CONCLAVE OF SCIENTISTS ON SCIENCE, TECHNOLOGY AND INNOVATION POLICY:
FORESIGHT, GROWTH, ROADMAPS, SECTORAL IMPACT ASSESSMENT AND ALLIANCES

November 27-29, 2014

Venue

Indian National Science Academy (INSA) Auditorium
Bahadurshah Zafar Marg, New Delhi-110002, India

ABSTRACTS

Organized by

Zaheer Science Foundation
UNESCO

in collaboration with

Centre for International Co-operation in Science (CICS) Chennai

United Nations Educational, Scientific and Cultural Organization

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New Delhi Office
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Department of Science and Technology (DST)
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सत्यमेव जयते
Department of Science and Technology
Government of India

Ministry of Earth Sciences

Department of Biotechnology
Govt. of India

Chairman
Zaheer Science Foundation,
4 Udyan Marg, New Delhi 110001
Former Governor of Bihar, West Bengal
& Haryana and Ex-Member, Rajya Sabha

MESSAGE

I am happy that Zaheer Science Foundation is organising Conclave of scientists on Science, technology and innovation policy: foresight, growth, roadmaps, sectoral impact assessment and alliances. The conclave will be attended by more than 100 delegates from South Asia, South East Asia, Central Asia, Europe, North and South America, who will present very useful papers of topical interest based on their research experience covering a wide gamut of emerging areas of science & technology. In fact the conclave will go a long way in fulfilling the mandate of Zaheer Science Foundation for the promotion of science, technology and higher education, namely meeting the challenges and utilizing the opportunities which have emerged from the globalization of the world economy. It will also promote greater understanding and interaction between the scientists, educationists and parliamentarians of the region covering South Asian and South East Asian Countries.

I take this opportunity to thank the organizers of the Conclave namely, Zaheer Science Foundation, UNESCO, New Delhi office and all the Government Departments which supported the Conclave. I would also congratulate Dr. Mohsin U Khan, Coordinator of the Conclave and other officers and staff of the Foundation for preparing this document of Abstracts of research papers to be presented.

ARKidwai

(A.R. KIDWAI)

PREFACE

The term INNOVATION has now firmly captured the imagination of all countries in the world, big or small, rich or poor cutting across ideologies, politics, races, religions and faiths. It is also now well accepted that growing wealth of the developed nations is directly attributable to their technological prowess and ceaseless search for newer and newer knowledge and skills. The production society of the twentieth century has yielded to a creation society of the present century.

The fear of being left behind is gripping the nations who lag behind in technology – driven innovations. They are putting in place policies and actions to stimulate innovation Eco-systems both in the public and the private sectors.

If innovations can be broadly categorised as incremental, system and original, India has performed exceedingly well in the first and the second categories generating wealth, employment and economic growth. Green revolution (wheat), white revolution (milk and egg), blue revolution (outer space) are successful examples of system innovations. Sadly, original, homegrown innovations continue to be elusive, after Dr. CV Raman's Nobel Prize winning Raman Effect in 1928. Judged in this context India qualifies as an innovative nation but not, yet, as an innovation nation on par with the developed countries.

Mindful of this 'innovation gap' the Government of India initiated several schemes to stimulate original innovations and creative minds. Education, scientific and industrial research, manufacturing are among sectors identified for intensified pursuit.

In the context of STI Policy 2013 and in pursuit of its mandate the Zaheer Science Foundation is holding this International Conference. Nations in South Asia, South East Asia and Africa have several attributes which can be harnessed to forge alliances to advance knowledge and benefits to national economies and societal growth. The conference organisers have identified a range of issues of shared interest to be discussed and taken forward

On behalf of the Organising Committee and the Chairman of ZSF, Dr. A.R. Kidwai. I greet all the participants of the Conference. The invited papers and presentations promise to be interesting, instructive and inspiring

Welcome to the Conference

Dr. G. Thyagarajan
Chairman, Organising Committee
Zaheer Science Foundation

INTRODUCTION, THEME AND OBJECTIVES OF THE CONCLAVE

The Conclave of Scientists which is being organised by Zaheer Science Foundation and UNESCO, New Delhi office in collaboration with Centre for International Co-operation in Science (CICS) Chennai on “Science, Technology and Innovation Policy: foresight, growth, roadmaps, sectoral impact assessment and alliances” during 27-29th November 2014 at Indian National Science Academy (INSA), New Delhi will be in continuation of the three previous International Conferences held in 2005, 2007 and 2010, respectively. The first conference was inaugurated by Shri Kapil Sibal, Hon’ble Minister of State for Science and Technology. The second Conference was inaugurated by Shri Pranab Mukherjee, the then Hon’ble Union Minister of External Affairs and presided over by H.E. Mr. Koichiro Matsurra, Director General, UNESCO.

This is a big event where a large number of delegates from South Asia, Southeast Asia, Europe and North America as well as South America and Russia are participating. One of the interesting features of the Conclave is that half day on 29th November 2014 is devoted to the Parliamentarian of the region. UNESCO has suggested that we should also invite members of Parliament in South Asia and Southeast Asia region dealing with science policy. This would be a major scientific get-together to consider various aspects for cooperation and coordination among scientists of the region.

There will be an opportunity to have one on one interaction among the delegates to work out research programme on regional cooperation in Science and Technology especially in the field of drugs and pharmaceuticals, health services, information technology, energy and environment and agricultural science. The conclave in broader sense is to encourage regional cooperation in science and technology for the advancement of South Asia and South East Asia region. Researchers, academicians, Member of Parliaments from Asia and Pacific region, people from industry and government departments are invited to share their experiences, knowledge and research. The theme of the Conclave offers panellists a venue to express, recognize, define and question the many and varied interface between science and society. Various research perspectives might include:

1. STI Policy and its historical perspective.
2. Review of STI Policy 2013 and its implementation in different sectors like environment and climatic change, drugs and pharmaceuticals, Information Technology and Biotechnology.
3. Nurturing and promoting excellence and relevance in Science Education, Research & Development and Commercialization.
4. Enhancing private sector investment in R&D, Technology and Innovation.
5. Case studies on STI Policy of other South Asian countries participating in the Conference.
6. Sectoral Policies and its impact on Technological Development.
7. Cooperation among developing countries on STI Policy.

India has emerged as a focal point in the field of Science and Technology and higher education for this region, followed by its economic development. This has made the scientific community especially from developing countries to attend such a conclave in India voluntarily.

We have tried to compile abstracts of the papers given by the scholars for this Conclave, Zaheer Science Foundation will bring out proceedings of the Conclave and circulate them to the universities, research institute, and government departments in India and abroad. It is my humble request to all the participants who are presenting research papers should send me a copy of their full paper for publications as soon as the Conclave is over.

Dr. Mohsin U Khan
Organizing Secretary and Coordinator of the Conclave
Zaheer Science Foundation,
4 Udyan Marg (Near Gole Market)
New Delhi 110 001, INDIA
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TECHNICAL PROGRAM

CONCLAVE OF SCIENTISTS ON SCIENCE, TECHNOLOGY AND INNOVATION POLICY: FORESIGHT, GROWTH, ROADMAPS, SECTORAL IMPACT ASSESSMENT AND ALLIANCES

Date: 27-29th November 2014
Venue: INSA, New Delhi

Program is comprised of invited lectures, contributed papers and extensive discussions

First Day: 27th November, 2014

8:30 AM to 9:30 AM	**:**	**Registration**
9:30 AM to 11:00 AM	**:**	**Opening Session**
Inaugural Address	:	**Chaired by Dr. A.R. Kidwai** **Formerly Governor of several States, Ex-Member Parliament & Presently Chairman, Zaheer Science Foundation, New Delhi**
Opening Addresses	:	**Dr. T. Ramasami** Formerly Secretary Department of Science & Technology (DST) Government of India, New Delhi
	:	**Dr. Shigeru Aoyagi** Director & UNESCO Representative Cluster Office for Bangladesh, Bhutan India, Maldives, Nepal & Sri Lanka New Delhi Office
	:	**Dr. G. Thyagarajan** Former Director of CSIR Institutes Govt. of India, Presently Member Governing Council, Zaheer Science Foundation, New Delhi
	:	**Dr. Mohsin U Khan** Coordinator of the Conclave & Secretary Zaheer Science Foundation, New Delhi
Rapporteur	:	***Dr. Arif A. Waqif***
11:00 AM to 11:15 AM	**:**	**High Tea**

	11:15 AM to 1:30 PM	**:**	**Session 1**
	11:15 AM to 11:45 AM	**:**	**Keynote Address**
	Chair	:	**Prof. Shahid S. Siddiqui** Professor Northwestern University, Evanston, USA
	Speaker	:	**Dr. V. M. Katoch** Secretary, Department of Health Research (DHR) & Director General, Indian Council of Medical Research (ICMR), New Delhi, India
	Title	:	*Indigenous Affordable Technologies for Indian Public Health Care Delivery*
	11:45 AM to 1:30 PM	**:**	**Science, Technology and Innovation (STI) Policy and its Implementation**
	Chair	:	**Dr. Aqueil Ahmad** Visiting Faculty, Elon University, USA
1.	Speaker	:	**Dr. Neeraj Sharma** Advisor & Head, Policy Research Cell, Department of Science & Technology (DST) Govt. of India, New Delhi
	Title	:	*India's Science, Technology and Innovation Policy 2013*
2.	Speaker	:	**Dr. Sung-Goo Han** Director, Division of S&T Policy and Planning Korea Institute of S&T Evaluation and Planning (KISTEP), Seoul, Korea
	Title	:	*Presidential Leadership on STI Policy*
3.	Speaker	:	**Dr. Dinesh R Bhuju,** Academician Nepal Academy of Science and Technology Kathmandu, Nepal
	Title	:	*STI Prioritization in Nepal: Process and Findings*

4. Speaker	:	**Prof. Shahid S. Siddiqui** Professor Northwestern University, Evanston, USA
Title	:	*Challenges and Opportunities In Indian Science, Technology and Innovation Policy: The Missing '<u>Masala</u>'*
5. Speaker	**:**	**Dr. Annaflavia Bianchi** Freelance lecturer on economics of innovation University of Ferrara, Italy
Title	**:**	*The EC Stimulus to Improve Sub-National Regional Research and Innovation Strategies*
Rapporteur	**:**	***Dr. Yogesh Suman***
1:30 PM to 2:30 PM	**:**	**Lunch Break**
2:30 PM to 4:30 PM	**:**	**Session 2**
2:30 PM to 3:00 PM	**:**	**Keynote Address**
Chair		**Dr. Kirdina Svetlana** Head of Sub-Division for Evolution of Social and Economic Systems Institute of Economics, Russian Academy of Sciences, Moscow, Russia
Speaker	:	**Dr. G. Thyagarajan** Former Director of CSIR Institutes Presently Member Governing Council, Zaheer Science Foundation, New Delhi
Title	:	*Reaching the unreached assistance to small nations on capacity building in STI policy*
3:00 PM to 4:45 PM	**:**	**STI Policy and its Sectoral Impact Assessment on Health, Environment and Climate Change**
Chair	:	**Prof. Shahid S. Siddiqui** Professor, Northwestern University, Evanston, USA

1.	Speaker	:	**Dr. A. B. Mandal** Director, CSIR-Central Leather Research Institute Chennai, India
	Title	:	*Science, Technology, Education, Environment and Society: Their relevance to Leather*
2.	Speaker	:	**Dr. Satpal Sangwan** Sr. Principal Scientist CSIR-National Institute of Science, Technology & Development Studies, New Delhi
	Title	:	*Engaging Global Warming Energy Innovation & Climate Change*
3.	Speaker	:	**Prof. M. P. Srivastava** Department of Physics and Astrophysics, University of Delhi
	Title	:	*Sustainable Development*
4.	Speaker	:	**Prof. Veena Agrawal** Professor Department of Botany, University of Delhi
	Title	:	*Strong Therapeutic Potential of Indigenous Herbal Drugs in the Management of Different Types of Cancer: A Prospective Area of Future Research*
5.	Speaker	:	**Prof. Syed E. Hasan** Professor Emeritus of Geosciences University of Missouri Department of Geosciences, USA
	Title	:	*Zero Waste, Pollution Prevention, and Environmental Sustainability: Policy Considerations in Climate Change Adaptation*
6.	Speaker	:	**Dr. A.V. B. Sankaram** Ex-Scientist, Indian Institute of Chemical Technology (IICT), Hyderabad, India
	Title	:	*Plant Based Insecticides for Insect Pest Management*
	Rapporteur	:	***Dr. (Ms.) Y Madhavi***
	4:45 PM to 5:00 PM	**:**	**Tea Break**

5:00 PM to 6:30 PM	**:**	**Session 3**
5:00 PM to 5:30 PM	**:**	**Keynote Address**
Chair	:	**Dr. Torsti Loikkanen** Senior Research Scientist VTT Technical Research Centre, Finland
Speaker	:	**Dr. Suresh Das** Director CSIR-National Institute for Interdisciplinary Science and Technology, Trivandrum, Kerala
Title	:	*Bridging the innovation gap*
5:30 PM to 6:30 PM	**:**	**Institutional Models of STI Policy**
Chair	:	**Dr. Torsti Loikkanen** Senior Research Scientist VTT Technical Research Centre, Finland
1. Speaker	:	**Dr. Kirdina Svetlana** Head of Sub-Division for Evolution of Social and Economic Systems Institute of Economics, Russian Academy of Sciences, Moscow, Russia
Title	:	*Two institutional models of R&D and innovation policy: "State as an investor" and "state as a regulator" (Comparative analysis of Russia and the US)*
2. Speaker	:	**Dr. Gregory Sandstrom** Lecturer, European Humanities University Lithuanian Research Council, Vilnius, Lithuania
Title	:	*Proportionalising science, technology and innovation development: Extensive and Intensive Thinking Meets Institutional Matrix Theory*
3. Speaker	:	**Prof. O. Golichenko** Central Economics and Mathematics Institute Russian Academy of Sciences, National Research University Higher School of Economics, Moscow, Russia
Title	:	*Modes of Global Technology Knowledge Tapping*
Rapporteur	:	***Ms. Jyotsna Pandey***
Dinner	:	**7:30 PM at INSA**

