIBIC).

To enrol in the programme, the institution must have defined the following: a research policy committed to the programme and to be located within the scope of university research and graduate departments or similar institutions. The local programme coordinator is chosen by the Research Provost who must be preferably from a research career or be a qualified technician who can interact with the CNPq and with the other local and external committee members.

The programme has two types of committees, one local, composed by researchers of the institution with a Ph.D., working in the undergraduate and graduate courses, who have preferably research projects supported by the CNPq. The members of this committee must participate in the evaluation and selection processes of the scholars, and systematically follow the programme activities during the school year in partnership with the local programme coordination.

The other committee, called external, is composed by CNPq level 1 researchers coming from the university located outside the Federated Unit of which the institution is part. Its purpose is to act together with the local committee to evaluate the scholars. Both committees must include all great fields of knowledge according to the profile and characteristics of the institution.

The selection of scholars, research projects and advisers begins with the publication of the conditions and requirements for the presentation of proposals, observing the profile of the adviser, student and project. After receiving the request, the committee decides, based on research project and the adviser curriculum, grades transcript, workplan and the student's activity schedule. The projects presented are evaluated by observing the academic quality and scientific merit.

Work is evaluated annually through the scientific initiation events, where the results of each student's work are presented in posters or oral expositions. Local and external committee members, the CNPq representatives, advisers and the student and academic community participate in the seminar. The scholars' work is published in books of abstracts or

proceedings organized by the institutions themselves, and most of them grant awards for the best.

The scholarship is granted for a period of twelve months and allows two renewals if the scholar performs well according to his work plan and presents good academic results. Monthly, the CNPq gives each student on a scholarship an amount which corresponds to one-third of the master's degree scholarship in the country.

The quota for the institution is for twelve months beginning in August and ending in July of the following year; it can be renewed, enlarged and reduced according to the performance of the institution in the programme, and its capacity for providing guidance.

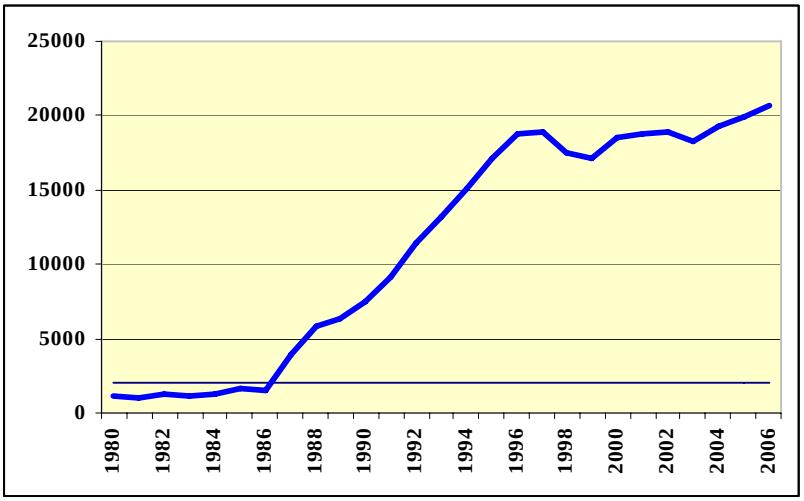
Through the scientific initiation scholarships, the CNPq has contributed to train future scientists fulfilling the regional demands to increase quality and quantity of researchers. *Table 6* and *Graph 2* show the marked growth of the number of SI scholarships since 1986. In 2006 a total of 20,704 undergraduate students received an SI scholarship from CNPq. Including the SI scholarships provided by the state foundation to support research, this number increased to over 30,000 scholarships.

Table 6. Brazil: Scholarship for undergraduate students funded by federal agencies according to modality, 1980-2006

Year	CNPq		SESU/MEC
	Scientific Initiation (IC)	Tecnological Initiation (ITI)	Special Training Program (PET)
1980	1,079	...	22
1990	7,548	55	594
2000	18,483	1,308	3,454
2006	20,704	2,664	...

Source: CAPES/MEC, MCT/CNPq, 2006.

Graph 2. Scientific Initiation scholarship for undergraduate students funded by federal agencies, 1980-2006.



Source: MCT/CNPq, 2006.

IV. FINAL CONSIDERATIONS: THE IMPACT ON SCIENTIFIC PRODUCTION

The success of the human resources development strategies analyzed previously can be established and measured when data on the growth in the number of institutions and groups involved in research and the growing Brazilian scientific production are analyzed. This has grown to a previously unheard of level in the last twenty-five years, as shown in the data in *Tables 7 and 8* below.

Table 7. Number of institutions, groups, researchers and researchers with Ph.D.s 1993-2004

	1993	1995	1997	2000	2002	2004
Higher education Institutions	99	158	181	224	268	335
Research Groups	4,402	7,271	8,632	11,760	15,158	19,470
Researchers (R)	21,541	26,779	33,980	48,781	56,891	77,649
PhDs researchers (D)	10,994	14,308	18,724	27,662	34,349	47,973
(D)/(R) in %	51	53	55	57	60	62

Source: MCT/CNPq, 2005.

Comparing the production data, publications doubled between the two periods analyzed, as shown in *Table 8.*

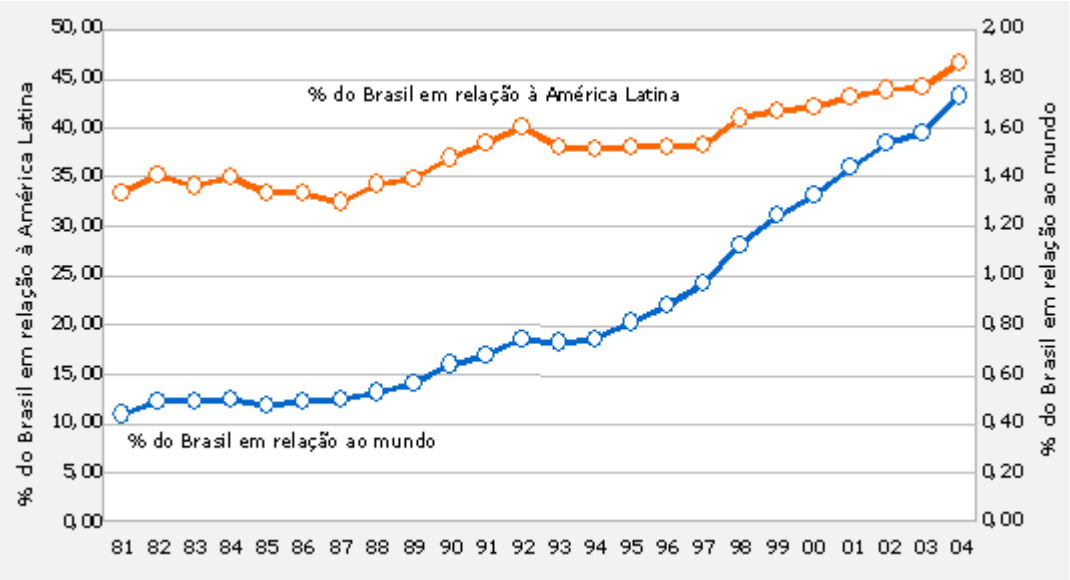
Table 8. Production and S&T productivity according to the type of production in the group activities, 2000-2004

Type of production	Number of productions		Number of productions by researcher	
	Year 2000	Year 2004	Year 2000	Year 2004
	Production 97-00	Production 00-03	Production 97-00	Production 00-03
1. Nationally published articles	76,960	201,477	0,63	0,89
2. Internationally published articles	78,192	133,675	0,64	0,59
3. Published papers	115,318	252,754	0,94	1,12
4. Books	8,123	17,156	0,07	0,07
5. Book chapter	29,848	77,164	0,24	0,34
6. Tecnical production	6,936	15,669	0,06	0,07
7. Theses	14,594	26,532	0,12	0,12
8. Dissertations	47,102	93,081	0,38	0,41

Source: MCT/CNPq, 2005.

Between 1981 and 2004, there was a significant increase in the publications indexed at the Institute for Scientific Information (ISI, Philadelphia, US). Brazil, which in 2000 contributed 1.33 per cent of the world total indexed published articles at ISI, began to contribute 1.80 per cent in 2004. In relation to Latin America, the proportion which was 42.1 per cent in 2000 increased to 46.61 per cent.

Graph 3. Brazilian articles published, percentagewise, compared to worldwide and Latin America



- Percentage of Brazilian articles compared to Latin American articles published.
- Percentage of Brazilian articles compared to publication of articles worldwide.

Source: MCT/CNPq, 2005.

The main purpose of this paper was to show how graduate studies in the last decades have become the essential tool through which Brazilian higher education was modernized, contributing decisively to a profound change in profile and performance. Through the graduate studies system academic competence was established; the process of research institutionalization was consolidated, and qualified human resources trained. Similarly, the Scientific Initiation Programme has become a fundamental instrument to learn research and qualify students.

Nowadays, the challenges and perspectives to be faced by the graduate programmes in order to allow system growth, involves:

- Strengthening of the scientific, technological and innovation bases.
- Training faculty for all teaching levels.
- Training staff for the non-academic market.

- Articulation of the federal agencies with the S&T State Secretariat and the state research support foundations.
- Overcoming both the regional and state asymmetries and inequalities and asymmetries between different fields of knowledge.
- Further planning to guide the development and performance of the graduation education system.

* * *

ANNEXES

Annex 1. Programmes maintained by CAPES in the country

Social Demand Programme (DS) and Graduate Support Programme (PROAP):

It grants scholarships to *stricto sensu* graduate courses (master's and doctorate's degrees).

Support Programme for Events in the Country (PAEP):

It grants resources for short scientific, technological and cultural events.

Faculty Qualification Institutional Programme for the Federal Network of Professional and Technological Education (PIQDTEC):

It gives support to training faculty from the Federal Technical and Agro-technical Schools and the Federal Centers for Technological Education

Institutional Project Support Programme with the Participation of recent graduated doctors (PRODOC):

It complements the formation of the recently graduated doctors stimulating institutional projects and the improvement of the Brazilian postgraduation programme performances.

Development Programme for Graduate Studies (PROF):

It promotes training of human resources to supply the needs of the public institutions offering *stricto sensu* graduate programmes (master's and doctorates)

Support Programme for the Post Graduate Private Teaching Institutions (PROSUP):

It supports the *stricto sensu* graduate studies (master's and doctorates) of the private teaching institutions.

Institutional Qualification Programme (PQI):

It supports joined post graduation and research projects among groups from different regions of the country or different cities of the same region and different institutions.

Periodical websites (Portal de Periódicos)

- Faculty, researchers, students and staff of 188 higher education and research institutions all over the country have immediate access to the world scientific production updated through this service offered by CAPES

- The website Periodical offers access to complete texts of articles from more than 11,419 international and national magazines and to more than 90 databases with document summaries in all fields of knowledge , and it also includes a selection of important academic source information with free internet access.
- Website use is free for users from the participating institutions. Access is through any terminal connected to the Internet located at the institutions or authorized by them.
- All the undergraduate, graduate and research programmes gain in quality, productivity and competitiveness with the use of the website which is always being developed.

Annex 2. Programmes maintained by CAPES abroad

Doctorate

It is for candidates with proved academic performance and that go to excellent and international prestigious institutions in areas with recognized need of consolidated groups in the country.