Second Day 28th November 2014

	9:00 AM to 11:00 AM	**:**	**Session 1**
	9:00 AM to 9:30 AM	**:**	**Keynote address**
	Chair	:	**Dr. V. Prakash**, Distinguished Scientist of CSIR- India Formerly Director ,CFTRI, Mysore, Currently Director of Research, Innovation and Development, JSS - MVP, JSS Technical Institution Campus, Mysore.
.	Speaker	:	**Dr. Aqueil Ahmad** Visiting faculty, Elon University,
	Title	:	*Technological Innovation and Socioeconomic Development in Knowledge-Based Societies: Parameters in Perspective*
	9:30 AM to 11:00 AM	**:**	**STI Policy and its impact on Socio-economic Development in future scenario as well**
	Chair	:	**Dr. Sung-Goo Han** Director, Division of S&T Policy and Planning Korea Institute of S&T Evaluation and Planning (KISTEP)Seoul, Korea
1.	Speaker	:	**Dr. Thomas Pastore** Boeing Research & Technology, Huntington Beach, California, USA
	Title	:	*450 mm Semiconductor Wafer Foundries: Implications for the Emerging Economies*
2.	Speaker	:	**Dr. Jaime Jiménez** Member of the ISA Executive Committee IIMAS, UNAM, Dept. of Mathematical Modeling of Social Systems, México
	Title	:	*A New Social Contract with Science: A Reality?*

3. Speaker	:	**Dr. Marja Häyrinen-Alestalo,** Professor, University of Helsinki Finland
Title	:	*The Imperative of Economic Growth in Science and Innovation Policy: Observations from Europe, India and China*
4. Speaker	:	**Dr. Yulia Balycheva** Central Economics and Mathematics Institute Russian Academy of Sciences, Russia
Title	:	*Basic Principles of Innovation Processes Decomposition into Elementary Processes: Theory and Examples*
Rapporteur	:	***Dr. (Mrs.) Tabassum Jamal***
11:00 AM to 11:15 AM	**:**	**Coffee Break**
11:15 AM to 1:30 PM	**:**	**Session 2**
11:15 AM to 11:45 AM	**:**	**Keynote Address**
Chair	:	**Dr. G. Thyagarajan** Former Director of CSIR Institutes Presently Member Governing Council, Zaheer Science Foundation, New Delhi
Speaker	:	**Dr. Parthasarathi Banerjee** Director CSIR-NISTADS, New Delhi, India
Title	:	*Innovation and Power*
11:45 AM to 1:30 PM	**:**	**STI Policy in the promotion of Science Education Private Investment in R&D and Commercialization**
Chair	**:**	**Prof. Arif A. Waqif** Professor and Founder-Dean (Retd.) School Management University of Hyderabad and former L&T Chair Professor, Chairman and Dean, ASCI, Hyderabad

1.	Speaker	:	**Dr. Raine Hermans,** Adjunct Professor Head of Strategic Programs Tekes, Helsinki
	Title	:	*Emerging Global Networks: Systemic Technology and Know-How Transfer from Multinational Companies to Small and Medium-Sized Enterprises*
2.	Speaker	:	**Dr. VV Krishna & Dr. Swapan Kumar Patra** Professor Centre for Studies in Science Policy School of Social Sciences Jawaharlal Nehru University, New Delhi
	Title	:	*Linkages Between Transnational Corporate R&D Units and Indian Firms and Institutions*
3.	Speaker	:	**Dr. Sadhana Srivastava** Scientist E, IPR Unit Indian Council of Medical Research Department of Health Research (Ministry of Health & Family Welfare), New Delhi
	Title	:	*ICMR Initiatives Towards Translational Research in PPP Mode*
4.	Speaker	:	**Dr. Sujit Bhattacharya** Sr. Principal Scientist CSIR-National Institute of Science Technology and Development Studies New Delhi, India
	Title	:	*University in the Innovation Ecosystem- A Case Study of India*
	1:30 PM to 2:30 PM	:	**Lunch**

	2:30 PM to 4:45 PM	:	**Continuation of Session 2**
5.	Speaker	:	**Dr. Nirmalya Bagchi** Professor and Area Chairperson Technology Policy, Management and Innovation Area, Centre for Innovation and Technology Administrative Staff College of India, Hyderabad
	Title	:	*R&D Expenditure in Indian Steel Industry: A Model*
6.	Speaker	:	**Dr. S Viswanathan** Editor & Publisher Industrial Economist Industrial Estate, Guindy, Chennai
	Title		*Enhancing Private Sector Investment in R&D, Technology and Innovation*
7.	Speaker	:	**Dr. Anatoly Ablazhey** Novosibirsk State University, Russia
	Title	:	*Neoliberal Science and the Crisis of the Traditional System of Training the Scientific Fellows*
8.	Speaker	:	**Dr. Deepak Agarwal** Director General Consultancy Development Centre Ministry of Science and Technology New Delhi, India
	Title	:	*Transferring Research to Industry- A Few Thoughts*
9.	Speaker	:	**Dr. Thomas Pastore** Boeing Research & Technology, Huntington Beach, California, USA
	Title	:	*450 mm Semiconductor Wafer Foundries: Implications for the Emerging Economies*
	Rapporteur	:	***Ms. Jyotsna Pandey***
	4:45 PM to 5:00 PM	:	**Tea Break**

5:00 PM to 6:30 PM	**:**	**Panel Discussion on Regional Cooperation in STI Policy & Networking**
Anchor	:	Dr. Mohsin U Khan (India)
Co-Anchor	:	Dr. Torsti Loikkanen (India)
Panelist	**:**	Dr. Shigeru Aoyagi (UNESCO, India) Dr. Jaime Jimenez (Mexico) Dr. Avudh Ploysongsang (Thailand) Dr. Dinesh R Bhuju (Nepal) Dr. A. B. Mandal (India) Dr. Akhilesh Mishra (India) Hon.Eng. Kafeero Ssekitoleko Robert (Uganda) Dr. Nirmalya Bagchi (India)
Rapporteur	**:**	***Dr. (Mrs.) Tabassum Jamal***
Dinner	**:**	**7:30 PM at INSA**

Third Day: 29th November 2014

	9:30 AM to 11:30 AM	**:**	**Session 1**
			Regional Cooperation in STI Policy
	Chair	**:**	**Dr. Jaime Jimenez** Member of the ISA Executive Committee IIMAS, UNAM, Dept. of Mathematical Modelling of Social Systems, Mexico
1.	Speaker	**:**	**Dr. Mohsin U Khan** Secretary & Coordinator of the Conclave Zaheer Science Foundation, New Delhi
	Title	**:**	*Government Interventions in Promoting Innovation Driven Economies in Asia Focusing on India*
2.	Speaker	**:**	**Dr. Torsti Loikkanen** Senior Research Scientist VTT Technical Research Centre, Finland
	Title	**:**	*Impacts Via Innovations – A Novel Dimension in the Assessment of Impacts of Research, Technology and Innovation Policies*

3.	Speaker	:	**Dr. Tabassum Jamal,** Sr. Principal Scientists CSIR NISTADS, New Delhi
	Title	:	*Building National Capability Through S&T And Innovation Policies- Opportunities and Challenges in Developing Countries*
4.	Speaker	:	**Dr. A. Amudeswari** Director Centre for International Co-operation in Science (CICS), Chennai, India
	Title	:	*STI Landscape of India: Learning Experience for other Developing Countries*
	Rapporteur	:	***Dr. Arif A. Waqif***
	11:30 AM to 11:45 AM	:	**Coffee Break**
	11:45 AM to 1:30 PM	:	**Session 2** **STI Policy and its relevance to IT & Biotechnology**
	Chair	:	**Dr. Annaflavia Bianchi** Freelance lecturer on economics of innovation University of Ferrara Italy
1.	Speaker	:	**Prof. Zahid H. Khan** FTK Centre for Information Technology, Jamia Millia Islamia (A Central University), Jamia Nagar, New Delhi India
	Title	:	*Innovations in the Teaching and Learning of Science and Technology in the Digital Age*
2.	Speaker	:	**Dr. Monica Singhania** Associate Professor Faculty of Management Studies (FMS) University of Delhi
	Title	:	*Mobile Governance in India: Innovative Sustainable Business Modelling*

3.	Speaker	:	**Dr. Khusro Kidwai** Assistant Dean, Distance Learning, School of Professional Studies, Northwestern University, Chicago, Illinois, USA
4.	Speaker	:	**Dr. Arun S. Ninawe** Advisor (Scientist 'G') Department of Biotechnology New Delhi
	Title	:	*Career Opportunities for Women in Science, Technology And Biotechnology*
	Rapporteur	:	***Dr. Yashpal Kathuria***
	1:30 PM to 2:30 PM	:	**Lunch Break**
	2:30 PM to 3:30 PM	:	**STI Policy & Globalisation**
	Chair	:	**Hon.Eng. Kafeero Ssekitoleko Robert** (MP) Vice Chairperson, Parliamentary Committee , Science and Technology Member, Physical Infrastructure Committee, Parliament Avenue, Kampala-Uganda
1.	Speaker	:	**Dr. Arif A. Waqif** Professor and Founder-Dean (Retd.) School Management University of Hyderabad and former L&T Chair Professor, Chairman and Dean, ASCI, Hyderabad
	Title	:	*Global Perspectives on Science and Technology, Economic Development and Ecology*
2.	Speaker		**Dr. Yu Fujimoto** Lecturer Department of Geography Nara University, Japan
	Title	:	*Constructing Local Knowledge Through Low-Cost* DIY *Methods*

3. Speaker	:	**Dr. Rajeswari S. Raina** Principal Scientist, CSIR- NISTADS New Delhi
Title	:	*Pandora or Cornucopia? Strengthening the Interface Between Science and Policy*
3:30 PM to 4:30 PM	:	**Parliamentary Session**
Chair	:	**Dr. Narong Boonyasaquan**, Former Adviser to the Standing Committee on Science and Technology, House of Representatives, the Thai Parliament; and former Adviser to the Deputy Minister of the Ministry of Transportation of Thailand
Speakers	:	Prof. Saifuddin Soz, MP (Rajya Sabha) Dr. Sita Ram Yachury, MP (Rajya Sabha) Dr. Ashwani Kumar, MP (Rajya Sabha) and Chairman, Parliamentary Standing Committee on S&T
4:30 PM to 4:45 PM	:	**Tea Break**
4:45 PM to 5:30 PM	:	**Summing up** Dr. G. Thyagarajan Dr. Mohsin U Khan Dr. Torsti Loikkanen
Rapporteur	:	***Dr. (Mrs.) Tabassum Jamal***

Contents

TWO INSTITUTIONAL MODELS OF R&D AND INNOVATION POLICY: "STATE AS AN INVESTOR" AND "STATE AS A REGULATOR" (COMPARATIVE ANALYSIS OF RUSSIA AND THE US)[1]

Kirdina Svetlana
Head of Sub-Division for Evolution of Social and Economic Systems
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32, Nakhimovsky Prospect
Moscow 117218 Russia

It is impossible to reproduce the real sector of economy and the sphere of R&D, ensuring the economic growth, without mobilization of the relevant financial resources. Economic entities are provided with the necessary financial funds through the activity of institutions that form various institutional models of financing of the real economy and R&D sector. To the greatest extent the differences between these models are determined by the ratio of the market and the government institutions.

Generally, the study of economic growth in mainstream economics explicitly or implicitly assumes the domain of neoclassical market model where the growth is the product of innovation activity of competing companies. This assumption is deemed to be a fundamental truth. This approach assumes that the government shall just search for the optimal level of interfering in the economy, which allows the whole economy to overcome all sorts of obstacles and traps (market failures) for the stable economic growth.

At the same time, there is another point of view on the problem of the government, markets and economic growth. It is based on the fact that we need to examine carefully the empirical data in order to understand where and when government economic intervention is good, and where and when it is bad, as well as the way it affects the overall economic growth (Fligstein, 2005).

The paper is aimed at identification of alternative institutional models of financing of the real sector and the R&D sector, ensuring economic growth and economic reproduction on the basis of empirical-statistical investigation, as well as analyzing the reasons of their operation. The hypothesis is tested that two institutional models in these

[1]The work is supported by the Russian Science Foundation, research project № 14-18-02948.

spheres could be singled out, so called “a state as an investor” and “a state as a regulator”. To check this hypothesis, data about the 20-year dynamics of financing in Russia (and China) and in the US are used.

The paper is organized as follows. Firstly we provide an overview of the statistical data analysis. The results of the statistical comparison of the composition of investments made in the real sector of Russia (*Nauka, tekhnologii i innovatsii Rossii)* and the US *(Bureau of Economic Analysis…)* are given in terms of sources and the property right system. In this context, some features of the national statistical accounting systems of each country, affecting the results of the comparative analysis, are considered. It is shown that inconsistency of data structure for survey entities and peculiarities of external financing sources grouping outlined impose certain restrictions on comparative analysis of the Russia and the US statistical data. It is necessary to keep these restrictions in mind. However, these discrepancies do not cancel the validity of conclusions made. The result of this statistical comparison is the conclusion on interactions of two different institutional models of financing of economic reproduction processes that define the macroeconomic policies for real sector financing as well as the R&D financing serving further as a technological base for real sector development. These institutional models for Russia and the US are "a state as an investor" and "a state as a regulator", respectively. Even though they do not exist separately but rather coexist, one of the models strongly dominates over the other one.The predominant position of any of the models is related to social, economic, and political processes as well as the culture. In order to explain the reason why the identified models prevail in the analyzed countries, we use the concept of X-and Y-institutional matrices (Kirdina, 2010). Its main provisions, the most significant in the present context, are given shortly in the paper. The paper ends with the conclusions. We suppose that it is reasonable to keep in mind the mentioned differences during the institutional overview of economic growth problems and mechanisms.

References:

Bureau of Economic Analysis, U.S. Department of Commerce website.http://www.bea.gov/iTable/iTable.cfm?reqid=9&step=3&isuri=1&903=177

Fligstein, N. (2005).States, Markets and Economic Growth. In V. Nee &R. Swedberg (Eds.), *The Economic Sociology of Capitalism* (pp. 119-143). Princeton:Princeton University Press.

Kirdina, S. (2010).Prospects of Liberalization for S&T Policies in Russia:Institutional Analysis. *Sociology of Science and Technology*, 1(2), 10-28.