Doctorate Training-PDEE

It provides the doctorate students, who had a score equal or above four at the last Capes evaluation with an opportunity to develop part of their research at a foreign institution of known excellence.

Doctorate Training- Counter

It provides the doctorate students, who had a score of three and new courses recommended by Capes, with an opportunity to develop part of their research at a foreign institution of known excellence.

Post-Doctorate Training

It allows the professor and/or researcher to develop joint activities with their colleagues or similar groups abroad.

Support Programme for Events Abroad (PAEX)

It supports the presentation of professors' and researchers' scientific works in events abroad.

Capes Thesis Grand Prize

Support to the winners of the Capes Thesis Grand Prize to perform Post Doctoral Training abroad, and to their respective advisers for the presentation of scientific works at events abroad.

Annex 3. Federal agency support to research)

CNPq (1951) (in the country and abroad)

Human resource training for research by granting different types of scholarships: SI, masters, doctorates, sandwich-doctorate, post doctorate, teacher-training and specialization.

Support Scholarship for research: productivity, just-doctorate, visiting researcher; foreign researcher.

Technological-entrepreneurial development Scholarships.

Support to T&S&I development programmes – Centres of Excellence.

PADCT (closed) PRONEX (1996) Millennium Institutes (1998).

PROANTAR International Cooperation, Scientific publication support.

FINEP (1965) Research and project financing

Administration of the Funding for Scientific and Technological Development (FNDCT).

Support to innovation in big and top companies.

Support to innovation and technological diffusion in local productive array.

Support to research institutes and technological base companies.

Responsible for the Science and Technology Sectorial Funds.

Other federal and state systems

EMBRAPA – Brazilian Agricultural Research Corporation.

FAPESP – Research Support Foundation for the State of São Paulo.

State Research Support Foundations.

Research support finance resources

Budget resources from the National Treasury.

Resources from budget and extraordinary resource Funds (international loans).

Sectorial Funds.

SECTORIAL FUNDS: New Financial Model**.** There are sixteen Sectorial Funds:

(1) CT-AERO (2) CT-AGRO (3) CT-AMAZONIA (4) CT-AQUATRANSPORT (5) CT-BIOTEC (6) CT-ENERGY (7) CT-SPACIAL	(8) CT-HYDRO (9) CT-INFO (10) CT- MINERAL (11) CT- PETRO (12) CT- HEALTH (13) CT-TRANSPORT	(14) FUNTEL-Funds for Technological and Telecom-munication Development Transversal Actions (15) CT-INFRA (16) GREEN YELLOW: University Interaction Company

* * *

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NB: Paper presented at the UNESCO Forum on Higher Education, Research and Knowledge. 2nd Regional Research Seminar of the Scientific Committee for Latin America and the Caribbean, Port of Spain, Trinidad and Tobago, 19-20 July 2007. Session 1- Building Research Capacity.

Biography of Professor Dr Clarissa Eckert Baeta Neves

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Social relevance and usefulness of higher education institutions in Cuba, Nicaragua and Bolivia: examples of good practices

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I. INTRODUCTION

This paper aims to emphasize the social relevance of higher education illustrating Good Practices (GP) analyses in three countries of Latin America and the Caribbean (Cuba, Nicaragua and Bolivia), each one with diverse historical traditions and significant differences in their political processes at this period in time.

PART ONE: THE CASE OF CUBA: CREATION OF SCIENTIFIC CAPACITIES BY MEANS OF PUBLIC POLICIES OF HIGHER EDUCATION, SCIENCE AND TECNOLOGHY

1. CHALLENGES OF THE PERIOD 1990-2007

The main hypothesis of this paper is the following: In Cuba, the massification (expansion) of Higher Education (HE) with quality and equity through national policies of social inclusion, has resulted in the development of state-of-the-art science in accordance with contemporary standards of research universities. Wholly devoted to fulfill national needs, this policy of HE – alongside science and technology policies – has had an important impact on capacity building and the development of human resources (human and social capital) in Cuba, as well as in other developing countries aided by Cuban international cooperation.

From 1989 up to the present time, 2007, the Cuban Government has faced enormous challenges: the overriding of socialism in certain countries; the intensification of US blockade; the emergency of a "Unipolar World" [*world political climate in which one superpower stands above the other*s] controlled by the United States; the economic and social crisis of the South; the 'victory of neoliberalism'; the sequels of 9/11 and of the current world recession; and the urgent need to be inserted in a new type of world global market. Cuba has resisted and continued its diverse programmes of development and construction of equity, among them those of the Higher Education Institutions (HEI), in spite of this problematic world environment.

The growth of gross domestic product (GDP) of 2005, according to CEPAL [*Comision Económica para América Latina y el Caribe*], was of the order of 5 per cent. The Cuban Government, according to its own methodology, estimated a growth of 11.8 per cent; however in 2006 it reached 12.7 per cent.

2. CREATION OF EDUCATIONAL AND SCIENTIFIC CAPACITIES.

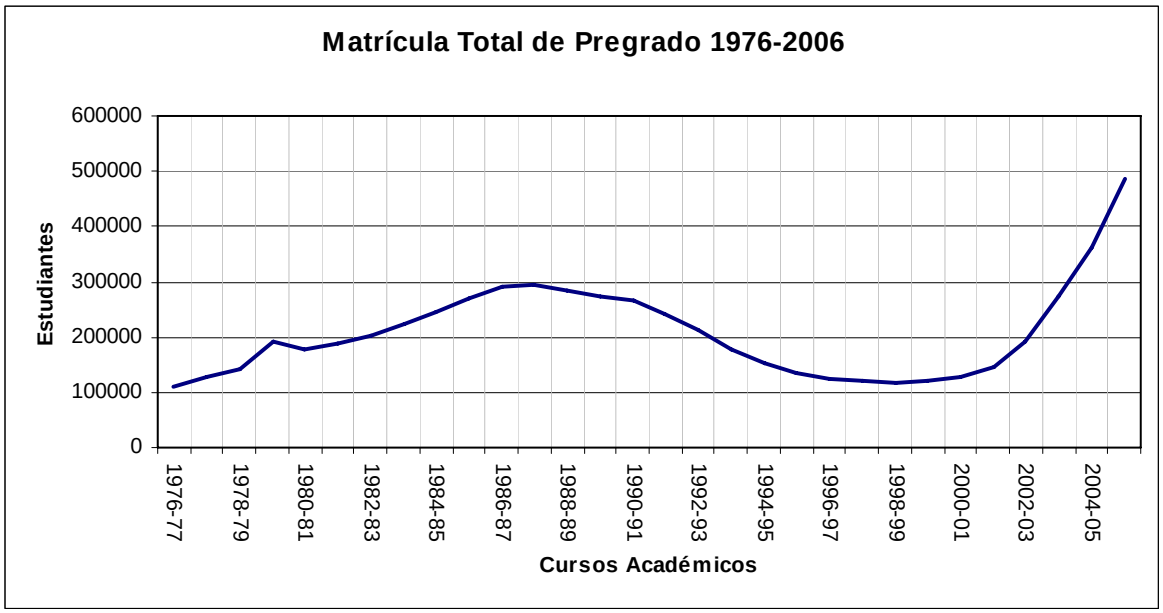
2.1 Indicators of Higher Education (HE)

The National Census of Population and Housing of Cuba (2002) reported a population of 11.17 million inhabitants, of which 712,672 were university graduates. This means that 6.91 per cent of the whole has, at least, a HE certificate. It is the women who constituted the majority with 52.05 per cent.

University students are 11.63 per cent of the segment of the population between 30 and 59 years and 10.01 per cent of the economically active population, of this latter category 10.45 per cent are women and 8.30 per cent men. The Gross Enrolment Ratio (GER) for the academic year 2006/07 reached 63.1 per cent. In the course of 2005/06, 65.16 per cent of the GER were women. [*Por ciento de la matrícula total con respecto al segmento de la población comprendida entre 18 y 24 años]*.

The Cuban subsystem of HE is made up of sixty-five institutions of HE and 3,150 headquarters at municipal level. The matriculation estimated for the academic year 2006/07 exceeds 620,000 students.

The evolution of the size of the subsystem over the last thirty years can be estimated as shown in the following graph:



2.2 Transforming tertiary education: the universalization of HE

Since the academic year 2001/02 the Cuban HE system has followed new and important transformations with a view of extending the possibilities of university studies to the least-favoured social sectors. This is being accomplished through the *universalization of the university*, which has implied a substantial increase of the Gross Enrolment Ratio (GER).

Since the creation of University Subsidiaries (US), the municipalities assume a more active role in preparing professionals needed for its development. Research linked to local problems will be a reality in these university subsidiaries for municipal university students.

2.3 Creation of scientific capacities by means of public policies of science and technology

A first period (1960 and 1977) of "Promotion Directed towards Science", with a predominant scheme of "Science Push". It was a stage identified by revolutionary transformations, massive access to education and the creation of a national health system; and that was the point when the US blockade against Cuba begun and escalated

Over the decade 1960 and 1970 seven scientific institutions on average were created per year. HE institutionalizes the careers of sciences and engineering and creates an agenda of research centred on economic and social problems. A massive training began of human high-level resources taking advantage of international cooperation. Institutions of coordination of science and technology were established during this period: in 1974, the National Council of Science and Technology (CONCYTEC), and in 1976 the State Committee of Science and Technology. The second period, named "Model of Centralized Direction" (1976-1990) is characterized by concentrating trade and cooperation together, trading with socialist countries of Eastern Europe, and as a consequence Cuban membership in 1972 of the Council of Mutual Economic Aid (CMEA). The transfer of technology was dominant and a better use of scientific results was promoted, incorporating them into production and services. In 1987 appeared the "System of Introduction of Achievements", the number of researchers doubled and a national system of scientific degrees was created.

As a consequence of the fall of European socialism and the collapse of the USSR and CMEA the country introduced changes in the economic model, and an important process restructuring agriculture and industry took place. In this context, a third period of the "Model of Science and Technological Innovation" was consolidated in managing and organizing science and technology. In the year 2002 Cuba invested about 1 per cent of its GDP in activities related directly to science and technology (Castro Díaz-Balart, 2006). The principal features of this model are: the "Creation of the Scientific-Productive Pole of West of Havana, and of every province of the country, dedicated to biotechnology and to the pharmacist industry"; the promotion of social movements that stimulate and value innovation (Forum of Science and Technology, Association of Innovators, Technical Juvenile Brigades); a major emphasis of technological management in the companies; creation of research groups in universities; the extension of postgraduate courses according to national needs; the universalization as well as municipalization of HE, which gave new opportunities to local innovation; the promotion of food sufficiency and sustainable agriculture; the appearance of a sector of the knowledge-based economy in biotechnology, and key developments in the software industry.

The supreme Cuban examples of the creation of scientific capacities and productivity of research have been biotechnology and the pharmaceutical industry. The genesis of the infrastructure for the biotechnological industry was the creation in 1965 of the National

Centre for Scientific Researches (CNIC) [*Centro Nacional de Investigaciones Cientificas*]. The principal zone of scientific development is nowadays the scientific-productive "Pole of West Havana", already mentioned, that constitutes an example of Good Practices (GP). Among its principal institutions are, the: (i) Centre of Molecular Immunology (CIM); (ii) Institute of Research Carlos J. Finlay, and (iii) Centre for Genetic Engineering and Biotechnology (CIGB) [*Centro de Ingeniería Genética y Biotecnología de Cuba]*.