Nauka, tekhnologii i innovatsii Rossii (Science, technology and innovation of Russia) (2011) Moscow: IPRANRAN (words 694)

MOVING FROM ILLNESS TO WELLNESS: NEED FOR INTEGRATIVE HEALTH POLICY

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Advances in science, technology and biomedical research seem not adequately resulting in translational advantages to improve affordability, accessibility and availability of healthcare. The developing world continues to carry significant burden of infectious diseases, malnutrition and now has joined the developed world to face new epidemics of diabetes, obesity and other metabolic diseases, which are attributable to changes in lifestyle. These new challenges and complications of emerging and re-emerging diseases are unlikely to be resolved only with drugs or surgeries but require mindset changes in the foundational paradigms and approaches of medical and public health systems. In such a situation, there is an urgent need to critically re-look at the innovative approaches to compliment current precepts of health and practice of medicine. This lecture advocates a fundamental shift in mindset from today’s illness-disease-drug centric curative therapies to person-health-wellness centric integrative approaches of the future. The lecture discusses various issues related to integrative models based on complementarities between biomedical research led breakthroughs in critical areas such as cancer, chronic degenerative and metabolic diseases on one hand and holistic concepts of Ayurveda, Yoga and other traditional systems on the other hand to move present focus from illness to wellness.

TRANSFERRING RESEARCH TO INDUSTRY- A FEW THOUGHTS

Deepak Agarwal
Director General
Consultancy Development Centre
Ministry of Science and Technology
New Delhi, India

In countries like India where most of the R&D activity is carried out through public funding and is limited in the private sector/industry, there is a need for collaboration/cooperation between the R&D and Industry for enhancing the socio-economic impact of the R&D outputs.

The need for sharing knowledge between research institutions and industry has become increasingly evident in recent years, which can be through various forms ranging from contractual research to collaborative research or even to structured partnerships. Most of these forms/interactions involve the transfer of knowledge between the stakeholders concerned and resulting in significant outcomes e.g. by creating new useful products, new jobs and sometimes new companies.

- Knowledge transfer between research institutions and industry could be through a variety of activities, comprising of the following:
- Research institution-industry staff-exchange programmes,
- Gifts and endowments by industrial partners (e.g. professorial chairs, etc.),
- Collaborative and contract research,
- Consultancy work.
- Increased mobility between the public and private sectors, which would help research institutions' researchers and managers identify shared needs with industry.
- Research institutions need to proactively develop their relationship with industry in order to maximize the use of the research results/output. Some of this would mean developing specialist staff to identify and manage knowledge resources with business potential, (i.e. how best to take a new idea to market) ensure appropriate resources (funding, support services, etc. to make it happen), and to obtain adequate buy-in by all stakeholders.

- It would be highly useful if existing resources in the research institutions are made more accessible to Industry, Universities and other likeminded agencies. This can be achieved through co-ordination. Certain research institutions have staff (Business Development Unit Heads/officers) who can actively pursue links with industry, but who do not interact amongst themselves (the Business Development Unit Heads of sister institutions/laboratories for eg, CSIR). By pooling their knowledge transfer competencies, they can ensure that such skills are made more widely available throughout the research institutions. Significant benefits may arise by outsourcing certain specialised functions or by pooling resources or R&D results.
- It would be interesting to note the wide range of benefits which can be obtained by pooling patents between research institutions. A patent pool can help create a critical mass of intellectual property which is necessary for an innovative idea to be attractive to the private sector. If marketed properly, every relevant industry player could be made aware of the research centres that generated the IP and this would help catalyse links with industry. Furthermore, building a patent pool can lead to stronger relationships between knowledge transfer mechanisms and provide a basis for further inter-institutional endeavours.
- It would be useful to set up transnational centres (on the lines of those set up by Department of Biotechnology) to provide personalised assistance for universities and industry (especially SMEs) for facilitating knowledge /technology transfer. Such Centres can also share information on new, commercially relevant technologies in a structured manner with companies.
- It would also be useful to set up a network of likeminded agencies (on the lines of OSDD of CSIR). Such network can ensure effective dissemination of information including R&D results. Although in certain cases formal protection (e.g. design rights, patents or material transfer agreements) may be necessary if a product is to be brought to market successfully, such network would also help in appropriately addressing these issues.
- Fostering an entrepreneurial mindset as well as the relevant skills among researchers can greatly contribute to the reduction of the cultural divide which exists between research institutions and industry. In order to foster interactions

between them, researchers need to be provided with basic knowledge transfer and business skills. Entrepreneurship education should be offered to provide training on how to manage intellectual property, interact with industry, start and run a business. One of the most effective methods of developing such skills and sharing knowledge is the movement of staff between research institutions and industry through developing appropriate exchange programmes.

- To inculcate entrepreneurship among research, it would be useful that their annual appraisal criteria also take into account other activities such as patenting, licensing, mobility and collaboration with industry.
- Both research institutions and industry can benefit from public policy support, which can take different forms, like promotion of exchange of good policies to direct financial support to knowledge transfer mechanisms. Organisations like DST, DSIR can appropriately evolve such schemes.

A NEW SOCIAL CONTRACT WITH SCIENCE: A REALITY?

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Science and its application, technology, have enjoyed for many decades a general acceptance and recognition of society. Indeed, many discoveries raised from basic science have conducted to a number of applications that benefited some segments of the world population. In life sciences, the discovery of antibiotics, in particular penicillin opened a track whose end result has been the rescue of many lives over the past seven decades. Ironically, S, T & I have notoriously progressed at times where humanity is preparing or is engaged in global war. Likewise, the gigantic technological steps made by humanity during the race to the moon and conquest of space are also examples of rapid progress in the right direction from which almost all societies have benefited, as witnessed by the development of micro/nano electronics. Science was regarded as the answer to the problems of humanity. However, many times science, rather the use that man makes of science is counterproductive to the human ideals, even prejudicial to its own survival. Based on scientific discoveries man has made, and used, weaponry for massive destruction. The potential for annihilation of the human race of chemical, biological and nuclear weapons currently stored by a number of countries is beyond limits. With globalization, problems are also becoming global. Environmental deterioration, depleting of natural resources, and preventive health care programmes, are examples of areas desperately needing concentration of efforts, including research, to reduce global damage. Capacity-building in basic sciences is an important preliminary step towards creating networks of experts capable of addressing these global programmes. Global climate change is a consequence of the abuse society has made of the so-called technological developments. Scientists in general don't pay enough attention to science tracks for the solution of community-felt problems. Scientists are more concerned either with research in *good global currency* or projects properly financed by official or unofficial grants, frequently related to the market needs.

Based on this inattention to social problems, UNESCO in an effort to catch the interest of scientists, and the population in general, organized the conference "Science for the 21st Century", in 1999. The objective was the formulation of a new relationship between science and society, that is, *a new social contract with science* based on the assumption that science is to be subjected to public scrutiny. The debate on the need for a democratic discussion of scientific priorities, the size of its budget, its institutional structure, and the use that is given to the results of scientific labor, was recuperated. It was asserted that such decisions cannot be left simply in the hands of scientists and government officials. A *global social contract with science* would recognize the rights of all people to have a voice in the orientation science should take in the future. However, fifteen years later, the results of this global effort seem to be null. This paper gives some insights and examples of the way society is responding to this challenge, and how it could be more involved on the decision making of the scientific labor.

TECHNOLOGICAL INNOVATION AND SOCIOECONOMIC DEVELOPMENT IN KNOWLEDGE-BASED SOCIETIES: PARAMETERS IN PERSPECTIVE

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Keywords: science and technology, socioeconomic development, socio-technical innovations, global invisible colleges

Decades old background theory and research confirms the positive relationship between planned approach to science and technology (S&T) and socio-economic development in the newly emerging world economies in the BRICS region and elsewhere like South Korea, Taiwan, Indonesia and others. However, this relationship is realized only in combination with a host of other independent variables or parameters. Included among these are (1) political and private industry commitment to science and engineering education, (2) full employment of technically qualified personnel, (3) public–private partnership, and (4) an all-out effort to participate in the global invisible colleges for mutually rewarding knowledge generation, socio-technical innovations, and their large-scale applications for the common good. This presentation will reflect upon the current state of the S&T and economic development relationship through the perspectives of parameters 1, 2, 3, and 4 above in the emerging Asian economies.

References:

Ahmad, A. (2014). Globalization of Science and Technology through Research and Development *Open Journal of Social Sciences*, Vol. 2, No. 4, April 2.(2013).

New Age Globalization: Meaning and Metaphors. New York: Palgrave-Macmillan.

(2012). Redefining Globalization. *Journal of Globalization Studies*, Volume 3, No 2.

(2011). Technology, Industry, and Society in the People's Republic of China: Past, Present, and the Future – Lessons for the World. *Sociology of Science & Technology*, 2, 4, Nov.

SCIENCE, TECHNOLOGY AND INNOVATION IN AFRICA: IS IT RHETORIC OR A SERIOUS BUSINESS?

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The contribution of science, technology and innovation (STI) to national development cannot be underscored as there is evidence that points to the strategic linkage between STI and economic development (Frempong, 2006). Today technology deserves new attention, because breakthroughs in digital technologies, genetic and molecular biology are pushing forward the frontiers of how people can use technology to eradicate poverty and generate wealth.

Since the industrial revolution, countries with well-developed STI capacity have experienced rapid growth and increasingly becoming wealthy. To such countries, as access and use of scientific and technological knowledge had greatly contributed to the material well-being, and improved quality of life (Watson, Crawford and Farley, 2003). The rates of economic growth of those countries have not diminished. Given the important contributions of STI to economic development, it is necessary for African countries to become more serious about the development, application and utilisation of STI. The situation has become more critical since the continent is plagued with rapid population growth, poverty, poor health and food insecurity among others (Economic Commission for Africa, 2002). The continent urgently needs a rapid, sustained, and broad-based economic transformation, and such development can be achieved when the continent has scientific and technological capacity to effectively address these challenges (Hassan, 2009).

Today STI has assumed new dimension in the global development discourse. It is not merely contributing to solve human problems, but it is increasingly being used to measure a country's level of development. Consequently organisations such as UNESCO, OECD and others have developed indicators for measuring developments in science and technology (S&T).

Interestingly, Africa long ago recognised the catalytic role STI plays in development. This is evidenced by the number of declarations, resolutions and plans to radically develop the requisite capacity to effectively harness STI for development. There was the Lagos Plan of Action for the Economic Development of Africa, (1980–2000) which recognised the importance of S&T and called on African countries to seriously integrate S&T into their development agenda.

More recently, the African Union declared 2007 as the Africa's year for Science and Technology and declared to commit 1% of GDP to STI activities. This declaration was merely a re-instatement of an earlier one made under the Lagos Plan of Action. The Africa Union, working with the NEPAD has also launched Africa's Science and Technology Consolidated Plan of Action in 2005 with the objective among others to help Africa harness and apply STI to eradicate poverty and achieve sustainable development (African Union, 2005).

However, Africa still remains under-developed and its standing in the global STI development and utilisation is also low. Almost all the sub-Saharan African (SSA) countries (excluding South Africa) over the years have performed poorly in terms of the UNDP human development indicators.

Evidently, there is the problem of implementing these declarations and this raises the question about Africa's seriousness in employing STI for development and contribution to global STI. The paper looks at Africa's general performance in the global STI development and ranking in the light of the various continental-wide initiatives, and declarations to build capacity in STI which will invariable improve Africa's STI status. It identifies challenges and proposes ways to reinvigorate the development, adoption and utilization of STI by African countries.

References:

African Union (2005).*Africa's science and technology consolidated plan of action*, Addis Ababa.

Economic Commission for Africa (2002). *Harnessing technologies for sustainable development*.ECA Policy Research Report, Addis Ababa.

Frempong, G.K (2006). Improving S&T development and policy making in Ghana and other Africa countries: Lessons from United Kingdom, *ATDF Journal Volume* 3, Issue 4

Hassan M. H.A. (2009). Promoting science, technology and innovation for sustainable development in Africa.E/ECA/CODIST/1/19

Watson, R., Crawford M., Farley S. (2003) *Strategic Approaches to Science and Technology in Development*, World Bank Policy Research Working Paper 3026

EDUCATION AND SCIENTIFIC TRAINING IN AFGHANISTAN

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The development of education and training in Afghanistan was seriously disrupted during the last two decades of the twentieth century due to internal and external conflicts. Since 2002 efforts have been made to rehabilitate the education system. Between 2002 and 2012, enrolment in general education increased from 2.4 million to 8.6 million including 3.2 million female students (38%). Enrolment in higher education during this period increased from 31,200 students to 101,000 including 19,200 female students (19%). In 2010 a total of 27250 students including 3338 female students were studying agriculture, science, technology and medicine in Afghan universities. The ministry of higher education has initiated in 2013-2014 a few research projects linked with the MSc programs.

The National Development Strategy of Afghanistan envisages investment in development of food, water, energy, transport, telecommunications, natural resources, and mining. Attention has been given to the ICT sector; the ministry of communication was renamed as ministry of communication and information technology in 2007. The application of science and technology is essential for the development of all sectors of the economy. In recent years the relevant ministries and the private sector have made significant investment in science and technology in the context of various projects. However, in the absence of strategic planning, coordination, research and evaluation, the efficiency and long-term impact of science and technology on these projects have been uncertain.

A national mechanism for science and technology policy and promotion of scientific and technical research would provide a systematic basis for application of science and technology to development needs of Afghanistan. It would also keep the government leaders informed about the prospects and potential of science and technology for development. The objectives of a national mechanism for science and technology in Afghanistan could include the following:

1. Formulate a science and technology policy for approval of the government.
2. In consultation with the ministries concerned and the private sector, prepare a strategic long-term plan for application of science and technology in social and economic development.
3. Provide consultation to the private sector for the application of science and technology, especially for innovation in small and medium-sized enterprises.
4. Promote research and development for application of science and technology, through technical services and funding.
5. Establish cooperation with relevant international scientific institutions and organizations and serve as an observatory of ideas and experiences for application in Afghanistan.

The subject of a science policy and strategic plan in Afghanistan was first discussed in the 1960s. In 1970 a UNESCO consultant proposed the establishment a Secretariat-General for science and technology, attached to the Office of the Prime Minister, and assisted by a National Council for Scientific and Technical Research. The Independent High Commission of Education proposed in 2003 that a national policy and long-term strategic plan for capacity building in science and technology be prepared for national reconstruction and development. Subsequently the Chairman of the Commission submitted to the government a proposal on science and technology policy for Afghanistan. At the request of the Afghan government, in 2007 a UNESCO consultant undertook a study on this subject in Kabul. He recommended the establishment of a National Council for Science and Technology.

Afghanistan has had many opportunities and challenges for economic development during the last decade. However for various reasons the efficiency and impact of the developmental projects have been below expectation. In education and training, significant developments have occurred. However, the quality and efficiency of education and training continue to be a challenge for national authorities. Scientific training and research require substantial resources and appropriate infrastructure. A number of scientific training institutions have been established in the universities, but scientific research activities have been limited. The government departments and the private sector also invest in science and technology as related to their specific projects. The country has not developed a national science and technology policy. There is an urgent need for a national mechanism for science and technology policy in Afghanistan.