The development of biotechnology has had great social relevance given its great impact on Cuban public health by means of the creation of new products such as: the recombinant vaccine against Hepatitis B; the PPG (Policosanol), a medicine for cholesterol control; *estreptoquinasa* recombinant, used in the treatments of cardiac attacks; a factor of recombinant epidemic growth, used for cases of severe burns; the components of a diagnosis kit for the precise detection of the stocks of HIV viruses; and monoclonal antibodies, used for diagnoses, for example of Hepatitis C, and the treatment of diverse diseases. These products constitute an important sample of the productivity of Cuban investigations in this field (Castro Díaz-Balart, 2006).

CREATION OF SCIENTIFIC CAPACITIES
THE BIOTECHNOLOGY SECTOR

With the purpose of creating a sector of biotechnology having an impact on the economy of Cuba, a series of key concepts were adopted (Castro Díaz-Balart, 2006, pp. 11-12):

- *Organizations in closed circuit.* The most important institutions were structured in organizations of investigation, production and commercialization, in which all cycles, from the money invested in research, development and production, to the recovery of investments in the market, was subordinated to the same management and same level of responsibility.
- *Organizations oriented towards export.* Given the reduced character of the Cuban internal market the development of products like the global market has an important future.
- *Intellectual Property*. The main biotechnology organizations of Cuba are proprietors of more than 600 patents registered abroad.

3. CONCLUSIONS: SOCIAL RELEVANCY AND CONTRIBUTIONS OF THE SYSTEM OF TERTIARY EDUCATION TO THE DEVELOPMENT OF THE COUNTRY. THE SYSTEM OF PUBLIC HEALTH AS AN EXAMPLE OF GOOD PRACTICES

Cuban HE has been characterized by its high social relevancy: it has given responses adapted to professionals' principal requirements, in harmony with the demands of the country for its needs in production of goods, services and research, as well as with its commitments of cooperation and solidarity with other countries worldwide, particularly in education systems and public health services.

Higher education – showing good practices in the area of the public health – has trained sufficient physicians and other health specialists. This allows Cuba to have a public universal national free health service, accessible to the whole population. The public health system is regionalized and has an integral character, within reach of all citizens in the city as well as in the country side.

The successful low infantile death rate is the lowest in the Caribbean Region and also recognized, in comparison, worldwide.. Cuba has the major rate of doctors for every thousand inhabitants of the world. Nowadays more than 20,000 Cuban doctors offer services in more than sixty different countries. Cuba offers thousands of free scholarships for students of developing countries to be trained as university graduates in different branches of science; in particular 12,000 students receive annually medical training in *ad hoc* schools.

HE subsystem provides the education system with the necessary teaching staff, including an additional number of teachers required in order to fulfil new demand challenges. More than 90 per cent of the teachers are university graduates and those who are not study to reach this level in university precincts. Nowadays more than 70,000 university teachers follow master's degree courses.

The training of an important number of professionals with high qualifications in different branches of science and having social vocations, has sustained the strategies of economic and social development adopted by Cuba, allowing the country to successfully overcome the principal difficulties of the economic crisis of the nineties and to sit tight on solid bases to reach for and attain new and better results.

Table 1. **National enrolment in postgraduate courses, 2005.**

Postgrado	TOTAL	MES[1]	MINED[2]	MINSAP[3]	OTROS
Cursos	38,5191	108,629	106,044	115,289	55,229
Diplomados	76,870	20,706	33,030	15,578	7,556
Entrenamientos	20,124	5,360	2,605	7,127	5,032
Maestría	98,795	10,617	76,455	10,833	890
Especialidad	14,296	2,564	91	11457	184
Doctorado	4,129	2,145	965	452	567
TOTAL	599,405	150,021	219,190	160,736	69458

[1]MES: Ministry of Higher Education. [2]MINED: Ministry of Education.
[3]Ministry of Public Health.

Source: Statistics Department, (MES), 2005.

PART TWO: THE CASE OF NICARAGUA: SCENARIOS, RELEVANCE AND SOCIAL USEFULNESS OF RESEARCH

1. CURRENT SITUATION OF THE EDUCATION SYSTEM IN NICARAGUA, WITH SPECIAL REFERENCE TO HIGHER EDUCATION

Nicaragua comes after Haiti, as the poorest country of Latin America. From 5.9 million inhabitants, half of them live in situations of poverty and 20 per cent in extreme poverty. The annual revenue *per capita* is the lowest of Central America: US$908.

As from 1990, plans of structural adjustment were applied in Nicaragua, in collaboration with the International Monetary Fund (IMF), in order to obtain a balance in the macroeconomic indicators. This policy will be continued by the present Government, with a modest increase of social expenses.

Table 2. Higher Education (HE) in Nicaragua.

Educational Level	**GER (percentages)**
Pre-School	23 %
Primary	82 %
Secondary	40 %
Higher Education	14 %

The University of León (UOL) in Nicaragua was the second to be established in the captain-general of the Kingdom of Guatemala; and during the colonial period (1812) Spain established the last one in the US.

Table 3. Higher Education Institutions (HEIs) in Nicaragua(*)

Higher Education Institutions	
Universidades Públicas Miembros del CNU(+)	4
Universidades Privadas Miembros del CNU(+)	5
Centros de Educación Técnico Superior Miembro del CNU(+)	1
Instituciones Privadas no Miembros y autorizadas por el CNU(±)	42
Instituciones Privadas no reconocidas por el CNU	1
TOTAL	**53**

(*) *No incluye a las Academias Militar y Policía.*
(+) Beneficiadas con fondos públicos del 6 % del Presupuesto General de la República (PGR).
(±) Se refiere aquellas universidades que no forman parte del Consejo de Rectores del Consejo Nacional de Universidades (CNU).
Source: IESALC/UNESCO, 2006.

Of the 100 per cent total of students, 60 per cent attend private universities which do not belong to the National Council of Universities (CNU) and 40 per cent to universities subsidized by the state. To these public universities integrating the CNU, 75,945 students attended in 2006, of which 75 per cent enjoyed total or partial exoneration concerning payment of tuition fees. These institutions graduated 7,270 professionals that same year.

There is a total of more than 500 careers of the bachelor's degree level offered, in public and private universities, and near on 200 postgraduate and specialization courses – with annual repetition.

For example: 33 programmes of Business Administration exist, 24 of Tourism and Hotel management, 21 of Accounting, 20 of Systems Engineering, 15 Information Technologies, 14 of Economy and 10 of Diplomacy and International Relations. In the postgraduate courses the specialities of Medicine (33 programmes) occupy the first place, followed by Law (18), Administration (11) and Economy (7) (Tünnermann Bernheim and Yarzábal, 2002).

The state contributes by constitutional mandate, to the ten institutions of HE that integrate the CNU, with 6 per cent of the National Budget, which is equivalent to the 1.2 per cent of the GDP (about US$80 million). The unit cost by student of the system subsidized by the state is of US$911; this amount does not include the costs of books, transport, canteen, etc.

2. SITUATION OF SCIENTIFIC-ECHNOLOGICAL DEVELOPMENT: WEAKNESSES AND PERSPECTIVES

A total number of 151 research institutions were surveyed in 1993 by the Institute for European Latin-American Relations (IRELA) in Central America, 18.5 per cent being established in Nicaragua. Regarding scientific publications having international recognition in the Science Citation Index® (SCI®), the written production of Nicaragua is very limited to 3.6 per cent.

Nicaragua lacks a real national system of science and technology, and the investment in R&D is no more than the equivalent of 1 to 0.77 dollars *per capita*.

3. PROBLEMS OF SCIENTIFIC RESEARCH AND CONSTRUCTION OF CAPACITIES: CHALLENGES TO OVERCOME

The function of research does not have the priority that it deserves in higher education institutions (HEIs) and the policies of scientific research lack the necessary resources for implementation.. Concerning the causes of this poor development of scientific research, the following could be mentioned: (a) the profession-oriented (and not research-oriented) character of higher education; (b) the deficiency of stimuli to the researcher; and (c) the separation of research activities from postgraduate courses.

The main difficulties that researcher face are, among others, the following ones:

(1) Lack of an adequate relationship between the scientific-technological infrastructure and economic activities.

(2) Limitation of financial and material resources, including the poor and deficient organization of bibliographical resources, collections of scientific magazines, centres of documentation, laboratories, computers, etc.

(3) Lack of 'critical mass' to sustain a programme of interdisciplinary research.

Nevertheless, in recent years, it has been witnessed the emergence of positive signs towards the promotion of research and generation of capacities.

1. It can be affirmed that scientific research is in an initial stage of development in HEI's in Nicaragua.
2. Nicaragua has at present times the *minimum necessary conditions* to shape a national system of science and technology, but this has not yet been created.
3. International cooperation, specially bilateral with Sweden, has allowed the beginning of the construction of an endogenous capacity of R&D, which has been translated in training in postgraduate courses of a still small, but already significant number, of university teachers and the existence of several units, programmes and projects of research supported by ASDI-Sida/SAREC.
4. In spite of this, research is developing in different academic units of the universities, especially in the public ones, due to the self-sacrificing spirit of the researchers and to their vocations.
5. The activities of R&D carried out in the universities belonging to the National council of Universities (CNU) show, in the themes researched, a good degree of social

relevancy. Nevertheless, it is not possible to evaluate adequately their quality, scientific and social impact due to the non-existence of databases and other sources with updated information.

4. SOCIAL RELEVANCE AND USEFULNESS OF RESEARCH. EXAMPLES OF GOOD PRACTICES (GP)

There are two outstanding public universities concerning fields of research and social usefulness, among the universities of the country. These are: the Autonomous University of Nicaragua (AUN), based in León, and the National University of Engineering (UNI), located in Managua, the capital city.

From the experience of these universities can be extracted the following examples of good practices. UNAN-León [*Universidad Nacional Autónoma de Nicaragua, la Primera Universidad de Nicaragua]*.has lately created centres of research and post-graduate courses that attract and train academicians of the highest scientific level; they have an adequate infrastructure with basic and specialized equipment of top technology available in the country and participate in networks with relevant international groups, with the same specialities as theirs, for the exchanges of experience and knowledge.

4.1 **Centre** for **Demographic and Health Research** (**CIDS**)

In May 2002, the CIDS was created with the mission to develop projects of research-intervention in the public health field; putting into practice the results of this research in the programmes of postgraduate training in epidemiology and public health, as well as designing and formulating actions for the improvement of the populations' living conditions and health. Its research gives the possibility of doing parallel studies on various problems of public health, such as: traffic accidents, suicide attempts of the younger population, teenage pregnancies, profiles of factors of risk for cardiovascular diseases (consumption of alcohol, bad nourishment and sedentary habits), domestic violence and its impact on the health of the pregnant woman and child, civil safety, and sexually transmitted diseases such as HIV/AIDS.

4.2 Geographical Information Systems (GIS) Centre

The GIS Centre, created in 2005, compiles and processes data and geographical information obtained by means of Systems of Geographical Information technology (SIG). The work

focuses on the development and system application of geographical information of public health, management of environment and natural resources, prevention, mitigation and attention to disasters, local development, integral managing of hydrographical basins and renewable energies. It has geo-indexed information concerning ten municipalities of the Department of León.

4.3 Centre on Health, Work and Environment Research(CISTA)

CISTA offers to the workers specialized tests in occupational health and has developed, together with the Nicaragua's Central of Workers, the project of "Promotion of Workers' Health and Safety" [*Prómocion de Salud y Seguridad de Trabajadores], (PROSSTRAB).*

4.4 Centre for Infectious Diseases (CIEI).

CIEI was created in 2005 to improve the health of the Nicaraguan and Central American population by generating and transferring knowledge and technologies, as well as training human resources in the field of infectious diseases. It is directly connected to quality assurance (QA), ethics, the search for education excellence and permanent links with the community.

4.5 Research and Reproduction of the Biological Controllers Centre (CIRCB)

CIRCB was constructed with the support of the Government of Japan. It was inaugurated in 2001 in order to obtain a mass production of the agents of biological control of agricultural plagues, principally *Trichogramma* and *Chrysopa.*

4.6 National University of Engineering (UNI)

The narrow relationship between teaching, research and extension is apparent through increasing linkages with the productive public and private sector, especially with the small- and medium-enterprises (SME-PyME), together with the creation of strategic alliances with majors and municipalities of countries as a whole. Two special units, the office of municipalities and the office of relations with PyMES coordinate these activities in the institutional area. The centres or institutes of research of UNI are, the:

(1) Programme of Cities Territories Environmental Studies (PEA/UT) is part of the Centre of Research and Studies of the Environment (CIEMA).

(2) Programme of Research and Teaching in Environment (PIDMA) is part of the Centre of Research and Studies of the Environment (CIEMA). This programme works in treatments of water, pollution and pollutants.

(3) Programme UNI-ASDI-FIQ, in the Faculty of Chemical Engineering involved in the processes and chemical technology area, especially processes and unitary operations (Dried). *[El programa (UNI-ASDI-FIQ) este programa atiende el área de procesos y tecnología Química, con un enfoque a procesos y operaciones unitarias (Secado)]*.

Other examples of good practices are: the Mediation and Resolution of Conflicts Centre and the National Agroplasticulture Reference Centre (CNRA).

In conclusion, up until now most of the activities of Research and Development (R&D) have been carried out in public universities with technical and financial support of international cooperation, especially with the contribution of the Swedish International Development Co-operation Agency (Sida) [*Agence suédoise de coopération internationale au development (ASDI))* through its Department of Research (SAREC).

The joint Swedish cooperation (Sida/SAREC) has been constant and is developed in three phases. The first focuses on the support of projects considered of great relevancy for the Nicaraguan society. The second is orientated to the training of human resources at postgraduate level (Masters, Ph.D.). The third, nowadays ongoing, is devoting itself to stimulating the construction of research capacity (in health, environment, agricultural and natural resources and technologies) and the accomplishment of institutional reforms in four state universities.

PART THREE: THE CASE OF BOLIVIA: PRODUCTIVITY AND RELEVANCE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH. ROLE AND CONTRIBUTION OF THE UNIVERSITIES

1. THE CHANGES IN THE POLICIES OF HIGHER EDUCATION IN BOLIVIA, CONTEXT AND PERSPECTIVES

Over the last two decades two political and ideological visions, sometimes contradictory, have emerged in Bolivia. They coexisted and prepared two different political projects, one in the decade of the nineties in which the *neoliberal* trends tried to construct a type of university based on the *neoliberal* paradigms of market and quality. The other vision, in 2005, marked by the arrival to power of populist nationalistic trends offering new public policies, based on currently Indian origin, aimed to decolonize the paradigms of *neoliberal higher education* but without replacing the structures and characteristics of the model which it tried to overcome.

1.1 National Plan of Research and Development: the research-oriented approach

As well as the scope of education changes in Bolivia, also new visions on development and production are expressed by the new governmental authorities in the modifications to the National Plan of Research and Development, which incorporates the National Plan of Science Technology and Innovation (PNCTI) (2004-09) [*Plan Nacional de Ciencia, Tecnología e Innovación* (2004-09), La Paz, Bolivia] In a sense it respects the normative precedents of already existing policies of research, putting emphasis on the recovery and systematization of ancient knowledge.

In the above-mentioned the new productive counterfoil needs of the participation of science, technology and innovation are admitted. It proposes the implementation of institutional structures that assure the interaction among the scientific-technological sector, productive sector and the state known as the Bolivian System of Innovation (BSI). This structure tries to breakdown the technological and knowledge dependence that has sustained the colonial model for centuries. [*Programa Nacional Indicativo de Ciencia y Tecnología* (PNICyT), 2006].

This system is based on two principal ideas, the development of scientific dynamic research, capable of giving response to the needs of development; and the evaluation and

systematization of local and ancient knowledge, the establishment of scientific culture, with universal access to knowledge and technology.

In harmony with the afore-mentioned visions it establishes five strategic lines:

- Science, Technology and Innovation (STI) for productive development.
- STI to study natural and social reality – and its potentials.
- STI for the solution of regional and national problems, with sovereignty and social inclusion.
- Scientific inclusive culture for the construction of a knowledge-based society with endogenous characteristics.
- Recovery, protection and utilization of local and ancient knowledge.

It is necessary to establish in a transparent fashion the role of universities and of cases in the same context.

1.2 Development of research capacities.

Research in Bolivian universities is weak and sufficient relevancy has not been afforded to it. They have a very small percentage of teachers with exclusive dedication, which does not exceed a quarter of the whole academic personnel. Nevertheless, universities are the principal institutions involved in research development. The biggest number of researchers is located at universities (60 to 70 per cent), the rest in NGOs' and private companies' sectors; with the state having a very small number.

2. PRODUCTIVITY, SOCIAL RELEVANCE AND LINKS WITH RESEARCH AND DEVELOPMENT

2.1 Scientific research in universities.

Out of a total of 183 centres of research and development in Bolivia, 141 are part of the public universities system, 25 centres of research depend on governmental organizations and the 17 remaining ones rely on private organizations. In the cities of the so-called 'Backbone of Bolivia', integrated by the cities of La Paz, Cochabamba and Santa Cruz, resides most of the population of the country and the biggest proportion of university students as well. A total of 60 per cent of the existing centres of research in the country are implanted in these cities. In private universities there exist smaller and less-consolidated centres.

Nevertheless, the level of scientific production existing in the country as a result of the activity of these centres presents many deficiencies and weaknesses. The gaps with the countries of the Region are still very wide.

In 1986, from the 1,400,000 articles published throughout the world, scarcely seven had their origins in Bolivia and the situation has not improved significantly since then. The technological production is equally small, less than 5 per cent of patents registered regionally have their origin in Bolivia (CEUB, 1993, pp. 14-15). The diagnosis of scientific capacities of 1992 helps us to add, that though public universities have the numerical majority of research activities, the same thing does not apply in relation to the investments and expenses in R&D that are only 21.20 per cent of the national whole. Inversely, the state fulfils only 23.20 per cent of scientific activities, but it manages 60-70 per cent of the total investment of R&D. Such percentages, in turn, would lack sense if the total investment in R&D was not explicitly made. Bolivia invested in R&D only 0.1 per cent of the GDP in 1982 and 0,3 per cent in 1992, that is to say, approximately US$20 million per year. *[El contraste con los países vecinos es flagrante: Brasil invierte tres mil millones y 500 millones anuales, Argentina o Chile]*. According to the records of the National Council of Science and Technology (CONACYT) [*Consejo Nacional de Ciencia y Tecnología]*, of this total amount public universities managed US$4.3 million in 1992. According to the Executive Committee of Bolivian Universities (CEUB), in 1995, the investment would have risen to US$56.7 million (Rodríguez and Weise, 2006). *[Según la memoria de la UMSA del año 1995, su presupuesto en 'investigación y servicios' habría superado los tres millones y medio de dólares]*. Considering that in that year 142 centres of research were registered, the average for each of them was US$47,183, this sufficiently illustrates the lack of funds for research and the difficulties that these centres and programmes of research have in order to survive.

The percentage of the PIB dedicated to the Public Autonomous Universities (UPA) in Bolivia has increased over the last fifteen years (Santa Cruz, 2005). Nevertheless, the main destination of the received funds has been principally the internal functioning of the university. An average of 94 per cent of its total resources is devoted to the functioning of the universities and scarcely 6 per cent for investment. In 1995, the public universities only devoted 7.44 per cent to R&D from their general budgets.

2.2 Links of HE with the national sector of science and technology. Efforts for improving social relevancy

The support to research and development from the state is made through the National Council of Science and Technology (CONACYT) [*Consejo Nacional de Ciencia y Tecnología*], the Inter-Ministerial Commission of Science, Technology and Innovation (CIMCITI) [*Interministerial de Ciencia, Tecnología e Innovación*], as well as the departmental councils of science and technology.

These structures do not have, and have not had, ideal functioning, they have very weak links with universities, giving them rather sporadic support.

Nevertheless, over recent years research has received an important send-off in public universities, as a result of financial support to research by the international cooperation. This aid has come mainly from Sweden, through Sida/SAREC, as well as from Belgium and France. Their financing is destined, in a very specific manner, to strengthening the structures and capacities of research, principally in both of the biggest universities of the system: the *Universidad Mayor de san Simón* (UMSS), Cochabamba, and the *Universidad Mayor de San Andrés* (UMSA), La Paz. However, financial priority of these funds is directly connected to social research.

The Good Practices (GP) of the Faculty of Humanities and Sciences of Education (UMSS), has a special relevance. It developed in 2006 an inventory of scientific and technological potential and a plan of strategic development of research. This late plan tries to articulate the demands of development established in the National Plan of Development (NPD) and the National Plan of Science, Technology and Innovation (PSTI). The process of change of the UAJMS ***[Facultad de Ciencias y Techología]*** the most consistent of the system, has been possible thanks to the strategic alliances that the institutional key actors have established, with external actors linked to the processes of development, together with the support and commitment of the *Instituto Internacional para la Educación Superior en América Latina y el Caribe* (IESALC) and UNESCO (IESALC/UNESCO).

3. CONCLUSIONS AND REFLECTIONS

Bolivia is in a process of deep change, that questions the traditional and hegemonic ways of understanding and carrying out science and, therefore, also the nature and role of university institutions.

With the emergence of social movements of autochthonous and Indian origin, which includes, as one of their principal claims, access to higher education (HE), it is obvious that the scenario requests universities, particularly the public ones, to open their doors and to reorient academic activity in order to contribute to the development and improvement of the standard of living of the whole population. Nevertheless, development in research and technology is still precarious; an enormous gap exists in relation to the countries of the Region.

This implies that research and development has paramount importance, as well as the universities, which are the supreme actors in promoting and generating scientific and technological knowledge throughout the country.

The neoliberal policies, which emphasized the professional function of the university (putting aside research and civic function), have kept in reserve for the developed countries the control of knowledge production, and in so doing weakened scientific activity in universities – mainly in developing countries – such as Bolivia.

Nevertheless, excellent in-depth experiences and important efforts made for developing and strengthening scientific activity are to be found in universities, with a long-term search for relevancy and pertinency in knowledge production.

In this context, the following are the most important aspects that need urgent attention for the development of consistent and integrated policies of research and development:

(1) *Strengthening* of the state structures for support and a policy of investment that determines priorities concerning R&D in the universities.

(2) *Propelling t*he processes of academic university reform, keeping in mind the frame of reference of respecting university autonomy.