References:

The Constitution of the Islamic Republic of Afghanistan, 2004

Education and Afghan Society in the twentieth century, S. R. Samady, UNESCO, 2001

The Revival and Development of Education in Afghanistan, Report of the Independent High Commission of Education, Kabul, 2003

The National Strategic Plan for Higher Education in Afghanistan, UNESCO-IIEP, 2005

Education and Scientific Training for Sustainable Development of Afghanistan, S. R. Samady, United Kingdom, 2007

The National Education Strategic Plan (2010-2014), Kabul, 2009

The National Higher Education Strategic Plan (2010-2014), Kabul, 2009

Education Statistics in Afghanistan, Ministry of Education, Kabul, 2012

Higher Education Statistics in Afghanistan, Ministry of Higher Education, Kabul, 2012

Afghanistan Technical and Vocational Education Providers Inventory, USAID, 2011

Scientific Policy and Research in Afghanistan, Babin de Lignac, UNESCO, 1970

Afghanistan Science and Technology Policy, M. Khan, Unpublished UNESCO Report, 2007

A STUDY ON THE PROPOSED POLICY ON SCIENCE AND TECHNOLOGY FOR THAILAND

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It has been proposed recently by the Standing Committee on Science and Technology of the Thai Parliament that the Thai Government should adopt and implement a new Eleven-point Policy on Science and Technology for the successful development of Science and Technology and derive from it the economic and social benefits for Thailand. The proposed Eleven-point Policy is briefly described here:

1. Establish clear and challenging targets or goals of creating and possessing the leading world-class technologies with the desire and the commitment to reach those targets or goals.
2. Stimulate or support or develop, or, if necessary, create from scratch, as many as possible technology-based industries of multiple levels and classes or categories.
3. Utilize various advanced technologies to further strengthen the promising or strong industries in the country such as the agricultural industry or those industries relating to the biological diversity of plants, animals and microorganisms.
4. Develop or build up, as large as possible, the human resources in Science and Technology for technology-based industries, especially in the areas that are the strong points of the country or that the country has the competitive edges.
5. Promote and support all levels of useful research and development activities emphasizing both quality and quantity.
6. Promote and support the private sector to invest more in the research and development activities by initiating large science and/or technology projects and providing adequate funding from the early stages of the projects which could start from basic researches or an early stage of applied researches, and by

employing various measures including improving purchasing regulations that are more amenable to the development of Science and Technology in the country.

7. Specify terms and conditions in the Government contracts for the projects that utilize imported advanced technologies for the purpose of transferring of those technologies to engineers and companies in the country.
8. Develop the capability and capacity of the country including Science and Technology personnel to get the country ready for acquiring advanced technologies transferred from developed countries.
9. Promote and support the development, by domestic companies, of widely-used imported high- tech goods and products, for domestic production and consumption and for future exportation.
10. Create and nurture the culture of realization of the importance of Science and Technology in the education system, political system and finally the whole society.
11. Appoint a qualified person, at the level of a Deputy Prime Minister, as the Chief Technical Officer (CTO) of the country to take the responsibility of overseeing the overall development of Science and Technology with the assistance from the to-be-established Congress of Science and Technology which will consist of scientists and engineers who will help the Parliament and the Government to have a more effective annual budget allocation process and will help in all other issues on the Science and Technology.

This paper will discuss more details of the proposed Policy and will attempt to analyze each point in terms of "How" and "Why". It will also describe the possible difficulties, hindrances or obstacles in the implementation of the proposed Policy.

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Keywords: Policy, Science and Technology, Government, Politics, Technology-based Industry, Congress of Science and Technology, Chief Technical Officer (CTO) of the country.

THE IMPERATIVE OF ECONOMIC GROWTH IN SCIENCE AND INNOVATION POLICY: OBSERVATIONS FROM EUROPE, INDIA AND CHINA

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Increasing government expectations of the effects of science and innovation policy on socio-economic policy have been visible both in the advanced and developing countries. Also high market demands have been integrated in the goals of research and technologies. Today the growth of the economy and the international competitiveness are seen as the most important goals of national and global economic policy as well as of science and innovation policy.

Economic stagnation in the US and Europe in 2007showed how the advanced countries can miss their growth potentiality in the global markets even though the investments in science and high-tech are high and the infrastructure for these activities is well-developed. During the past six years three economic depressions have been experienced having ruined the economic growth of most of countries in European Union. Main industries, also the ICT have been weak in the international markets. Citigroup´s forecast for Europe indicate that the growth rate of the economy is even now slow, only 0.8% in 2014. Although the Euro area unemployment rate has stabilized in late 2013; according to Euro stat the average is still 12.0% in 2014.

This shocking trend has provoked discussions of a need to reform the financial and economic policies to guarantee sustainable and long-term economic growth. In the worsening situation the limits of an expansive science and innovation policy and the aims of a generous public funding have been questioned. Earlier many European governments pursued an aggressive science and innovation policy by paying attention to the promotion of the European science to reach the top in the world science, to research topics that support the process of globalization, to new research priorities and to the importance of strategic research. Structural renovations were focused on the strategic regulation of science and innovation policy and on the efforts to make the science system more effective and responsive to industrial needs. Currently, science and innovation policy planning has become more defensive. Although the aims have been sharpened, economic and industrial policy demands are more tight and sensitive to economic risks.

In the view of many European governments two kinds of national rationalizations are obligatory. First, the productivity of all socio-economic activities should be maximized, both in the public and private sector and in the science and technology systems. Second, a radical structural reform of industries has to be accomplished to support international competitiveness and to renew the labor force. The rationalization effort has also resulted in the rise of new government-led strategic research programs with new socio-economic topics of strategic research.

It is characteristic of the present global order that economic growth has been very fast in the emerging countries -Brazil, India, Russia, China, South Africa - at the same time when the advanced countries have begun to lose the game. Nevertheless, science and innovation policy makers in the BRICS countries have followed in their priority setting much the same paths than in the advanced countries earlier. For example in India they have emphasized inputs to higher education, top level technological universities, science parks and to an infrastructure that helps S&T off shoring and business process outsourcing.

Recently the BRICS countries have also met difficulties. In India the fastest economic growth was in 2004-2007. Afterwards the annual growth rate has varied from 4.9% to 6.0%. The explanations refer to liberalization that was not complete enough, to corrupt government, financial and social instability (poverty) and to the unbalance of payments. India lacks big export industries other than technology and it does not attract foreign capital sufficiently.

China´s export dynamism has been sustained and diversified since 1995. It has been the world´s leading exporter of many manufactures and has a huge scale economy. The share of foreign funded enterprises is high and they play a big role in the strategy of export diversification. But the political system does not support democracy and the laws are too closed to respond to the needs of economic growth.

Both India and China have been lower-cost producers but the situation has changed. The MINT countries - Mexico, Indonesia, Nigeria and Turkey - have become to represent new and flexible financial actors. They have natural resources and young labor force. But the socio-political obstacles, which already had effects on science and innovation policies of some earlier fast growth countries, are even worse there, to mention corruption, violence, injustice, human rights violence and weak governance.

CONSTRUCTING LOCAL KNOWLEDGE THROUGH LOW-COST DIY METHODS

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The declining birth rate and resulting increase in the proportion of the elderly pose Serious problems for contemporary Japan [1] to response to these problems, both the central and local governments are making efforts to increase the population. Some local areas aim to attract young people who were born, raised and work in urban areas, while others attempt to call back natives of their region who left to take jobs in urban areas. Raising awareness among young people of the importance of increasing the birth rate is a critical problem in Japan today. In many rural areas the construction and sharing of knowledge about the local culture and natural resources for use in local education or linked to concepts of eco-tourism or geoparks is regarded as an important objective [2].

On the other hand, due to a lack of attention, the cultural and natural environments have in some cases been drastically changed from earlier, more prosperous times. Although cost is an issue, reconstructing local knowledge from historical materials is regarded as extremely important. For these reasons, developing low-cost methods of constructing local knowledge is an essential task for local regions. Following this background, this paper will introduce an example of an ongoing project at Nara University developing low-cost digitizing methods utilizing current hardware and open-source technologies.

Since 2013, a team composed of Nara University professors of cultural properties, history, Japanese literature and geo-informatics has been attempting to construct a digital archive of a Collection of materials by the local photographer, writer and journalist Nobuaki Kitamura (1907-1999), donated to the university by his family in 2000 [3][4]. One part of the collection, dry plates, includes photos of local landscapes from 100 years ago, critical for a full understanding of the late modern culture and nature in Nara City. The collection also includes photos of historical figures including the Japanese royal family. The project team members believe that the collection is of great cultural value and should be shared with the university and the local community. However, because there was no budget for this project, the team was challenged to find inexpensive ways to proceed, utilizing their own personal equipment. As a result, a tablet device was used as a substitute for a light box, and a mirror less interchangeable-lens camera (MILC) was used as a digitizing device. Using this set of ordinary devices, the digitization of more than 300 old dry plates was successfully accomplished by the team members in just two and a half days. Numerous post productions processes such as metadata extraction, raw image processing, database management and Html reports were automated by utilizing open-source technologies.

Current high-spec digital devices and open-source technologies potentially provide “Do It Yourself (DIY)” methods, not unlike building LEGO blocks. Although this paper focuses on the Case of dry plates, by combining cutting edge technologies and open-source technologies, such DIY methods can be applicable to a wide range of historical materials. One of the great benefits of these technologies is that we can easily develop new methods in an economical way. However, many rural areas face a lack of human resources with the skills necessary to develop such DIY methods.

After the age of rapid economic growth and the concentration of people and industry, it is time to turn our attention back to local regions. Discovering and sharing the worth of local areas with the assistance of technologies should be an essential theme in developed countries. Also, how best to encourage people such as information engineers to live and work in local regions and contribute to local society should be an important role of cultural science and university education.

References

Masuda H. (2014). The Death of Regional Cities: A horrendous simulation Regional Cities Will Disappear by 2040 A polarized Societies will Emerge, Discuss Japan – Japan Foreign Policy Forum, No.18.

Eder W., Patzak M. (2004). Geoparks – geological attractions: a tool for public education, recreation and sustainable economic development. Episodes, 27/3, 162-164.

T.Asada (2006). Nara University Library Kitamura Collection - Introduction of Katue Kitazono's early stage & unpublished poems-, Memoirs of Nara University, vol.34, pp.1-40, Nara University.

T.Asada (2007). Nara University Library Kitamura Collection II - Addendum documents of Katue Kitazono's early stage and letters sent to Nobuaki Kitamura, Bulletin of Research Institute of Nara University, vol.15, pp.141-162, Research Institute of Nara University.

450 MM SEMICONDUCTOR WAFER FOUNDRIES: IMPLICATIONS FOR THE EMERGING ECONOMIES

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Keywords: 450mm semiconductor wafer foundries, American-European foundry development, ICT, Internet of Everything, Medical chips, Smart Buildings, Smart Cities, Smart Grid, Wearable Devices

This discussion focuses on the techno-financial implications for the development of 450 mm wafer foundries to manufacture new-age semiconductors in order to increase the economy of scale by 2.25 times and reduce manufacturing cost by 30 percent. Semiconductors devices manufactured in these wafer foundries are expected to drive the Internet of Everything by 2020 with things such as actuators, cameras, sensors, and other information and communication technology to realize, smart cities, smart grids, smart buildings, autonomous vehicles, medical devices, wearable devices and a host of other robotic technologies. According to Cisco, the global economic benefits resulting from these applications are expected to be around $14.4 trillion. The recent progress made these American and European foundries along with Europe's science, technology and innovation policy known as a 10/100/20 program will be presented. STI opportunities like benchmarking, evaluation and possible collaboration can accelerate growth in emerging economies with their own advanced wafer manufacturing foundries, to enhance local techno economic capabilities, and to enter into new markets in a highly competitive world order.

References

Ahmad, A. (2014). Globalization of Science and Technology through Research and Development *Open Journal of Social Sciences*, Vol. 2, No. 4, April 2.

Pastore, T. (2014).*A Quantitative Study to Explore Financial Resources and Technology to Transition to 450mm Semiconductor Wafer Foundries* (Doctoral dissertation, School of Management, Walden University)

Rose, D. (2014).*Enchanted objects: Design, human desires, and the Internet of Things*. New York, NY: Scriber.

Singer, P. (2013). Europe's 10/100/20 Program. Solid State Technology, Vol.56, No. 7,Oct.

CONTEXT APPROPRIATE TECHNOLOGIES FOR DEVELOPMENT: CHOOSING FOR THE FUTURE

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Technology fore-sighting is the attempt to predict the most likely technology developments in the medium-term. While technology fore-sighting can be applied to any field, it is most commonly associated with technologies as they relate to economic growth and development. Technology fore-sighting activities have traditionally taken place predominately in developed countries (Ciarliet al., 2013a,b). However, developing countries have increasingly adopted fore-sighting activities in an attempt to catch the next technological "wave" from which they can benefit to drive economic growth (UNIDO, 2005). Among the developing and emerging economies that have conducted fore-sighting activities include Argentina, Brazil, Chile, China, Colombia, Czech Republic, Hungary, India, Peru, Poland, Russia, Slovenia, South Africa, Thailand, Turkey, Ukraine, Venezuela, and Vietnam. While a review of the literature reveals fairly extensive work on fore-sighting methodologies, including the numerous types of survey techniques employed, there are two largely unexplored or underdeveloped issues around fore-sighting; and they are, we believe, connected. The first observation is that the fore-sighting literature has been linked in only very limited fashion to the literature around economic convergence. The second is in the translation of fore-sighting activities into actual policy initiatives.

We will discuss first the relationship (or lack thereof) between the fore-sighting literature and the convergence literature. Convergence refers to what was once believed the process of poorer countries "catching up" to richer ones because they have the ability to "copy" technologies developed by technology leaders. Convergence theory suggests that countries behind the technology frontier would thereby be able to close the gap with technology leaders, first rapidly, and then gradually more slowly, until they reached the technology frontier themselves and no more leading technologies were available to be copied. At that point those countries, like the technology leaders, would be forced to develop their own technologies if they hoped to maintain their pace of economic growth.