(3) *Involving*, in a more consistent manner, companies and productive and services sectors in the policies of R&D.

(4) *Recognizing* the fundamental role played by international cooperation organizations, in countries with weak economies and deficient scientific policies such as Bolivia.

PART FOUR: GENERAL CONCLUSIONS

Cuba is placed 52 on the Human and Social Development Index (HDI) this being the result of mid- and long-term policies of social inclusion. The Gross Enrolment Ratio (GER) of the higher education age group is 63 per cent. The correlation that can be observed between exorbitant enrolments rates in higher education and the high place on HDI, is once again, corroborated in the Cuban case.

In countries like Bolivia and Nicaragua, without mid- and long-term science, technology and higher education policies, and marked lack of policies concerning social inclusion, developments in these areas have been extremely marginal with low impact on the Human and Social Development Index (HDI). In Nicaragua the Gross Enrolment Ratio (GER) in higher educaton is 14 per cent of the age group and occupies number 112 in HDI. Bolivia has 41 as GER and is placed 113 on the Human and Social Development Index.

However, the situation in Bolivia and Nicaragua is improving due to recent political and social transformations. A key role has been played in recent times in these two countries in developing higher education and research as well as in capacity building, through international cooperation projects, mainly due to SAREC/Sida collaboration.

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Social Relevance and the Utility of Research, Part 2.

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Training of researchers in Latin America and the Caribbean

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Introduction

Throughout its history, Latin America and the Caribbean have welcomed international trends, innovations and ideas, those which aided in the reconstruction and modernization of their societies. This has become more evident in recent decades and nowhere has this been clearer than in the domains of higher education and science policy. It is not surprising, then, to verify the Region's rapid acknowledgement of influential ideas concerning the training of researchers – especially among high profile research groups – that have had an influence on national academic domains linked to policy initiation reform, and the setting up of programmes of research training in the Caribbean Region.

Large-scale activities promoted by international organizations throughout the Region, with the support of local scientific groups seeking to professionalize research and modernizing their countries, led to reinforcing national research capacities, which were fundamentally based on the increase in the number of persons with master's and doctoral degrees, concentrated in public universities and specialized centres, and reflecting a weak interest of the productive sector on the knowledge that was locally produced. The features of these capacities are directly related to a view of scientific activity and, in particular, to the prevailing view of the training of researchers in the Region, linked to an orthodox image of the researcher that corresponds more closely to that of the basic scientist. Although this has functioned well for the development of certain capacities of unquestioned value, it is also true that this notion, when generalized as a recipe to all the fields of science that gradually emerged in the Region, limits in a perverse fashion their potential usefulness. The criteria of evaluation and promotion that tend to be applied independent of the cognitive field are concentrated almost exclusively on the features and culture of the most basic segment of research, and relate to more conventional criteria of productivity evaluation.

Paradoxically, when the most diverse international organizations, from the World Bank to the International Council for Science (ICSU) expose the theory that research activity in developing countries should be compatible, in a more relevant way, to the realities and challenges of these countries' societies, the state of affairs for science in those countries ends up, in many cases, acting as a significant obstacle precisely to the contribution to sustainable social and environmental development and to the transfer and adaptation of technology in contexts of real application. It is undeniable that the challenges for defeating the problems of developing countries are huge, but the single-minded solution adopted by science institutions in the majority of our countries seems to be neither the most efficacious nor the most efficient. One cannot help but think that for critical areas the key is being looked for in the small circle illuminated by the street lamp and not where it went astray. Many of the most recent initiatives to do research oriented towards socially and economically relevant results are mostly rhetorical, while in many instances traditional training persists, reinforced by the presence of an exaggerated and often distorted mechanism of conventional evaluation. But let us see what the main features are of the scientist's identity in the Region.

1. The building of identity. A language issue?

The identity of the scientist is clearly an artificial devise, but it serves the purposes of the scientific institution to rebuild itself, expand and self govern. Scientists learn to see and evaluate themselves, and the world, in a distinct and characteristic way. In order to do so, they absorb an ideology. The development of this identity is the result of a more or less prolonged process of interaction between students and researchers, during which the former gradually internalize, through practice and mimicry, the different aspects of the role of a researcher. Ultimately, this leads them to build their self-image as researchers and to be accepted as members of the scientific community through the mutual recognition that sharing certain beliefs affords. Such an image derives from the understanding of science as a system of communication and control. Deeply rooted in the ideology of scientists is the idea of the "Republic of Science", which rests on accepting the judgment of the 'equals', of the 'peers', that is to say, the other colleagues with whom one interacts. In passing, it may be said that these are not necessarily the totality of the universe of potential colleagues, for among them there will be some who do not share the assumptions or who do not have common interests, as shown not only by the presence of controversies but also antipathies, disputes, and mutual

ignorance within the scientific 'community'. The 'peers' are, at the same time, judges and third parties with regard to quality, novelty, originality and other aspects of the scientist's activities.

The socialization of the basic researcher takes place by means of a long process that includes selection/induction/co-opting, among other components, which has been called 'training', and which takes place through a set of complementary processes that include: (a) the elaboration of a research project that culminates in the writing of a thesis; (b) the relationship with the tutor/supervisor; (c) interactions with the disciplinary reference group, and (d) enacting/representing the role of researcher through the participation in congresses and other public rites. Scientific journals constitute the canonical mode of transmission of certified knowledge and in multiple more or less subtle ways orient the scientist's identity. The importance of the so-called mainstream scientific journals is crucial in these processes. They are the ones more read and cited, according to the *Science Citation Index* – an organization that has been instrumental in the diffusion, standardization of communication, validation and certification criteria of scientific knowledge – that in the past, when the very scale of the scientific enterprise was smaller, remained largely implicit. Of course, this is not the only index; there are others, such as *SciSearch, Chemical Abstracts, Biosis, Pascal, Medline, Inspec, Compendex, CAB*, etc., with international visibility in different fields of knowledge. Together they contribute to set the patterns of scientific communication. The training of the scientists must be coherent with such patterns, thus of crucial importance assigned to his socialization dimension which may be related to the very learning of the language that distinguishes the role of the researcher.

The works and theses the future researcher will be writing, and particularly his doctoral thesis, illustrate the domain of the rules of the socialization game through language. The basic axiom is that every author writes for an audience. The audiences of the scientist-to-be, especially with regard to the main *rite de passage* constituted by the doctoral thesis, are the future colleagues (basically represented by the members of the thesis jury) and other representatives of the discipline or profession who will eventually read it. The young trainee will have to learn to codify his arguments for that audience and will have to master the main rhetorical structures valid for writing and defending a thesis in different research traditions. Acceptance into the scientific 'club' supposes fulfilling a set of requisites of which the rhetorical ones are not the least important. Thus the candidate will learn to recognize the weight of *authoritative*

judgments. He must show that he knows the intellectual genealogy of the thematic field and that he is up-to-date on the state-of-the-art in his field: therefore, the bibliographic references that he will use are crucial. In particular, it is expected that he does a prominent display of erudite references, including footnotes or endnotes, methodological sections, the use of familiar academic metaphors and images characteristic of his cognitive field, as well as introductory material about his intellectual genealogy and clever defense of the scientific importance of the chosen problem.

It is assumed that supervisors or tutors must be experienced in the exercise of professional writing in his field and accompany the candidate in his learning process of the explicit and implicit components, as well as the rhetoric of the disciplinary discourse, to ensure the achievement of a successful graduation. Thus the importance of their individual abilities and the role of the faculty who serve as tutors. A sign of maturity of the researcher is that his Works be accepted by weighty scientific journals. But this is not easy. There is normally a process by which the student does his first works in collaboration with his supervisor. The relative scarcity of publications in Latin America just reflects the limited number of able and experienced individuals capable to act as supervisors, and facilitate the transit to training, as researcher of the candidate.

If the local supervisor of the scientist-to-be has no experience of publishing in mainstream journals, if he is not familiar enough, and lacks contacts with, the international domain, it will be more difficult for him to help his student, and therefore, the latter will find himself in situations of inferiority with respect to students of academia contexts – while earlier on in their careers research students get used to writing for publication purposes.

Today, however, the challenges of training purport to going beyond the generation of new specialized knowledge in the academic or industrial laboratory. In addition to the ‘classic’ targets of research training, a variety of new approaches to capacity building and professional opportunities, specially identified with the integration of knowledge and its active application in the real world, the support to decision-makers, the evaluation of possible benefits and obstacles of different options of response, and the facilitation of the implementation of the required actions, imply the implicit knowledge that there is no single formula for the realization of the activities related to research training that may serve all. The educational curriculum of training programmes increasingly includes, in more fields, basic support of the

links between the natural sciences, the social sciences, development studies, and the fields of engineering and applied technology (although at the same time, this must be balanced with the permanent need of a firm base in the basic disciplines of science and engineering). There are many ongoing initiatives, seeking to develop integral research strategies with systematic orientation; with novel approaches to understand and characterize the links between changes at different scales, from the local to the global; working directly with development specialists, policy designers, citizen groups and other stakeholders in identifying and defining R&D needs and translating knowledge into action; working on topics of patent legislation; be it scientific editor and/or developing skills in communicating with non-technical audiences and operating efficaciously within the domain of negotiation and advice. Evidently, the features of research training include a range of meaning and finality which is broader or different from the classic pattern.

A lesson learnt during several decades about the efforts linked to development is that to ensure lasting success, the development of capacities must include not only the training of researchers, but also the institutions and communities in which researchers operate. Therefore, the central challenge is to strengthen the ability of existing institutions for responding to the themes of durable social and environmental development. This concerns linking institutions (such as the national academies of science) that may influence directly the definitional processes of policies. It includes, besides, universities and organizations for the promotion of science, that often hinder the development of new forms of integrative R&D due to the conservatism of rigid structures having disciplinary orientations.

Another factor that may affect in clearly diverging ways is related to the impact of ‘academic capitalism’, recognized more as an ‘accelerating trend’ than as a ‘new event,’ at least in countries like the US, in connection with the culture acquired through the socialization process by graduate students. The term is referred to the “deployment of the only real good of the universities and higher education institutions, the human capital of its teachers, to increase their incomes, an institutional and professorial market or efforts of the market kind to insure external funds”. Critical arguments to the idea of incorporating (as it already happens routinely in many departments and graduate programmes in developed countries) are referred among others to the possibility that future researchers feel inclined from the very process of training to do research benefiting corporate interests beyond and above research related to public interests that very likely will not generate profits. Arguments in favour adduce that

there is empirical evidence that in those programmes that have extensive relationships with industry, both teachers and graduate students sustain the classic values of the basic structure of traditional academia expressed in the discourse of defense of academic freedom, publication in recognized journals and basic research.

2. The dilemma of the doctorate at home or abroad

The picture offered today by the population of Latin American universities at the graduate levels, aimed at the training of researchers, confirms the view that it comprises a small portion of the national enrolment in higher education in those countries that have developed some research infrastructure. After a rapid period of growth in the 1950s and 1960s and in view of later budget cuts and political changes, some of the traditional prestigious universities have managed to keep a position of pre-eminence, although the great majority of more recent educational institutions did not manage to increase their status. Although some tried to improve their position, perhaps due to the impact of accumulative and self-reinforcing phenomena, they have often not managed it. A frequent feature is that in many places the disarticulation between the undergraduate and graduate levels has not been resolved within the same institution and the graduate level continues to be a late appendix, without political influence in institutional life (as is the case of Argentina). Another one, is that although it is still common that the research profession is practiced by individuals with *licenciatura* level (Argentina, Colombia, Ecuador, Panama, Uruguay,) or with Magisterial diplomas (Bolivia, Chile, Nicaragua, Venezuela), the search for a homologation with the international academic market (including the doctoral level, conventional measures of research productivity and selection by open competition) is being sought and becomes generalized through the increasingly popular processes of accreditation and evaluation. The dilemma then becomes whether to do research training in the home country or abroad?