We should acknowledge here that the convergence literature has reached very mixed conclusions about the extent to which convergence is happening as well as the conditions under which it is more likely to occur. However, what does not appear to be subject to much debate is that the process is not automatic. Both Abramowitz (1986) and Baumol (1986) suggested that countries require sufficient absorptive capacity (the ability to understand and apply the more sophisticated technology) in order to successfully copy the technologies developed by the technology leaders. This suggests that capability development must precede successful adoption of foreign technologies. Another related issue of import seems to be the issue of "technology gap", or the gap between the technology leader and technology follower; that a gap that is too large will actually impede the ability of the technology follower to successfully copy the technology.

The convergence literature has important implications for fore-sighting. Both the issue of the technology gap, as well as that of absorptive capacity, which are little discussed in the fore-sighting literature, would seem to suggest that fore-sighting activities should take account of 2 where the country currently is technologically in making decisions about the kinds of technologies to be targeted. Current practice in technology fore-sighting seems to focus predominately on the identification of leading and next-generation technologies; which may not be consistent with the country's ability to adopt and adapt those technologies effectively. There is an interesting contradiction here; as most of the technology fore-sighting attempts explicitly to point to catching up as one of the activity's primary objectives. Identification of leading technologies and catching up may, however, be inherently contradictory in at least some cases.

The second, and related, challenge is in converting the outputs of technology fore-sighting into actionable policy initiatives (Meissner et al, 2013). The discussion above with respect to fore-sighting and convergence theory is one element that should inform policy initiatives. A second issue is the decision around whether the technologies targeted should be developed (through national inventive and innovative effort) or acquired (accessed from other countries, generally through multinational corporations). We should point here to another issue with the identification of leading technologies alone as part of fore-sighting activities, which is that they lend themselves primarily only to acquisition and not to internal development. Furthermore, the fore-sighting activities that we are aware of generally omit to link the acquisition of those technologies to the development of internal capabilities.

A core element linking these issues surrounds policy toward foreign investment, as multinational corporations (MNCs) are widely considered the most important transmitter of technologies to developing countries. These may take the form of either intentional transmission (technology transfer) or unintentional transmission (technology spill over's) from MNCs to host countries. Both of these forms of transmission, however, share something in common; which is that the host country needs to have developed adequate capabilities to take advantage of the technology. This is true both because 1) host countries require those capabilities in order to absorb the technology; and 2) the decisions of MNCs regarding the type of investment (asset-seeking or asset-exploiting, with the former providing the greatest opportunity for technology to be shared with the host country), are contingent upon the extent to which those capabilities are developed.

Thus, a key policy choice to be made with respect to fore-sighting is which technologies a country should attempt to develop internally; and which should be targeted for acquisition through policies toward foreign investment. This choice was highlighted by Fu, Pietrobelli and Soete (2011) that contends that indigenous capabilities and the selection of technologies to borrow from abroad need to happen in parallel. There are strong links here, we believe, with the fore-sighting literature; as identification of the technologies that a country wants to target must precede the decision about whether the technologies are acquired or developed.

Summing up, fore-sighting has been increasingly adopted by developing countries as a Mechanism for identifying emerging technologies whose adoption might serve as a platform for 3 future economic growths. However, fore-sighting activities have not resulted in well-developed policy initiatives. In considering how fore-sighting activities can successfully be translated to policy, two closely related ideas must be considered. First, foresight activities would benefit from being more informed by the convergence literature, and should therefore incorporate the ideas of absorptive capacity and technology gap into fore-sighting exercises; and second, policies emanating from fore-sighting activities should clearly define both a) which technologies identified through fore-sighting should be developed internally vs. those that should be borrowed from abroad; and b) consider the internal capabilities that need to be developed in conjunction with (and as a precursor to) those technologies that are targeted for acquisition from abroad.

References

Abramovitz, M. (1986) “Catching Up, Forging Ahead, and Falling Behind”, the Journal of Economic History, 46(2): 385-406.

Baumol, W. J. (1986) “Productivity Growth, Convergence, and Welfare: What the Long-Run Data Show”, The American Economic Review, 76(5): 1072-1085.

Ciarli, T., A. Coad, I. Rafols (2013a) “Quantitative Analysis of Technology Futures.

Part 1: Techniques, Contexts and Organizations”, Nesta Working Paper 13/08, May. (www.nesta.org.uk/wp13-08)

Ciarli, T., A. Coad, I. Rafols (2013b) “Quantitative Analysis of Technology Futures

Part 2: Conceptual Framework for Positioning FTATechniques in Policy Appraisal”, Nesta Working Paper 13/09, May. (www.nesta.org.uk/wp13-09)

Fu, X., C. Pietrobelli, and L. Soete (2011) “The Role of Foreign Technology and Indigenous Innovation in the Emerging Economies: Technological Change and Catching Up”, World Development, 39(7): 1204-1212.

Meissner, D., L. Gokhberg, and A. Sokolov (eds) (2013) Science, Technology and Innovation Policy for the Future: Potentials and Limits of Foresight Studies, Springer.

United Nations Industrial Development Organization (2005) “Technology Foresight Manual. Vol 1: Organization and Methods”, Vienna: UNIDO.

EMERGING POLLUTANTS, HEALTH ISSUES AND REGULATORY CHALLENGES

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Point source pollutants are well recognized and better controlled by the regulatory authorities. However, the list of priority pollutants is growing and challenges from emerging pollutants are enormous. Environmental pollution due to products of personal use often escape regulatory controls and in most of the cases overlooked due to lack of monitoring abilities and seriousness of their health or ecological impacts. A simple example of the emerging pollutants is the pharmaceuticals and personal care products (PPCPs) released in the environment through sewage, contaminating drinking water and exerting effects on aquatic ecosystem. Another emerging challenge is the use of manufactured nano-materials in a variety of industrial and household products. Over a thousand consumer products are currently listed to contain nano-particles, including sunscreens, paints, semiconductors and cosmetics, with global markets expected to reach over $1 billion by 2015. Nano-particles range between 1 and 100 nm and have unique physical and chemical properties due to their small size and greater surface reactivity. During manufacturing and household waste nano-materials are likely to end up in the environment exerting unwanted effects on the exposed organisms. It is increasingly documented that nano-particles have different biological effects than the parent compounds and they have the ability to penetrate and accumulate into the cells of the organisms.

However, the knowledge about the interaction of nano-material with the biological system is inadequate. With sophistication in analytical technologies, a majority of chemical pollutants can be detected at extremely low levels, and the information is growing that certain chemicals prevalent in air and water bodies can exert deleterious effects on human health and also create ecological imbalance at very low concentrations. Contrary to lethality used as safety evaluation criteria; other endpoints like neurobehavioral changes, immunological disturbance, and endocrine disruption could specify previously unknown effects that are not recognized using current assessment criteria. The challenge for the regulatory bodies is to develop strategies to tackle emerging pollutants which were previously unseen before they become critical ecological or human health problems. However, mere measureable presence of a chemical or a cocktail of chemicals in the environment should not be the basis of concern for ecological or human health risks; rather its measureable effect should determine their benefits or harmful effects. At the same time, we must keep in mind that a large number of pesticides that have been enthusiastically used in past are health risk today at extremely low residual levels. Internationally more efforts and money is being spent in recent years to contain and mitigate such chemicals.

STI LANDSCAPE OF INDIA: LEARNING EXPERIENCE FOR OTHER DEVELOPING COUNTRIES

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Science, Technology and Innovation (STI) are increasingly driving economic prosperity and growth of nations and determine competitiveness. Both developing and developed economies are spearheading innovation driven growth strategies and are developing policy frameworks for integrating STI. This has led to a spate of policies focused on increasing the innovative capacities of private firms, public sector organizations and research institutions.

The emphasis of the developing economies is more on inclusive innovation where the process or the product is affordable and is able to reach a large number of people. Countries like India have laid out a Road Map for innovation through the Science, Technology and Innovation Policy (STI) of 2013. The policy aims at integrating science technology and innovation through an innovation driven science and technology development. The developing countries look for STI integration for resolving issues of pressing challenges such as energy, environment, water, food, health, sanitation and employment.

The R & D landscape of developing countries is diverse and policy initiatives aim at development of country specific policies for STI rather than adopt the policies of other countries in too. This necessitates sharing of experience in STI amongst developing societies to evolve a sturdy, robust, sound and implementable Science, Technology and Innovation Policy in the respective countries. The paper describes the learning experience of Indian and 9 member States of the African Union in the development of S & T and STI policies in their respective countries.

INDIGENOUS AFFORDABLE TECHNOLOGIES FOR INDIAN PUBLIC HEALTH CARE DELIVERY

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As per the XII Plan Goals of the Govt of India for faster, sustainable and inclusive growth and keeping in mind the large demographic divide & varied geographical conditions, the focus of innovation in the area of Science & Technology including medical technology needs to be targeted on population in need and disease profile of the country. The Science, Technology & Innovation Policy (2013), emphasize the need to convert the generated scientific knowledge in to product and processes to achieve the developmental goals of the nation. The paradigms of the innovations have to be country and context specific. As India has declared 2010-20 as the 'Decade of Innovations', the need is to identify the priority areas and address the pressing challenges by providing affordable health care.

Indian Council of Medical Research (ICMR) continues to remain the apex medical body for the formulation, coordination and promotion of biomedical research in India since last more than hundred years. ICMR has made significant strides in knowledge generation all through the centenary of its existence and many of the technologies developed or supported by ICMR have find way in national and international programs such as Multi-drug therapy (MDT) in leprosy, directly observed short course chemotherapy (DOTS) in tuberculosis, non-insecticidal methods of malaria control, *etc*. It has also supported polio and guinea-worm eradication program and helped in identifying new infections/diseases like leptospirosis, kyasanur forest disease (KFD), and new dirrhogenic strain of *V. cholerae* 0139 as well as providing solutions to various nutritional disorders.

In recent years, with the creation of Department of Health Research (DHR) in the Ministry of Health & Family Welfare, the focus of ICMR has shifted from knowledge generation to its translation aiming at bringing modern health technologies to people by encouraging innovations and its application through diagnostics, technologies and other interventions including vaccines, products and processes in synergy with other departments of MoHFW and sister S&T Agencies as well as through collaborations with other global organizations and nations.

For the purpose, the Department of Health Research (DHR) and ICMR have undertaken many initiatives to encourage innovations in the area of medical and biomedical research and an institutional framework and innovation action plan has been prepared with setting up of Translation Research Units in each of the ICMR Institutes and a coordination cell at ICMR. The Scientists at ICMR Institutes and non-ICMR Scientists funded by ICMR have been involved in various innovations related activities and have been successful in developing new drugs/devices and technologies.

ICMR in collaboration with DHR has been successful in launching of 8 new technologies in the area of vector borne diseases, diabetes, nutrition, Genetic disorders, cancer, *etc.* during 2013-14. These technologies are: (i) Glucose monitoring device; (ii) Testing strips for diabetes (Suchek & QuickcheQ); (iii) First indigenously developed Japanese Encephalitis vaccine (JENVAC); (iv) Dried Blood spot (DBS) – collection kit for sub-clinical deficiency of Vit.A; (v) Technology for Ferretin estimation; (vi) Development of PCR based method to detect food borne pathogens; (vii) Development of magnifying device (magnivisualizer) for screening cervical cancer; and (viii) Rapid Diagnostic kit (RDB) for the detection of β- thalassemia syndromes: inherited blood disorder. Many other technologies are ready for launch.

ICMR and DHR also promotes career in science and research and innovations through number of human resource development programs/activities as well as help in strengthening infrastructure by establishing Multidisciplinary Research Units (MRU), Model Rural Health Research Units (MRHRU) and by establishing a network of viral diagnostic research laboratories (VDRL) across the country to promote medical science and innovations and creating an environment for other agencies and private partners to collaborate.

DHR in collaboration with ICMR is striving hard in the area of technology promotion by encouraging innovations. The Department is also in the process of establishing a Medical Technology and Assessment Board (MTAB) so that affordable technologies can be identified, validated and reaches to poor and marginalized section of the society aiming to reduce out of pocket expenditure. The Department in technical collaboration with ICMR is committed to translate generated knowledge in to products and process for the benefit of the society.

Various science agencies like DBT, DST, CSIR, DRDO, Department of Space, Department of Electronics & Telecommunication, ICAR/DARE, other Departments of MoHFW and others including some in private sector are also involved in development and use of appropriate technologies for health care. Department is working to take all the advances to the people by creating an appropriate mechanism.

SUSTAINABLE DEVELOPMENT

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It is well known that for the survival of mankind on this planet earth it is essential to have good quality air, water, balanced and nutritious food, shelter and for socializing with other human beings the minimum infrastructure development such as the fastest communication system of information, energy for fulfilling daily basic needs and for entertainment etc. The quality of air, and water should be such that the pollutants remain within the permissible limits for living beings. The carbon monoxide and the carbon dioxide exhaust from domestic use, vehicular emission and thermal power exhaust should be recycled by making use plasma based technologies for decomposition. The plasma based technology should be used for heating/cooling as it can provide a high temperature in the absence of oxygen. Similarly, the water used by industries, domestic and agriculture purposes should be recycled after due processing and there should be different connections for drinking purposes as well as for other non-drinking use. Rainwater harvesting should be done wherever it is possible to recharge the ground water so as to raise the water table and water should not be wasted by allowing it to flow in the river and subsequently to oceans from domestic as well as industrial use.

The course content of education of architectural Engineers should be totally overhauled keeping in view the needs of equatorial part of planet rather than suited for upper latitude in terms of energy requirement. The architectural design of residences, offices or place of work, use of technology enabled offices, virtual libraries; office cum residences should be studied fulfilling the need for equatorial part with minimum energy consumption so that they make use of sunlight during the day for lighting and heating/cooling purposes. Energy is an important component for the development. But for sustainable development it is necessary to emphasise on energy conservation rather than on energy consumption. It is well known that the whole universe is full of different forms of energy. Though it is well known that energy can be extracted from mass through Einstein's mass- energy relation. But for sustainable development we have a question in mind that we have to convert mass into energy in laboratory through fusion, fission or chemical methods resulting in radioactive waste as a by product.