Recent efforts to internationalize research training in the countries of the Region with more resources and infrastructure have been specially addressed consisting of stays of intermediate duration (from twelve to eighteen months) in foreign universities, with support from international cooperation, as for example, through the French-Venezuelan Postgraduate Cooperative Programme, (PCP) implemented by the French Government together with different Latin American research groups and the bilateral cooperation from Brazil with France, COFECUB, (*Comitê Francês de Avaliação da Cooperação Universitária com o*

Brasil); the several Programmes of the European Commission, such as the ALFA (América Latina - Formación Académica) is a programme of co-operation between higher education institutions of the European Union and Latin America, the ALBAN Programme of high-level scholarships for Latin America [Programme ALBAN will enable Latin American students and professionals, future academics and decision-makers in their own countries, to benefit from the excellence of the Higher Education Area in the European Union]., and some of the Marie Curie Actions of training, mobility and professional development open to researchers from developing countries, the scholarships from the Spanish Cooperation, [Spanish Agency of International Cooperation (AECI)] etc. Mechanisms known as 'sandwich scholarships' or thesis short-stays, where the student carries out the bulk of schooling requirements in the institution of his own country, has become more frequent in some countries of the Region, and the country which has gone farthest in this direction is Brazil.

Available international funding, new and old, for research and training suggest a not very easy panorama. On the one hand, it is observed that although the local training of researchers has been expanded in recent decades, what is done in the Region is still insufficient. On the other hand, what exists is in constant danger of being lost because it is attracted by the international market of skills in an intensification of the so-called 'brain drain' that has not ceased to occur in the Region and that in some fields is truly worrying, as in the case of ICTs and in the new cutting/edge science and technology disciplines, such as *nanoscience* and *nanotechnology*. To this contributes, paradoxically the fact that the universities that are intensive in research within the Region tend to be the higher education institutions with a higher level of participation in the most important international networks. But international funds also aim in other directions. Thus, it may be noticed a shower of small and not so small funding for initiatives in little-known institutions, sometimes intellectually opaque, but obviously with interesting prospects for donors, either in terms of researches for the market or of social or political insertion in the local domain. The result is a picture of coloured patchwork, of which only a minority has to do with classic scientific research, and diversifies widely the local picture.

Several very small and selective programmes of student differentiation that locate students in special programmes, with tutors and additional funds, isolated physical contexts and an emphasis on the collective development of the academic spirit have been, and continue to be, promoted in the Region. A basic assumption is that in peripheral countries, research training

faces special institutional and cultural conditions that are different and negative compared with those existing in the central countries where western science emerged, because they lacked scientific traditions. Therefore, basic attitudes and scientific values are acquired by individuals relatively late in their academic careers. Among those experiences is the one in Brazil, with the Programme of Scientific Initiation from the CNPq [*Conselho Nacional de Desenvolvimento Científico e Tecnológico* – National Counsel of Technological and Scientific Development] and the Special Training Programme (PET) from the Brazilian Ministry of Education, CAPES [*Programa Especial de Treinamento* (PET/CAPES)]; that of Colombia, pointing to link young researchers to high quality research centres or groups, stimulating in them a feeling of belonging to scientific communities; in the National Autonomous University of Mexico, México [*Universidad Nacional Autónoma de México* (UNAM)*]* a group of researchers from the Institute of Biomedical Research sought to break down the division between the classroom and the laboratory and to engage in the effort of training scientists from the undergraduate level (where traditionally students were not exposed to 'true' research), by making researchers teach in their own laboratories; more recently, Chile, through its Millennium Initiative has included also the training of small quantities of young people in their centres and nuclei.

Table 1. Graduate education in Latin America. Some examples

Argentina:
Great heterogeneity of the graduate system. In 1994-2002 from 793 programmes to 1941. Clear research orientation in doctoral programmes in exact and natural sciences. In social sciences, master's courses have marked a road to quality in graduate studies. In the humanities, growing presence of doctoral programmes in catholic private universities and also in public ones.

Bolivia:
Universities are weak but they concentrate most of the research done in the country. Master's programmes of a mercantilist orientation prevail. A set of factors act against the consolidation of research capacity and graduate training in the country, including the small number of FT teachers, lack of competence of the teaching staff, absence of a support academic system, high cost of graduate programmes, absence of scholarships, incentives, and policies.

Brazil:
Largest doctoral population in the Region. Process led by CAPES. In 2003, 1,722 Master's programmes and 986 Doctoral ones. Already in the 1990s only one out of every five doctoral degrees were obtained abroad. Still in 2007, of a total of 250,000 teachers in HEI, 54,000 were doctors and 100,000 held masters. Important efforts are being made to reduce the marked Regional asymmetries in the country.

Colombia:
In 1990, graduate education was considered far from satisfying its mission as a tool for research training. Since then a plan has been defined and implemented to make the graduate system grow, including the doctoral level. In 2005 there were 145 doctoral programmes, most of which in the Center and Occidental Regions.

Chile:
The process of massification of HE occurred in 1990-1998. To the extent that research grows, also

graduate programmes grow in Chilean universities, reaching an enrolment of 11,300 students in 2001. Initiatives like MeceSup seek to strengthen national doctoral programmes and the renewal of academic staff. In 1999-2005 doctoral programmes passed from 80 to 128, and from graduating fifty doctors per year to 144. The aim is to reach the target of 1,000 doctoral graduates in 2010.

Jamaica:

The environment in which higher education operates has been radically transformed since the mid-1990s.

The University of the West Indies is the main research institution in Jamaica. Graduate degrees are offered at both the Masters and Ph.D. levels. In addition to local public institutions, local private tertiary institutions and overseas colleges and universities registered are offering their services and have contributed to the expansion of access in the Region. Despite these developments, however, the demand for tertiary education is still not completely filled.

Mexico:

Graduate enrolment grew considerably, totaling 13,887 doctoral graduates between 1995 and 2005, which represents eleven doctors in science and engineering per million populations against six doctoral graduates per million inhabitants in social sciences and humanities. The doctoral programmes are only 4 per cent of all graduate programmes. In 1995-2005 SNI membership more than doubled, from 5,868 to 12,092 persons.

It seems obvious that the possibilities of increasing advanced national capacities exclusively on the basis of training abroad are unsustainable, and the small isolated experiences that appear as being promising, are no more than anything else by what they suggest in terms of conceptual and organizational innovation, but that their scale of development results are very insufficient, and it is necessary to build *in situ* the required infrastructure as well as ensure its local reproduction (see *Table 1 above).*

3. Discussion

In all the national cases revised it was found that there is generalized agreement that an international orientation in education and training at the doctoral level is worthwhile to help countries to position themselves in a world and economy that have changed significantly, and that extensive stays abroad are important ways of achieving this. Motivations are varied: on the one hand, a desire to improve the quality of research graduate training; and on the other, at the level of international politics of countries, an intentionality to increase the capabilities of participation and negotiation in an international scientific community, and other domains of the economy, that require greater familiarity with the increasingly globalized regimes of regulation and control. Nonetheless, in fields that are especially nationally-oriented or where the topic of a thesis is of a national character often visits abroad are not considered so relevant. And finally, a similar complexity characterizes the motives of the student whose concerns

might be to collect data or improve the theory that he/she needs to finish his/her thesis, or a broader expectation of his/her own personal growth as a scientist.

Against this background, the question arises: "Why have there not been more graduate students with more prolonged stays in foreign universities during their training period?" That a stay abroad would be beneficial to the student rather than staying in his/her own university tends to be accepted as a basic assumption. Is this true that: "The disadvantages of leaving the country of origin for most students can be greater than the advantages of a stay abroad?" As it has been indicated in previous studies, the challenges of research training abroad are enormous and unsustainable in time, among other reasons because of the high financial costs involved, fundamentally of public nature. But most of all because of the existing risks, given the current conditions in international employment markets, of losing these highly-qualified personnel who are in more favourable conditions of making a career in the new economy. This is often unavoidable, when there is a lack of sufficient development of a competitive industrial base capable of setting up virtual mechanisms of demand and supply of the capacities of the researchers being formed. These challenges, then, include the need to generate a favourable context in society, economy and politics, to be able to make optimum use of needed capacities, and finding ways to design compensation mechanisms with world centres that capture the scarce resources of qualified personnel of our countries who are already trained and in their best productive stage.

The training of researchers in the Region, despite having grown at great speed in recent decades, continues to be insufficient and presents problems of sectoral disarticulation, and of uncoupling with the job markets. In view of the coming up to retirement of research cadres, trained in past decades, a new vigorous impulse is required of promotion of critical masses of teachers and researchers on a full-time regime in institutions of learning. The topics of quality of training and of its evaluation and accreditation become increasingly urgent, at the same time that career patterns become more homogeneous and normalized in function with the search of participation in globalized competence markets. Different forms of evaluative knowledge become aligned with assumptions about *who* ought to have the power of control or *how* to exert it. The increasing will of the state to break the academic hegemony and implant the criteria of public policy has led to drastic changes in the type of knowledge that now is created and employed. State organizations assume that both teaching and research ought to have particular forms of end results that may be measured and ranked – and that includes

contributions to the economy. However, few generalizations in this field are completely true or false. We may conclude, with Kogan (2007) that “we do right in trying to specify and generalize the ‘power-knowledge nexus’, but remain tentative about any generalization derived from doing so”.

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NB: Paper presented at the UNESCO Forum on Higher Education, Research and Knowledge. 2nd Regional Research Seminar of the Scientific Committee for Latin America and the Caribbean, Port of Spain, Trinidad and Tobago, 19-20 July 2007.

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Ingredients for creating successful research Universities to support the future development of Latin American countries

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Abstract

This paper presents the main results and conclusions of a survey of experiences involving research universities in different countries in Asia, Europe and the United States (US). The main factors that were studied are: (i) how research universities participate in wealth creation processes; (ii) which are the main impacts on society and markets; (iii) what is their contribution to the update of professions, and (iv) how they participate in new development frameworks for their countries. Based on these factors, a concept of successful research universities to support the future development of Latin American countries is proposed. Finally, the good practices (GP) or ingredients for creating successful research universities were developed on the basis of the understanding of those experiences.

1. INTRODUCTION

As from the nineties of the last century there has been much analysis concerning the roles of universities, particularly research universities, in the emerging knowledge-based societies. Due to growing research and development (R&D) activities and budget management in businesses in developed countries, more and more science and technology initiatives are performed out of the bounds of universities – thus challenging these institutions to keep in pace. This situation is also found in some emerging economies.

At the same time, the increase in number of teaching universities in Latin America and South Asia attract an increasing number of students. Now, a fewer proportion of the whole student populations study at research universities, although the total number is greater. Two or more decades ago this situation was quite different.. The position of universities was more

influential: a greater number of projects on research and development were carried out in universities and a bigger proportion of students participated.

At present, the challenge for research universities is how to continue to influence societies and markets by means of new ideas and leadership. For Latin American research universities this is an opportunity which holds attention as they can learn from international experience and produce a deeper understanding of the problems and opportunities they face at country level.

This study intends to demonstrate that there are a set of good practices (GP), or ingredients, to develop research universities resulting in the required outcome.

2. RESEARCH UNIVERSITIES AND WEALTH CREATION

Research universities are strongly linked to wealth creation processes in developed countries. This is the case, for example, of Oxford University in UK, Stanford University and Massachusetts Institute of Technology (MIT), US; and more recently the National University of Singapore. It should be mentioned that in all the aforesaid universities new ideas are formulated leading to the creation of new businesses and reorganization of societies' systems. The mechanisms can vary from one institution to another however wealth creation is apparent everywhere in their vicinities.

In developing countries, the situation is completely different. Research universities, when they exist, have more links with universities from developed countries than to the societies in which they belong. In emerging economies, however, there are certain transition frameworks of great interest.

Nevertheless, over the last two decades, more or less, several Latin American universities started up initiatives to increase the quality and intensiveness of linkages with local problems and opportunities. That is the case of several universities like Universidad de São Paulo and the State University of Campinas (UNICAMP) [*Universidade Estadual de Campinas*] in Brazil, Universidad de Concepción and Pontificie Universidad Católica in Chile, just to mention these two countries.

(a) Research and development with real impact

Creation of local pertinent knowledge must be integrated with global knowledge advancement and transfer to produce real impact.

(b) Updating of professions

Professions need to be updated in order to solve development problems and take advantage of new opportunities.

(c) Creation of new development frameworks for societies and countries

Countries need new and improved development frameworks (ideas and proposals) based on their own specific features.

3. RESEARCH AND DEVELOPMENT WITH REAL IMPACT

Real impact is a key output indicator to define which kinds of R&D projects and programmes could be financed. To a greater degree, both public funds and private companies which provide grants give socio-economic impact an important place in the decision-making processes related to resources allocation.

Impact can be understood as a combination of *quality, relevance* and *pertinence.*

- *Quality* measured according to international standards for science and technology.
- *Relevance* measured as the kind and magnitude of likely transformations in society.
- *Pertinence* measured as the level of interest for the nearest social environment to which the university belongs or is linked to.

R&D initiatives and projects with relevant impact are characterized by the following features:

3.1 Meaning of relevant impact

Besides the concept explained above, relevant impact means world-class quality R&D activity that produces socio-economic benefits for society (i.e. environmental, regional, country or global).

3.2 Linking R&D with innovation

Innovation is the *keyword* for every society in the global economy; due to innovative acceleration in some countries their industries achieve higher levels of competitiveness. In which case, other countries need to maintain also some level of innovation to close the emerging competitiveness gap.

As from the nineties of last century it has been accepted in scientific and technologic communities that R&D is one of the main sources needing innovation. Therefore, it is of great importance to understand society's requirements and possible opportunities; those which can be backed up by new products and processes based on the advancement of science, technology, knowledge creation and transfer processes.

That is more important than studying only science disciplines and specialties, because of the huge amount of knowledge available worldwide and its fast generation (duplicating almost every five years).

3.3 Deep understanding of country development sources and requirements

Research universities must work closely together to solve problems in society and anticipate new opportunities, as it is from this joint cooperation that impact arises. These are the main sources for innovation and value creation.

3.4 Attraction of talents and resources to afford challenges.

Talented people (researchers, innovators, managers and others) are urgently needed to develop projects with real impact. Problems are not easily solved, and opportunities not easily grasped, without talented people to increase the possibilities of success.

4. RENOVATION OF PROFESSIONS

The world is undergoing a huge transformation process, mainly as a consequence of three forces: (i) *science* and *technology* advancement; (ii) globalization of *economy* and *society*, and (iii) explosion of *human capital* worldwide.

These three forces interact together and create a very strong momentum which has repercussions on societies' daily lives all over the world.

One of the main activities affected by that momentum, in at least two ways, is professions. The *first* one is the impact of knowledge on professions. New knowledge needs to be incorporated. At the same time, obsolete knowledge needs to be removed from curricula and practices. The *second* way is that the transformation momentum changes society and hence, professions must evolve to afford new opportunities and problems that are created.

Research universities have a relevant role in both ways of that transformation process because they create new knowledge accepted by society. Also, research universities have unique

responsibility because in some cases there is no other institution to lead the transformation and, hence, the renovation of professions.

From those perspectives, the two main concepts explained below are central to renovation of professions based on the contributions of research universities.

4.1 Graduates from research universities need to be prepared to transform professional activities in the world of work and at the same time continue usual work responsibilities.

Society requires new ways for solving problems and facing new opportunities. In general, professional profiles are still conceived for past employment situations in the world of work, not for future ones. Research universities can contribute to innovating professions and influence all citizens in the fields in which they are competent.

Take for instance 'energy-related' fields. Oil and hydro sources should be continued but also solar and bio sources should be introduced.

4.2 Knowledge deriving from international science and technology advancement must be complemented with local R&D knowledge results

It is more than necessary to determine new professional profiles, with continuous adaptation of people throughout their learning life-cycle. Local R&D results represent a source of pertinent knowledge that leads to a new balance between basic formation, postgraduate studies and life-long learning.

4.3 The main issues in the updating of professions based on R&D results (advancement of knowledge and its impact) are:

(a) *Deeper understanding of development sources for societies*: (i) production technologies; (ii) environment protection; (iii) wealth creation and distribution processes; (iv) energy sources and several other relevant fields.

(b) *Effective utilization of science and technology advancements* in curricula and developing new competences in professionals, mainly in fields related to: information and communications technologies (ICTs), biotechnology, new materials technology, and energy and water technology.

(c) *Anticipating new problems and opportunities in society and markets*
There is a higher creative value when opportunities and problems are anticipated. The quality of design is better and the performance greater.

(d) *Promoting entrepreneurship and innovation*
In a global society entrepreneurship is absolutely necessary to ensure that professionals are able to cope with the changing face of the labour market in order to progress well.
From the innovation perspective it provides opportunity to create bigger and better economic and social values. Besides, if the innovation process is flexible, then there are more chances of success.

(e) *Effective working in teams with different specialists (interdisciplinary and multidisciplinary).*
In Latin American countries it is well-known that teamwork is not recognized by professionals and it is common to find that companies prefer to work in hierarchical organization/groups instead of horizontal organization/taskforces and teamwork. Obviously this is due to cultural roots.
Building-up teams necessitates different specialists as role models in order to create value; as it is not just a matter of a number of people working as a group.

(f) *Ability to participate in global societies (international teams)*
Networking with professionals from different countries and societies all over the world is increasingly necessary to maintain a high professional standard.

5. NEW DEVELOPMENT FRAMEWORKS FOR COUNTRIES

Countries need development frameworks to achieve high standards for development and wealth creation. R&D is one of the keys for building-up those frameworks. Therefore, research universities have an important role to play in this respect.

In order to build-up development frameworks, it is necessary to consider the following:

5.1 New ideas about development

Research universities need to contribute new in-depth development ideas for the benefit of their societies.

Already existing ideas are not sufficient for specific countries like Chile or Mexico, for example. Each and every country which has recently achieved a high level of development (i.e. Finland and Ireland) has found and defined a framework based on its own ideas and initiatives; besides taking into account worldwide experiences.

5.2 Talents and research universities

To create such development frameworks, countries need their alumni and research universities have the unique opportunity to contribute to that goal by attracting brilliant people.

A country's development framework should be based on profound knowledge of its population's behaviour to grasp transformation potentials and evaluate creation mechanisms. This development framework should be capable of creating new platforms, organizations and institutions both public and private.

The above-mentioned is not common but when the appropriate time comes talented people will be needed to build-up the new and improve the existing objectives and organization.

Almost from the outset, Latin American research universities have been a source from which professionals and researchers expatriate to developed countries (US, Canada, several countries of European Union). That situation of brain drain started to be balanced out in some places due to the increasing attraction of the capabilities of regional universities.

5.3 Strong linkages among universities, government and industry

Building-up development frameworks gives universities, government and industry the opportunity of working together in a long-term partnership. Research universities contribute with ideas and proposals, governments with the organization and financing of programmes, and industry with the entrepreneurial performance capabilities.

There is a trend in major Latin American countries to promote this kind of linkage, mainly through government financing. Already, some successful experiences have been noted (for instance, The State of São Paulo Research Foundation (FAPESP), São Paulo; Fund for the Promotion of Scientific and Technological Development (FONDEF), Chile – and at least some ten other initiatives have already met with success or judged favourable by others, over the next few years (Mexico and Argentina).

The challenge now is how to give volume to these successful experiences and initiatives in order to build-up an organic tissue which will give momentum to the 'wealth creation' process.

5.4 Starting framework development processes

Research universities can start framework development processes when non-existent, speed up the pace and give directives at least in the following: (i) human capital formation; (ii) defining concepts of solution based on science and technology; (iii) integration of diverse disciplines; (iv) adopting criteria from abroad.

Human capital formation is, by far, the main goal of universities: research universities can go further to provide students with the necessary preparation for achieving higher level performances following the needs of society. "Which kind of professionals will be required?" "How will those professionals create value and transform society?" "Which competences do they need to meet these challenges?" These and other questions must be answered by research universities in order to control and guide human capital formation processes.

To sum up, *New Solutions for Framework Development Processes* are required. Consequently, research universities can provide the necessary science- and technology-based knowledge.

6. FLOURISHING RESEARCH UNIVERSITIES

Nowadays every institution wants to succeed, achieve aims and purposes. Having a favourable development reputation gives approbation to its existence and provides sentiments of identity and pride to the staff therein.

6.1 What does 'Successful' really mean?

Analyzing the experiences of those universities with a successful reputation (using the concepts/parameters to analyse rankings made by international institutions) some conclusions may be reached, as the following.

(a) Some remarkable events *via* research and development work at universities

R&D projects are not neutral they affect people, society and the environment, in several ways. Research universities are aware of this phenomena and build-up their R&D proposals to give greater impact. For instance, new advancements in optics can create a realm of new products, mainly in the field of information and communication technologies (ICTs). A successful research university leads some very productive fields in optics and strongly contributes to its leadership.

(b) Others, different from the academia, recognize the results and value of research and development (R&D)

This is crucial. Industry, government and the population at large, must be involved in the valorization of results coming from R&D activities performed by universities. But this does not necessarily come about as fast as researchers and university managers would esteem necessary..

(c) Universities learn to manage those processes to maintain and strengthen the impact of R&D results

Universities must learn how to manage their R&D activities along the evolution of science and technology waves.

At the beginning of the cycle, forming new visions and working in teams are a must. And it is necessary to have research results that provide real insight into the potential of technology. Then, a performance ratio is required: (i) “How do the new technologies supersede existing ones?” (ii) “What new products and processes could be achieved?” (iii) “What are the market or society transformations and improvements?”

Universities in the US are, by far, the leaders in the management of technology waves and cycles. At the same time, there is question in some Latin American universities concerning those management capabilities.

6.2 Who defines the success of research universities?

There are at least three kinds of stakeholders able to define if research universities give outcome results.

(a) Graduates and postgraduates: value the superior knowledge and capabilities achieved at universities and actively demonstrate them by performing better elsewhere; rising up to new standards.