In my opinion, the energy available through natural process in the form of Solar, solar wind, water heads (hydroelectric), geothermal, seawater tidal waves and many moving conducting objects in the presence of magnetic field etc on this planet earth are sufficient for energy requirement of the mankind on this planet earth. This form of renewable energy sources should be used for the benefit of mankind to affect the sustainable development. Moreover, the efforts should also be directed towards the energy conservation by making use of electric energy generated by renewable methods for street lighting by LED’s and making use of nano devices for communication and entertainment. Devices containing remote sensing and remote control can solve many internal and external security problems in addition to geo-mapping weather forecasting etc

UNIVERSITY IN THE INNOVATION ECOSYSTEM- A CASE STUDY OF INDIA

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Innovation has become a ubiquitous term. This is driven by increasing evidence that innovation driven regions, and firms have created wealth at a dramatic rate and contributed towards higher living standards of the nations at large. The innovation driven activities are largely observed in North economies. The North-South divide is primarily seen as capacity and capability of creating and exploiting knowledge. In the last two decades or so developing countries have come to the realization that innovation must be a central component of their economic development strategies. This is observed more so in some Asian economies which have given rise to the 'Asian Driver Hypothesis' (Kaplinsky and Messner, 2007). The Asian driver hypothesis argues that while the OECD countries continue to be important, the change comes primarily from Asia.

Scholars and academicians are now increasingly recognizing that innovation happens through a complex set of interactions and relationships among institutional actors such as government, industry and academia. This integration of institutions and instruments form an innovation ecosystem that facilitates an environment for productive knowledge exploitation. Universities are now seen as an important factor in the innovation process. Model ecosystem frameworks like National System of Innovation (NSI), Triple Helix Model (THM), National Innovative capacity (NIC) discuss the role of universities in developing the innovative capacity of a nation. Among the models, 'Triple Helix' suggests a more entrepreneurial role of universities in contrast to other models (Datta and Saad, 2011). The government plays the role of a facilitator and designing appropriate policies for developing strong university industry linkages. Researchers argue that a global convergence is currently taking shape toward entrepreneurial universities playing a central role in a knowledge-based economy that moves beyond etatism and pure market relations to an immediate position within the triple helix regime (Etzkowitz et. al, 2008). It can be

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observed that universities in innovation driven economies are embedded within the research and innovation ecosystem. They are not only seen to play a role in the 'supply side' of the innovation process but are involved in the whole 'innovation value chain'.

In recent years, Indian government through various policy articulations, programs and creation of strategic instruments and institutions have given a strong indication of its desire to undertake the path of innovation led economic growth. A distinct feature of its innovation approach is her intention to broad base the agenda of innovation towards more inclusiveness i.e. to bring in important stakeholders that have been ignored earlier. It also entails enhancing the competitiveness of the micro and macro small-scale industry by strengthening their capacity to innovate.

The role of universities in developing innovative capacity of the nation has been under scrutiny and it has been a point of discussion among the academia, the policy makers and lay public. Attention towards involving the Indian higher education system in the R&D and in building innovation capacity can be seen in the documents by the planning commission and new institutional setups: National Innovation Council (NInC) and National Knowledge Commission (NKC).

The paper revisits these documents to delineate the major policy actions envisaged for and some implemented for universities and their implications. Some of the question the study investigates in this regard are: Whether the policy articulations and plans were based on rationale driven from theoretical perspectives and/or scholarly thinking or it has been more a reaction driven by international rankings and popular debates? Whether the roadmap envisaged for the universities to play allows them to participate more actively in the innovation process? Does the new innovative approach still subscribe to linear model of innovation with university role mainly in upstream stage of the innovation process or argues for a more entrepreneurial role of university? Do we observe emergence of functional structures that connects universities with the innovation ecosystem?

References

Abrol D 2013. New Science, Technology and Innovation policy: A critical Assessment. Economic and Political Weekly Vol XLVIII No 9. 10-13

AICTE 2009. Yashpal Committee Report - The Committee to Advise on Renovation and Rejuvenation of Higher Education.

Cabinet Note for the Universities for Research and Innovation Bill, F.No. 4-40/2009-U.I.(A), April 2012.

Dahiya B S 2011. The University Autonomy in India: The Idea and the Reality. Shimla, India: Indian Institute of Advanced Study

Datta, S and M Saad 2011. University and innovation systems: the case of India. Science and Public Policy, 38(1), 7-17

Etzkowitz H et al 2008. Pathways to the entrepreneurial university: towards a global convergence. Science and Public Policy, 35(9), 681-695

Etzkowitz, H and L Leydesdorff 200. The dynamics of innovation: form national systems and mode 2 to triple helix of university-industry-government relations. Research Policy, 29(2), 109-123

Economic Times 2013. "Indian universities should be in top league: Pranab Mukherjee" (http://articles.economictimes.indiatimes.com/2013-03-17/news/37787200_1_president-pranab-mukherjee-universities-indian-institute)

Economic Times 2013 "Budget 2013: Corporate funds to assist technology incubators" (http://economictimes.indiatimes.com/news/emerging-businesses/startups/budget-2013-corporate-funds-to-assist-technology-incubators/articleshow/18785562.cms)

Gupta, B M and S M Dhawan 2008: "A Scientometric Analysis of S&T Publications Output by India during 1985-2002", DESIDOC Journal of Library and Information Technology, 28(2), pp 73-85.

Krishna V V 2013. Science, Technology and Innovation Policy 2013 : High on Goals, Low on Commitment. Economic and Political Weekly. Vol - XLVIII No. 16

Kanhere, D G M Arjunwadkar and A M Vichare 2009. Rise and decline of India's state university system: neglect, design or neglect by design?. Current Science, 97(7), 1013-1021

National Innovation Council 2012 " Report to the people : 2012"

National Knowledge Commission 2007 "Innovation in India" General Trends In Innovation. Section 2.1 9-14

National Knowledge Commission 2009 "Report to the Nation: 2006-2009," Excellence Section 5 Page 64

New Indian Express 2013 " Innovation Universities Bill". (http://newindianexpress.com/opinion/article1458323.ece)

Planning Commission 2007a. XIth Five Year Plan. Section 1.139. Page 22

Planning Commission 2007b. XIth Five Year Plan. Page 18

Planning Commission 2012a. Draft XIIth Five Year Plan. "Science and Technology" Chapter 8 Section 8.6. Page 236 Volume I

Planning Commission 2012b. XIIth Five Year Plan. "Education," Chapter 21, Sectin 21.292 Volume III

Rabbani Attar 2009. 'Universities' in need of reform. Economic and Political Weekly. Vol - XLV No. 17

RamaprasadArkalgud 2011. Envisioning a world-class university system for India. International journal of Technology Management & Sustainable Development. Vol 10 Numer 1. 45-54

Science, Technology and Innovation Policy 2013. Department of Science and Technology. (www.dst.gov.in/sti-policy-eng.pdf)

SalmiJalim 2009. The Challenge of EstablishingWorld-Class Universities. The World Bank.
Times Higher Education 2013 Rankings. World University Rankings 2012-2013. (http://www.timeshighereducation.co.uk/world-university-rankings/2012-13/world-ranking)
Times of India 2013. “Need to push higher education: President Pranab” (http://articles.timesofindia.indiatimes.com/2013-03-22/news/37936036_1_higher-education-reforms-indian-universities-education-loans)
UGC Website . Innovation Universities Note. http://www.ugc.ac.in/pdfnews/3155745_InnovationUniversity.pdf
UGC Website. UPE – Universities with Potential for Excellence. (http://www.ugc.ac.in/page/Universities-%28UPE%29.aspx)
Universities for Research and Innovation Bill, 2012 – prsinida.org
Union Budget and Economic Survey 2012-2013. “Speech ofP. ChidambaramMinister of Finance” Clause 76. Page 13 (http://indiabudget.nic.in/bspeecha.asp)
Yashpal Committee Report 2009. Report of ‘The Committee to Advise on Renovation and Rejuvenation of Higher Education’Pg 5

MODES OF GLOBAL TECHNOLOGY KNOWLEDGE TAPPING

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Many developing countries are trying to achieve the increased productivity and welfare generally not at the expense of research and development performance and its commercialization but due to absorption of already-known-to-the world technological knowledge. However, only few of them have achieved a significant economic success.

Among the channels of technological knowledge diffusion, the open information channel and that of commercial knowledge transfer are of great importance for successfully catching-up processes (Golichenko, 2013). The performance of the channel of transformation of open knowledge into pre-competitive and competitive one is much less significant. The low level of secondary education significantly limits the ability to use the open information channel. The investment in higher education partially improves the situation. At the same time, only the availability of high-quality human capital does not mean that this capital can be effective to provide a large-scale knowledge transfer if many other components the channels are missing.

In processes of transfer and diffusion of global technology knowledge, the role of the protection of intellectual property rights is ambiguous. To extend the scale of foreign technology diffusion, it is reasonable to use weak protection of intellectual property. It may significantly increased technology level of domestic firms and their absorptive capacity. If the new technology and capacity level of domestic companies is reached rather high value, the problem of transition to a more advanced level of technology will arise. The problem cannot be solved without strong enforcement of intellectual property that allows domestic companies not only get access to the most advanced technology but also protect their own technology advances.

To manage the knowledge transfer process effectively, it is rationally to integrate domestic markets in the global ones and use foreign competition as a driver of development. In other words, countries need to strengthen competition through strong export orientation of domestic firms or open domestic markets to foreign competitors.

Nevertheless, it must be borne in mind that the excessive strong competition may cause irreversible far-reaching negative consequences for domestic industry (Aghion, 2009). The opening of domestic markets without a supportive government policy may initiate the disappearance of many national industries and generate risks that the home country's innovative capacity can be dismantled. At the same time, classic protectionism conserving the high barriers to entry for foreign companies into domestic markets preserves the backward technological structure of the developing country.

To find ways out of this contradictory situation, the national models of technology diffusion in India, China and Korea are considered.

It is shown that there are two ways to avoid the detrimental effects of vigorous competition. According to the first one, the government strongly supports the large export-oriented company-leaders (the Korean way). The government policy pursued the integration of the sophisticated outward-oriented and import-substitution strategy. At the same time, the intellectual property rights are strictly enforced. The domestic market begins to open up to international competition as soon as domestic industry leaders became close to maturity.

The second way is to use the international competition for creation of an eligible pool of technology capacities and a potential threat of foreign competition for domestic producers (Chinese way). This could be made by means of establishment of special economic zones. The threat may encourage domestic enterprises to innovate, and the use of the pool of technology capacities provides prerequisites in order to survive in the future competition. The opening of the domestic market and intense competition with foreign firms became a reality for domestic producers as they reach a certain technological level due to technology diffusion.

Finally, one needs to recognize that pure catching up strategy leads eventually into a dead end under the modern level of market and technology development (Golichenko, 2013). The country's long orientation only towards the problems of technology catching up can result in essential deterioration of creative facilities of the nation as a whole and its human resources in science and technology particularly. During passing the investment (catching-up) stage, the institution and resource base for transition to the next stage should be brought into being. In other words, there is a demand for the mixed policy implementing in some proportions institutions and institutional instruments corresponding to both the current investment stage and the future stage driven by national innovations.

References

Aghion, P., R. Blundell, R. Griffith, P. Howitt and S. Prantl (2009). "The Effects of Entry on Incumbent Innovation and Productivity", *Review of Economics and Statistics, 2009, 91.*

Golichenko O.G. (2013). "The Methodology of National Innovation System Analysis". *In Chen Jin, Latif Al-Hakim (eds.) Quality Innovation: Knowledge, Theory and Practices. Hershey (USA): IGI Publishing.*

GLOBAL PERSPECTIVES ON SCIENCE AND TECHNOLOGY, ECONOMIC DEVELOPMENT AND ECOLOGY

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The paper begins with a brief global and Indian update on science and technology, review of releavant concepts of ecology, followed by brief discussion on the contents of globalisation and regionalisation, market and growth fetishism, internationalisation of production and marketing, and discussion of relevant ecological and developmental implications. It ends with some specific suggestions for the STI sector, and a few insightful thoughts from very eminent persons.

SCIENCE, TECHNOLOGY AND INNOVATION POLICY IN NEPAL – A HISTORICAL PERSPECTIVE

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Technological developments in Nepal dates back to ancient times up to 1000 years BC with records of innovations in animal husbandry, agricultural farming, use of bamboo, hay, thatch and timber for construction. The Malla period, which extends from 1200 to 1768 AD, witnessed a high level of technology growth comparable to contemporary advanced nations (Singh & Bhuju 2001). Even in 1279 AD, the pagoda architecture was internationally recognized as evidence by the White Pagoda of China built by Arniko of Nepal (Joshi 1987). The superb blending of robust architecture with religious and aesthetic structures of this period has won UNESCO recognition as World Culture Heritage for six sites of Kathmandu valley. Besides excellence in civil engineering and architecture, technological competence in metallurgy, textile, mining & extraction of iron; Ayurvedic dispensary was comparable to neighbouring countries (Bajracharya, Bhuju, Pokhrel 2006).

With the advent of democracy and the abolition of Rana regime in 1951, Nepal freed itself from the self-imposed isolation of over a century and began to embark on the path to modernization. It was during this period that the Science Society of Nepal, the first scientific organization, was formed and a first conference on S&T was organized in 1956. This conference inaugurated and attended by the King provided valuable inputs to the First Development plan of Nepal (GoN 1956, Singh & Bhuju 2001). Since this development plan, the Nepal Government initiated the development of infrastructure for S&T activities. The Departments of Irrigation, Hydrology and Meteorology, Mines and Geology, Survey and Medicinal Plants were among the first government S&T institutions to be established.

However, modern S&T was initiated only from the introduction of S&T policy in the 6th Development plan 1980-85. Following the establishment of National Council for Science and Technology (NCST), the Sixth Plan (1980-1985) gave due importance to S&T for the first time in the country's development plan. An explicit Science and Technology policy statement was formulated by the government in the Sixth Five Year Development

Plan (1980-1985) (NPC 1981). The policy guidelines in this Plan envisaged the need for strengthening and coordinating the existing Science and Technology organizations, mobilizing the country's natural resources and manpower and the development and adoption of appropriate technologies. This was followed by the establishment of The Royal Nepal Academy of Science and Technology (RONAST) in 1982 as the highest scientific autonomous institution to expedite development of S&T. With inputs from RONAST the Seventh Plan (1985-1990) carried the spirit of the sixth plan and emphasized the development of endogenous S&T capabilities through the integration of S&T activities with the basic objectives of economic development (NPC 1986). RONAST in 1989 formulated the first National Science and Technology Policy of the country after intensive brain storming, interactions, conferences and media consultations with scientific as well as the public (Rana 1988, RONAST 1989, HMGN 1989). This policy emphasized on proper resource utilization and development, Technology transfer, Quality manpower development and promotion, extension and participation in S/T development for fulfilment of the basic needs.

The Ministry of Science and Technology was established in 1996 and upgraded to the Ministry of Environment, Science and Technology in 2005. It prepared, a preliminary draft of 20-Year Perspective Plan for the development of S&T (Suwal 1996) in collaboration with RONAST. But this plan was not well integrated and implemented by the Ministry. Later, the Ministry put forth the new National Policy on Science and Technology 2005 with the objectives to enhance national capability, to contribute in reduction of poverty, to take the nation in competitive advantage by utmost development of Science and Technology, to replace the first policy of RONAST (MOST/HMGN 2005). This policy was brought through very little consultation and discussions, and did not embrace the changed political transition from monarchy to democratic set up. It did not get reflected and integrated into development process and plans as MOEST is not yet considered a very important portfolio for the politicians.

The country has transformed in 2006 to a Federal Democratic Republic of Nepal. It will have a new political, administrative structure and development set up. This will require new strategies, policies and plans. The country is yet to receive a new constitution, new development policies and a new S, T & innovation policy in this changed context. Some exercise, as what should be the new STI policy, has been initiated recently by RECAST in collaboration with STEPI/APCTT for STI strategy development in the changed context (STEPI 2013). What form of governance will be adopted and what will be the development plans and policies of the country is still awaited. These things will be the determining factors for the development of new STI policy of the country.

References:

Joshi, SM. 1987. Kalakar Arniko (Architect Arniko) in Nepali. G Vaidya, Kathmandu.

Singh, RM and Bhuju, DR. 2001. Development of Science and Technology in Nepal Science, Technology and Society 6(1): 159-178, Sage publications, New Delhi, India

Government of Nepal 1956 A concise draft of five-year plan. Kathmandu, Government of Nepal.

Suwal, PN. 1996. National Policy and Program. Report Submitted to Ministry of Science and Technology, His Majesty's Government of Nepal (in Nepali), Kathmandu, Nepal.

RONAST. 1989. Proceedings of First National Conference on Science and Technology (Apr. 24-29, 1988). Royal Nepal Academy of Science and Technology, Kathmandu, Nepal

Rana, RS. 1988. National Policy for Science and Technology. Proceedings of National Conference on Science and Technology (Apr. 24-29) 7-12. Royal Nepal Academy of Science and Technology, Kathmandu, Nepal

HMG/N. 1989. National policy on science and technology (in Nepali) Nepal Rajpatra. Ministry of Law and Justice, His Majesty’s Government of Nepal, Kathmandu, Nepal

NPC 1981. The sixth plan (1980-1985). National Planning Commission, His Majesty’s Government of Nepal, Kathmandu, Nepal

NPC 1986. The seventh plan (1985-1990). National Planning Commission, His Majesty’s Government of Nepal, Kathmandu, Nepal

MOST/HMGN 2005. Science and technology policy, Ministry of Science and Technology, HMGN, Kathmandu, Nepal

Jeong Hyop Lee, Sira Maliphol, Fine Yang, Innovation System Diagnosis and STI Strategy Development: The Case of Nepal 2013, STEPI, R of Korea

PROPORTIONALISING SCIENCE, TECHNOLOGY AND INNOVATION DEVELOPMENT: EXTENSIVE AND INTENSIVE THINKING MEETS INSTITUTIONAL MATRIX THEORY

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The paper recalls the work on intensive and extensive growth by early-Soviet engineer-economist Grigory A. Feldman in the context of national-union planning. It explores Feldman's and other uses of 'intensive and extensive' models and re-moulds them to inform the neo-institutionalist work of Svetlana G. Kirdina in the realms of social, economic and political dynamics of human development. This comparison serves as a background structural and theoretical discussion to explore science, technology and innovation (STI).

The paper draws for empirical support on completed or on-going development/modernisation work involving Cooperative Extension Services in agriculture, education, new language acquisition and systems ideology. The global reach of agricultural (USDA) and educational (Cambridge & Oxford) extension models, systems, visions and practices provides a background with which to consider the present and future of science, technology and innovation for national and regional development. The paper advocates policies and programs that aim to balance proactive intensive and extensive thinking about STI across a range of SSH disciplines.

We recognise current challenges in STI through the ideas of entrepreneur and venture capitalist Peter Thiel's reconceptualised notion of 'intensive and extensive.' Theil's 'thinking that leads to growth' features modern-day problems of technology, innovation diffusion, investment, distribution and scale. According to Thiel (Loftesness 2010), 'intensive thinking' (vertical) contributes more to innovation than 'extensive thinking' (horizontal), which makes it of greater value and demand for science and technology development. If a nation wants more innovation, it needs more focus on intensive thinking and intensive growth. How is this possible to attain?

The paper also applies extensive and intensive thinking to social, economic and political matters in Kirdina's X&Y matrices theory. For Kirdina, institutions serve as units of research that can be observed within a proportional framework of X- and Y- matrices. Human Extension is juxtaposed with Kirdina's theory to enable a discussion of proper proportionality in development and institutional dynamics at macro-structural and mass agent levels.

Intensive and extensive growth occurs regularly in human life; we act both intensively and extensively by nature and character. Our focus is placed here on how to measure proportionality using empirical indicators. Previous attempts to quantify intensity and extensity leave gaps both experimentally and theoretically. Social surveys and 'big data' techniques can, however, enable new metrics. Likewise, not only collecting contemporary data, but also analysing data that becomes digitalised from previously non-digital records becomes highly relevant. Digitisation is, however, not itself the end goal of study, but a means that enables more diverse analyses and explorations of the intensions and extensions of humanity.

The broad outline of this paper traces a path from science studies (*naukovedeniye*), sociology of science and science and technology in society (STS) to science, technology and innovation studies (STIS). The main thesis addresses economic and social aspects of STI using the notions of Human Extension (M. McLuhan, E. McLuhan, Sandstrom), extended knowledge (Pritchard, Pederson), the extended mind thesis (Chalmers and Clark) and extended cognition (Theiner). It acknowledges the important contribution of Kirdina's X&Y-matrix thesis for 'non-western' countries as an opportunity to recalibrate the discussions and actions of global, regional and local institutional dynamics using the Human Extension approach.

References:

Bergson, A. (1985). "Gorbachev Calls for Intensive Growth." *Challenge*: pp. ABC.

Brookfield, H.C. (2001). "Intensification and Alternative Approaches to Agricultural Change." *Asia Pacific Viewpoint* 42: pp. 181–192.

Cincera, Michele and Reinhilde Veugelers (2010). *Young Leading Innovators and EU's R&D Intensity Gap*. Luxembourg: Publications Office of the European Union.

Galor, O. and D. N. Weil (2000). “Population, Technology, and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond”. *American Economic Review*, September.

Keys E., McConnell W.J. (2005). “Global Change and the Intensification of Agriculture.” *Global Environmental Change,* 15: pp. 320–337.

Kirdina, Svetlana and Sandstrom, Gregory (2010). “Institutional Matrices Theory as a Framework for both Western and Non-Western People to Understand the Global Village.” MPRA.

Loftesness, Scott (2010). “Intensive vs. Extensive Growth – and more – Peter Thiel at Stanford.” Accessed 13-05-2014: http://sjl.us/main/2010/12/intensive-vs-extensive-growth-and-more.html

Ofer, Gur (1990). “Macroeconomic Issues of Soviet Reforms.” NBER Macroeconomics Annual 1990, Volume 5, MIT Press: pp. 297-342.

Pisarski, G. (1969). “The Need for Intensification.” *Zycie gospodarcze*. 14-09-1969: pp. 1, 9.

Sandstrom, Gregory (2012). “Instead of Capitalism vs. Socialism: A Proportion-Seeking Review of Two Contemporary Approaches in China and Russia.” *Montenegrin Journal of Economics,* Vol. 8, No. 4, 2012: pp. 43-60.

Sandstrom, Gregory (2011). “A Comparative Analysis of Russian and Canadian Sociologies of Science and Technology.” *Sociology of Science and Technology*, St. Petersburg, Russia, Vol. 2, No. 1, 2011.

Sandstrom, Gregory (2011). “Evolutionary and Institutional Economics: A View from the Post-Neo-Classical Perspective.” In *Theory and Practice of Institutional Reforms in Russia* / Collection of scientific works, ed. B.H. Yerznkyan. Issue 21. – Moscow, CEMI Russian Academy of Sciences, 2011: pp. 90-113.

Theiner, Georg (2011). *Res Cogitans Extensa: A Philosophical Defense of the Extended Mind Thesis.* Peter Lang.

Winfrey W, Darity W, Jr (1997) “Increasing Returns and Intensification: A Reprise on Ester Boserup’s Model of Agricultural Growth”. Metroeconomica 48: pp. 60–80.

STRONG THERAPEUTIC POTENTIAL OF INDIGENOUS HERBAL DRUGS IN THE MANAGEMENT OF DIFFERENT TYPES OF CANCER: A PROSPECTIVE AREA OF FUTURE RESEARCH

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Cancer is a deadly disease affecting millions of people in both developing and developed countries of the world (Miranda *et al.*, 1999, Tan *et al.*, 2006). The abnormal increase in number of body cells, due to uncontrolled cell division is the characteristic of cancer. With time these cells form tumours and enter blood stream to affect other organs of the body, apart from its organ of origin. At the early stages these tumours are harmless and are known as benign, whereas at later stages these transform into malignant ones, which tend to harm. Cancer, if diagnosed at the early stages is curable by several therapies which include the chemotherapy and the radiotherapy (Miranda *et al.*, 1999). These therapies kill the cancerous cells, but due to lack of specificity, normal body cells are also affected. Apart from these, there are several side effects of these medicines, which is not the case when we look upon plant bioactive compounds as medicine. The plant derived herbal medicines are more effective, with a wide therapeutic range, less deleterious side effects and synergistic action (Gupta *et al.*, 2010). Several bioactive compounds, which serve as a cure for cancer, have been reported (Mukherji *et al.*, 2001, Tan *et al.*, 2006). In fact, as far as anti-cancerous compounds are concerned, a whopping 74% of them are natural plant bioactive compounds or derived from them (Tan *et al.*, 2006). The most famous ones are the Vinca alkaloids i.e. Vincristine and Vinblastine, derived from *Catharanthus roseus* (Pezutto, 1997, Miranda *et al.*, 1999). The strategy, begins with first making plant extracts in different solvents with varying nature like Methanol, Hexane, Petroleum ether, *etc.* The extracts are made from different plant organs too. These crude extracts are then tested on the desired human cancer cell lines (Skehan *et al.*, 1990). The effective crude extract is then in turn fractioned upon columns to deliver the bioactive compound. This approach has been performed on various plants to yield various bioactive compounds (Lee *et al.*, 2005, Wu *et al.*, 2007, Wang *et al.*, 2008, Lim *et al.*, 2011, Lee *et al.*, 2012).

In this regard, research is being carried out in our laboratory wherein various indigenous plants are being tested for its anti-cancer/anti-tumour potential. Various human cancer cell lines of different organs such as brain, liver, pancreas and colon have been employed to perform the bioefficacy testing. The testing involves different assays which check cell viability and apoptosis such as MTT and DNA fragmentation. Assessment of cell viability using various fluorescence dyes such as DAPI, Acridine Orange and Ethidium Bromide is also being carried out. The crude extracts and fractions of plants like *Nardostachys jatamansi* and *Psorealea corylifolia* have shown a strong anti-cancer potential against various cancer cell lines. These herbal based drugs caused apoptosis in micro-gram quantities and inhibited the further growth of cells. The work is in progress for tracking the molecular pathway involved in cell death.

Surprisingly, the crude extract of the plant have been seen to be more effective as compared to the isolated fractions, thereby confirming that various compounds in the crude extract act synergistically to heal. Herbal based drugs have minimal side effects on the normal cells of the body which is an advantage over the harmful chemotherapeutic chemicals in use currently. Hence, exploring the Indian medicinal plant wealth for the cure and management of cancer and other diseases is a promising strategy to save many lives and establishing herbal based system.

“CHALLENGES AND OPPORTUNITIES IN INDIAN SCIENCE, TECHNOLOGY AND INNOVATION POLICY: THE MISSING ‘*MASALA*’”

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With the emergence of a new world order, the strength of a nation may not be measured by the nuclear arsenal, and the military capability; but the wealth of intellectual property that a given nation possesses. The true wealth of a country is in the innovative ideas that the rest of the world wishes to consume and utilize. Thus, oil rich countries such as Saudi Arabia are also embarking on the vision of knowledge based economy based on innovations and translational research that brings fruits of basic, technical and clinical research from the bench to the bed. Japan and South Korea, nations with relatively limited natural resources represent leading economies due to their significantly higher share of innovations in science technology. India, on the other hand has made notable strides in science and technology, yet its share of intellectual property lags behind most of the developed countries. Indian presence in the international patent listings and intellectual property is way behind the world leaders such as the USA, Germany, UK, France, Japan, Italy, South Korea, and Japan. Interestingly, China that started very late in this race has risen to the second place, edging Japan in the wealth of innovations, patents and international intellectual property.

There is no dearth of talent and motivation in India to make significant contributions to innovations in science and technology, but the poor infrastructure for intellectual property acquisition and its lukewarm promotion persist. In addition various cultural barriers in India inhibit the harnessing of a large intellectual and technical base in Indian public and private sectors. Has there been an improvement in the intellectual property landscape in India?

International and multinational corporations have been intrigued by the Indian patent environment; for example the case for the cancer drug Glivec also known as Gleevec (imatinib mesylate) from Novartis Corporation. Novartis has been denied a continuing patent (‘ever-green”) in India due to the lack of novelty in polymorphic forms of the drug in the exiting Novartis patent by the Indian Supreme Court. Nevertheless, foreign and domestic stakeholders have contributed to an increase in patent filings, especially since 2007-2008 when new Indian patent act was drafted. According to the NIPO (National Intellectual Property Organization, India), new pharmaceutical product patents have consistently increased in the last decade, such patents tripled from 765 in 2004-2005 to 2,373 in 2008-2009 after the new patent act was introduced by the government of India. There is a distinct increase in the filing of patents during recent years as such patents increased from less than 2000 to more than 18,000. Prior to the Indian Patent Act in 2007-2008, the foreign companies dominated the patent scene (79%) versus the Indian companies obtaining a much smaller fraction of total patents (21%).

What structural and policy changes are needed to ramp up Indian representation in the emerging intellectual property domain will be analyzed and discussed in the oral presentation.

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NEOLIBERAL SCIENCE AND THE CRISIS OF THE TRADITIONAL SYSTEM OF TRAINING THE SCIENTIFIC FELLOWS

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Report is devoted to a discussion of the patterns and the difficulties of transforming the system of training fellows for science in the context of neoliberal capitalism. It is obvious that modern science has become more pragmatic, practically oriented. Today scientist is obliged not only to be a qualified researcher. He should know what the market research products, how to work in this market, how to find the money for research and how to sell the results.