(**b) Users of knowledge** (industries, governments, institutions, other universities and humanity, as well) value the knowledge created and acquired at universities. In order to be accountable, the users must be able to provide evidence and examples of society and market transformations based on superior knowledge acquired at universities.

(c) Researchers and academic staff from universities. They show evidence, by way of their experience, of having been taught by others on how to participate effectively in building-up a developed society based on acquired knowledge and commitment.

6.3 Impact as the major measurement

As a consequence of the above-mentioned, flourishing research universities are recognized by their impact on society – and can be evaluated on such.

In the long term, social impact is the true value by which universities are assessed as achieving the required outcome. Impact is a combination of R&D and human capital outcomes that transform societies and markets mainly through knowledge advancement and better peoples' capabilities.

Hence, research universities can be evaluated utilizing a metrics base on those impacts. For instance:

- "What kinds of new industries have arisen from university research work ?"
- "Which new nation-wide projects and programmes have taken place due to university contributions?"
- "Which new public policies and government modernization reforms have been set in motion?"

• "Which new or improved professions have developed to create value in society and markets?"

The kind and magnitude of impacts vary with science and technology fields. Medicine and human health are very productive in R&D results, mainly when more treatment for diseases is needed. Other relevant cases occur when there are breakthroughs like biotechnology applied to natural resources (bio-fuels, functional foods, new plant varieties).

In several regional research universities there are on-going initiatives to assess the impact of R&D activities (mainly situated in Argentina, Brazil, Chile, Colombia, Mexico, Uruguay and Venezuela).

7. DEFINING INGREDIENTS FOR CREATING SUCCESSFUL RESEARCH UNIVERSITIES

Following the developments explained above, it is possible to define some key ingredients for creating flourishing research universities: (a) building-up high-performance academic teams, (b) developing appropriate institutional organization of research universities and (c) strong participation in R&D initiatives with relevant impact.

These ingredients, which are outlined below, define the scope and results of research universities.

7.1 Build-up high-performance academic teams and staff

Due to strong rivalry among institutions higher performance teams and staff are required at research universities.

In order to build-up high performance academic teams it is necessary to establish: appropriate team members' profiles, continuous updating mechanisms, and important required criteria and effective management patterns.

(a) Appropriate academic teams and staff profiles

High performance academic teams and staff should coordinate with and imitate several different role models: researchers, developers, innovators, R&D&I managers and transfer of technology specialists.

Of course, in a knowledge-based society's creation process researchers are the major academic personnel. Nevertheless, their unique role is not enough to build up a high-performance team – other roles are necessary. It is obvious that that in some universities certain researchers have well-developed additional capabilities and competences, that go far beyond research ones. Hence some researchers can perform one, two or even more roles. Anyway, each and every role is needed.

This situation is not very well understood or accepted in Latin America universities, and causes, therefore, a restriction to bigger productivity in research and development (R&D) projects.

The main appropriate profiles for academic teams and staff are:

- *Researchers*

  Researchers must be sufficient in number to have diverse criteria with many and various interests in comparison with those of other research universities.
- *Developers (technologists)*

Usually, developers are deemed as having special interest activities, by some researchers (for instance, instrumentation developers in physics). This is insufficient in fields such as electronic engineering, software engineering and most other technology fields.

- *Innovators*

  Innovators are required for teamwork to create value related to market and society opportunities and also related to knowledge created by researchers. Innovators can be found outside, in companies and as entrepreneurs.
- *R+D+I managers.*
- *Transfer and diffusion specialists.*

(b) Continuous updating of academic staff and teams

Academic teams and staff must be continuously updated in knowledge advancement, R&D practices and management. If there is no updating then a loss of competitiveness arises and, as a consequence, universities will be taken over by others in the value creation processes.

Updating is also necessary to get and benefit from other ideas, mainly from science and technology breakthroughs.

In Latin American countries, continuous updating at research universities is almost impossible and, in some cases does not really exist. This is a consequence of bad practices concerning appropriation of academic practices and budgeting.

To promote a continuous replacement of people, the following is required:

- Mechanisms for continuous hiring and disaffiliation of researchers and other staff and appropriate allocation of them.
- On-the-job training (R&D projects, working in industry).
- Formal training, mainly post-docs (at same university, other centres and universities worldwide).

(c) Critical capabilities ('critical mass')

Research universities, like all high performance institutions, require critical capabilities ('critical' in the sense of the physical chain reactions). Below the threshold there is no vigorous value creation, although activities are carried out. Critical capabilities must be established over the threshold, and they are recognized when:

- Adequate numbers and high-class quality researchers, innovators and others to produce 'ignitions' of new good ideas and projects.
- Existence of strong relationships with world-class centres and industry in their various fields.
- Building-up value in the R&D network worldwide.

Very few research universities in Latin American countries manage effectively the concept of 'critical capabilities' to build-up their high-performance teams. This is a consequence of individualism which, unfortunately, prevails in research organizations.

(d) Management criteria

Management is a fundamental key. There are at least two distinctive competencies in R&D management. The first one is balancing the many activities carried out by research universities. The second one is taking advantage of other institutions' and organizations' management criteria.

- Research universities must make R&D compatible with teaching, make researchers coincide with other professionals, make university pace keep pace with industry. These balances are required to accomplish, with several other university functions, quality and cost effectiveness.
- Adopting criteria implemented by others for increasing chances of success and avoiding unnecessary costs and risks. Adopting management criteria from others is very important; in order to get enough resources from other institutions, governments and industries to accomplish relevant R&D purposes,

7.2 Institutional organization of research universities

Research universities require appropriate and strong institutional organizational methods to prosper. If this ability does not exist or is methods are weak, universities will not able to maintain the deal flow with main institutions of society as a whole. In such situations, much knowledge created by universities and resources could be lost causing academic teams' frustration.

The main institutional organizations necessary for achieving the required success outcome are the following:

(a) **R&D units (centres, institutes, departments, projects, task forces)** with measurable results and accountability. Measurable results are a key for credibility. Accountability is a key for confidence. Both are required for continuous and growing knowledge production and effective utilization by others, institutions and industry in society.

(b) **Transfer of technology and appropriate intellectual property rights (IPR) management (professional capabilities).**

Protection of valuable knowledge and transfer of technology are keys to maintaining the flow from brain to market and society.

To accomplish these purposes it is necessary that research universities have a dedicated department dealing with all professional competences. If this is out of the question then research universities should consider the possibility of sharing with other universities and institutions.

(c) Management of new entities (consortia, companies etc.)

Research universities need to develop new entities, usually associated with other institutions and companies, to increase and assure their knowledge-based contributions to society. The most common are: consortia, emerging companies and new institutions.

Hence, research universities tend to behave like holdings in R&D fields and they need to learn how to manage them.

Consortia are very relevant because they represent a transition from university- based projects to a more complex institutional tissue, where university and industrial interests converge. Australia and Finland have built-up a lot of successful experiences based on consortia. Recently, some states in the United States, following suit with Chile and Brazil, started developing these kinds of initiatives.

7.3 Involvement in R&D initiatives with high impact.

It is essential that research universities are involved in R&D initiatives with high impacts. Hence, it is obligatory to avoid those R&D activities that are not relevant, pertinent or have insufficient quality.

For successful involvement in high impact research and development initiatives, the following needs consideration:

(a) Formulation, evaluation and selection of R&D initiatives and building-up of portfolio

Formal processes for formulation, evaluation and selection of R&D projects are required in order that every researcher has the chance to participate with superior proposals, to:

- **Identify** and formulate much more R&D initiatives than those that can be carried out (Ratio 10:1). This is necessary to guarantee enough initiatives and projects in order to select the best.

- **Evaluate** and select projects and initiatives using compound criterion: (i) high quality science and technology standards; (ii) most likely socio-economic impact in the country. This compound criterion is important to assure that both value creation sources are participating as creative forces: science and technology advancements and markets. Usually, both forces are not easy to keep on balance at universities. Then, the institution must learn how to cope:
- **Select** enough projects to build a portfolio with high chances of success.

The rationale of a portfolio is of utmost importance for research universities to acquire favourable development or outcome. Researchers prefer one or a few projects related to their own interests. But, research universities are not the simple addition of researchers. They are knowledge-based value creating networks, both internal and external, with strongly creative nodes (which are the research teams).

(b) Adoption of criteria

Research universities rarely have all the capabilities to solve a relevant science and technology problem from the country development perspective – so, the answer is to collaborate with other institutions and industries. The most effective way to deal with this kind of collaboration is the following:

To attempt to adopt the criteria used by others, institutions and companies, research universities must build up credibility and confidence.

Credibility is required to promote mutual understanding and sharing of ideas and visions. Confidence is required to share resources and capabilities.

Each institution needs to experience this adoption process and its benefits. It is not acceptable that only one institution benefits from the relationship. This process must be positive sum games (‘win-win’ relationships).

The main types outlined as:

- ***Complementary research capabilities (researchers, developers and laboratories).***

  The key is to identify, on a worldwide basic, which are the research teams and laboratories than can complement their own capabilities to build partnerships and a synergistic relationship.

- ***Financial resources***.

  Local and international cooperation are based in access to financial resources.

- ***Market access.***

  Market access is important because of the transfer of technology from R&D projects and also to be granted financial assistance from different entities all over the world. Collaboration among universities can increase this kind of market access.

(c) Continuous R&D application and production with real impact

R&D activities must be maintained continuously by research universities, making way for the evolution of more rich ideas. This is of utmost importance concerning changing movements of science and technology.

The main actions to take are as follows:

- Producing excellent results of value to society: new knowledge (papers), new technology (patents, contracts, spin offs, others), breakthroughs.
- Attracting other institutions, industry and people to follow the universities' work and make them participate as new performers.
- Promoting a positive environment for R&D results leading to investments from government and industry (local and international).

8. CONCLUSIONS

It has been estimated that there is a lot of experience to benefit from, worldwide, concerning prosperous research universities, mainly in developed countries but, also, in emerging economies.

More recently, some new and interesting experiences have taken place in Latin American countries like Argentina, Brazil, Chile, and Mexico. Nevertheless, the challenge is great and

there are demands on, and expectations of, universities to build up wealth for society as a whole. At present research universities are changing their attitudes in the Regions.

Although every university is a unique institution in its own right, their experiences give us the possibility to systematize a *set of main successful practices or ingredients* (as outlined in this paper) for the creation of successful research universities to support the future development of Latin American countries. That is the major contribution of this study.

In conclusion these ingredients can be summarized as:

(1) ***Build-up*** high performance academic teams and staff with appropriate academic profiles including researchers, developers, innovators, R&D managers and transfer of technology specialists.

(2) ***Continuous updating*** of the activities of academic teams and staff.

(3) ***Build-up*** critical capabilities and appropriate management.

(4) ***Build-up*** necessary institutional organization (R&D) units, transfer of technology, intellectual property rights (IPR) management.

(5) ***Management*** of new entities such as consortia.

(6) ***Involvement*** in R&D initiatives with relevant impact (formal process for formulation, evaluation and selection of R&D initiatives to build-up a portfolio).

(7) ***Adoption*** of criteria of other institutions, industries and governments.

(8) ***Continuous*** R&D application and production with real impact.

Indeed, it is possible that many research universities can use the above-mentioned ingredients as a reference for improving their performances – eventually resulting in the required outcome.

* * *

Selected reading

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