Young scientists are in a very difficult situation now: while the older generations urge them to follow the principles of the traditional value of science, speaking advocates a conservative approach, the situation itself in society and science is forcing them to change the stereotypes of professional conduct, seeking funds for research, looking for customers of their projects. An essential part of post-graduate students are willing to engage in knowledge-intensive business. This raises the problem of relations between the younger and older generations of scientists. The result is the generation gap. Measures are needed to optimize this interaction. It is important that in this conflict the government takes the side of young, actively fighting the conservative model of professional behavior scientist. There is a conflict between the existing system of training for science and the demands of society for its graduates. If the traditional system of training the core is to provide a purely research or teaching competencies, from the point of view of the neo-liberal view of the role of academic research community needs to competently interact with potential customers: the state, economic actors and so on. Essentially, we can talk about the crisis of the traditional system of training for science and universities. In the paper will be propose actions designed to smooth the sharpness described crisis.

BASIC PRINCIPLES OF INNOVATION PROCESSES DECOMPOSITION INTO ELEMENTARY PROCESSES: THEORY AND EXAMPLES

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This study focuses on the identification and analysis of types of innovative behavior, associated with the implementation of innovation processes in a company. For this purpose the innovation process is represented as a combination of some elementary processes (S. Roper and al, 2008; J.C. Guan and K.H. Chen, 2010). The following processes are considered as elementary in this paper: creation, imitation, modification and distribution of innovations.

Creation of an innovation by a company is an activity, aimed at economic application of a new idea with the use of the company's internal resources. The process of imitation if innovations is the activity that involves copying and manufacturing of innovative products, services or methods of production, known on local or foreign markets. Two types of imitation are considered: legal and illegal. Imitation may also vary according to the source of borrowing: an imitated product may either be already known on a local market or known only on foreign markets, and in this case such imitated product will be new for the market of the company, which makes this imitation. The modification process consists of the actions, aimed at improvement of an innovative product, service, or method of production. Modifications can be implemented based on the company’s own developments (closed modification) or using the results of work of external organizations (open modification). As well as imitation, the open modification can be both legal and illegal. And finally, as an elementary process of innovation we consider the process of distribution or diffusion of a resulting innovation. At a given moment in time any of the aforementioned elementary processes or their combination can be implemented.

The analysis includes four basic phases. The first phase includes the identification of the type of an innovative product according to the classification of its quality specifications (M. L. Tushman and al, 1997): technological and market novelty. The second phase identifies the elementary processes of the innovation activity, which led to the creation and manufacture of an innovative product of the corresponding type. The third phase identifies whether the process of distribution of innovations was realized. The third phase is the unification of all results obtained and creation of a general scheme of the innovation process.

REACHING THE UNREACHED ASSISTANCE TO SMALL NATIONS ON CAPACITY BUILDING IN STI POLICY

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The power of Science Diplomacy of the 197 independent countries in the global society today 106 are small with a population of one million or under. 45 of the 197 are Island States with limitations in terms of size, geographical isolation, narrow economic and knowledge base, making it difficult for them to participate in International conclaves such as this assembly. On the other hand, they matter much to global science on issues such as climate change, sea level rise and ecological event. It is high time mainstream sciences recognises their needs and find ways to address them.

The speaker, who has science diplomacy experience, will elaborate citing a successful practical example, and argue why we should matter more to the disadvantaged nations in a meaningful way.

PLANT BASED INSECTICIDES FOR INSECT PEST MANAGEMENT

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Host Plant resistance for pests may be expressed as morphological and anatomical characteristics of the host plant or its secondary metabolites playing a vital role. Insect attacks contribute hugely to the loss of food, fiber, and beverage (Tea Coffee, and Cocoa) outputs of standing crops and stored harvest. Synthetic organic chemical compounds (Insecticides, Fungicides Bactericides and Herbicides) are used for crop protection for increasing the yields. Several novel organic synthetic compounds are in use as insecticides and some of them are phased out for causing health hazards to field workers, harmful changes in the environment, undesirable tilting of ecological balance, creeping of pesticide residues into the food chain and development of resistance.

Neem (Azadirachta indica A.Juss) seeds, kernels and oil or products derived from them are in use for crop protection against insect pests from a long time. Sustained research in several countries have demonstrated that formulations of solvent extractives of neem seed, kernel and oil containing the biologically active organic compound Azadirachtin A and its analogues are very potent insect antifeedants and insect growth regulators covering a wide range of commercially important insect pests of commercially important crops. Many of the insect pests feed on multiple crops. Azadirachtin A is a complex molecule and its synthesis is not economical. SAR studies did not lead to active compounds with activity comparable to Azadirachtin A.

India has a large pool of neem seeds harvested annually. The kernels of neem seeds contain Azadirachtin A in a concentration range of 0.3 to o.6%. Investigations carried out by the author and his associates at the Regional Research Laboratory and subsequently changed to Indian Institute of Chemical Technology, Hyderabad, India, led to the development of insect pest control emulsifiable concentrate formulations enriched in Azadirachtin A for use in Insect Pest Management (IPM). Patents were granted in India, USA and some other countries.

Annonaceous acetogenins are a group of compounds possessing insecticidal and anticancer properties. Research work carried out at Regional Research Laboratory, Hyderabad changed to Indian Institute of Chemical Technology by the author and his associates resulted in the development of emulsifiable concentrate formulations of solvent extractives of seeds of Custardapple (Annona squamosa) enriched in the major insecticidal constituent Isosquamocin possessing very potent insecticidal activity against several insect pests of important crops. Which can be recommended for use in IPM Patent was granted in USA.

New Trends in the discovery novel safe eco-friendly and safe insecticides from higher plants are presented.

THE EC STIMULUS TO IMPROVE SUB-NATIONAL REGIONAL RESEARCH AND INNOVATION STRATEGIES

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The paper proposes some comments on an action of the European Commission addressing the Research and innovation policy of Regions and of member States: Research and Innovation Strategies for Smart Specialization (RIS3).

On the basis of the OECD's definition, 'Smart specialization is a policy framework combining industrial, educational and innovation policies (including their design, implementation, and evaluation) that promote new growth opportunities. The smart specialization approach suggests that countries or regions should identify and select a limited number of priority areas for knowledge-based investments, focusing on a region's strengths and comparative advantages on the basis of:

- More effective spending of public resources, concentrating on certain domains of knowledge or expertise.
- The creation of synergies between public support mechanisms for R&D and innovation, industrial promotion and training institutions.
- The elimination of fragmentation and duplication of policy interventions that may result in a waste of public resources.
- The identification of the strongest or promising domains for entrepreneurship and growth through a careful analysis of the existing capabilities, assets, competences, competitive advantages in a city, region or country.
- Mechanisms to enable strategic development based on multi-faceted and multi-governance interactions.
- Mapping and benchmarking of cluster including analyses of the role and influence of key players.
- Evidence-based monitoring and evaluation systems to select the knowledge domains and innovation projects.'

RIS3 is an integrated, place-based economic transformation agenda characterized by five things:

- To focus policy support and investments on key national/regional priorities, challenges and needs for knowledge-based development, including ICT-related measures;
- To build on each country's/region’s strengths, competitive advantages and potential for excellence;
- To support technological as well as practice-based innovation and aim to stimulate private sector investment;
- To get stakeholders fully involved and encourage innovation and experimentation;
- To be evidence-based and include sound monitoring and evaluation systems.

The stimulus to improve a sub-national regional research and innovation strategies is addressed to (European) Structural Funds Managing Authorities, policy-makers and regional development professionals.

The proposed process is based on the concept of smart specialization and provides orientations on how to develop research and innovation strategies for smart specialization (RIS3).

Guidance is structured around a 6 practical steps:1) analyzing the innovation potential, 2) setting out the RIS3 process and governance, 3) developing a shared vision, 4) identifying the priorities, 5) defining an action plan with a coherent policy mix, 6) monitoring and evaluating.

The main tools put in place are scenarios, foresight, participation, sharing and access to research results, universities and patents, attracting and stimulating private investment in research, orientating public procurement for stimulating innovation, relying on various governance models.

Out of the novelties are: building on the past; widespread experience of national/regional innovation strategies in the framework of the EU cohesion policy; achieved greater co-operation among private and public stakeholders and better communication between technology providers and clients.

A special focus is devoted to the 21 Italian Regional/Autonomous Province governments.

The research emerging areas in the Italian context were selected on the basis of existing scientific knowledge, industrial experience and plants, ability to respond to social challenges and to trigger economic growth. They are: aerospace, agrifood, cultural goods, green chemistry, sea-water economy, energy, intelligent factory, non R&S innovation, sustainable mobility, life science, smart communities, ambient assisted living technologies. Within each of them, priorities are identified as sub-areas for a better response to the socio-economic areas of each Region.

Support with technology experts, assistance in feeding cooperation activity between Regions, and in identifying areas of action for the State and the EC, e.g. standard definition, need for general shared infrastructures, capacity building, education programs, are the main attempts to support the EC initiative at the Italian regions level by the Department for Economic Development and Cooperation of the Ministry of Economic Development.

A first attempt to read the RIS3 action in terms of its philosophy and goals and in terms of its acceptance and uptake by the Regions is proposed to discussion.

IMPACTS VIA INNOVATIONS – A NOVEL DIMENSION IN THE ASSESSMENT OF IMPACTS OF RESEARCH, TECHNOLOGY AND INNOVATION POLICIES

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The assessment of socio-economic and ecological impacts have become a permanent part of performance evaluation of research, technology and innovation (RTI) policies. Impact assessment (IA) aims at supporting public RTI decision-makers by detailed knowledge of additional impacts of public activities to private RTI and to improve public RTI policies. Among the key criteria in IA based performance evaluation are efficiency, effectiveness and impacts of policies.In the short term RTI activities yield scientific and technical publications and patents, in the middle term product and processes innovations and in the long term business benefits and socio-economic impacts. Impact data in IAs is produced by various quantitative and qualitative analysis and methods and by using various output and impact indicator data.Often IAs are based on company-level data collected for example by surveys from R&D staff (`subjects´).For example Community Innovation Survey (CIS) of the European Union is based on questionnaires to R&D staff of enterprises of EU Member States. In spite of ample rhetoric around innovation, data of individual innovations (´objects´) is missing from IAs albeit innovation as such is among key performance indicators of RTI investments. The reason to this is a lack of corresponding innovation data. This is a point of departure of this paper: extensive database of industrial innovations as collected and analyzed systematically over the years, gives a novel dimension not only to in-depth understanding of industrial innovation dynamics but also a novel dimension to IA of RTI policies. The first effort to collect and analyze innovation database was SAPPHO in the 1970s in Sussex University and since then various innovation surveys and data compilations have been carried out in different countries. Systematically and continuously gathered, maintained and up-dated innovation databases, such as VTT´s SFINNO database, are however rare. SFINNO database contains roughly 5,000 significant innovations commercialized since 1945. The article gives, first, an overview on empirical and underlying theoretical aspects of the rationale of innovation policy and on the role of IA in empirical performance assessment of RTI policies. Second, the article gives examples on how innovation data from SFINNO database have been used as a complementary data in empirical IA studies on a level of National RTI Funding Agency and on a level of public Research and Technology Organisation. Third, the article describes on-going activities of the European Union in developing "impact via innovations" methodology in order to support ex-post evaluation of The 7th Framework Programme and ex-ante evaluation of Horizon 2020. Fourth, the study draws conclusions and gives future perspectives and suggestions for the further research of the role of innovation databases in assessing the performance and impacts of RTI policies.

Sources

Loikkanen, T., Rilla, N., Deschryvere, M., Lehenkari, J., Oksanen, J., Hyvönen, J., van der Have, R., and Arnold, E. (2013) Roles, effectiveness, and impact of VTT. Towards broad-based impact monitoring of a research and technology organisation. VTT Technology: 113. VTT, Espoo.http://www.vtt.fi/inf/pdf/technology/2013/T113.pdf

Hyytinen, K., S. Kivisaari, O. Lehtoranta, M-L. Toivonen, T. Loikkanen, T. Lyytinen, J. Oksanen, N. Rilla, and R. van der Have (2012) Funder. Activator, networker, investor… Exploring Roles of Tekes in Fuelling Finnish Innovation, Tekes Review 289/2012.http://www.tekes.fi/Julkaisut/Funder_activator_networker_investor.pdf

ZERO WASTE, POLLUTION PREVENTION, AND ENVIRONMENTAL SUSTAINABILITY: POLICY CONSIDERATIONS IN CLIMATE CHANGE ADAPTATION

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The Earth has entered a unique period in its billions-year old existence that is characterized by unprecedented ecological impacts which, to a large extent, are the result of human activities. Slow but continuous entrapment of carbon dioxide and related greenhouse gases in the atmosphere for centuries, but notably since the beginning of the Industrial Revolution, has caused global warming that, in turn, has triggered climate change. The resulting disruption of earth's natural cycles has resulted in an increase in both the frequency and severity of meteorological hazards, such a blizzards, draughts, floods, heat waves, tropical storms, and sea level rise (Brooks and Adger, 2013). The underlying cause of present climate change is the emission of huge quantities of greenhouse gases derived from widespread use of fossil fuels that are needed to power our industries.

For centuries, polluting waste, resulting from the industrial and manufacturing processes, was let out in the air, land, or water at the convenience of the generator without any concern for the potential adverse impact on the environment. This uncontrolled disposal of wastes was a legally- and socially-accepted practice that continued for a long time until the decade of the 1970 when the negative impacts of polluting waste began to manifest itself in noticeable loss of air, land, and water quality. Earth Day, first observed in the United States in April 1970 (Rome, 2013), quickly evolved into a global event that effectively drew everyone’s attention to the deterioration of earth's environment and brought to fore the awareness about the fragility of the ecosystem and the need for its protection. The ensuing environmental laws that were enacted in many countries (Hasan, 1996) represent nations' resolve to take measures for environmental preservation. The presentation discusses human influence on earth's environment and puts forth the argument that mismanagement of waste generated in our society and the lack of any control on the pollution it created, has been the primary cause of the serious environmental problems that we are confronted with now.

Starting with mild skepticism, followed by doubts, and often outright rejection, the reality of adverse impacts associated with climate change has finally been accepted by the global community. It is heartening to note that the focus of the debate has shifted from whether or not climate is changing to what measures can and should be taken to adapt to the changes (IPCC, 2013). Among the multiple-pronged approach for mitigation, the fundamental issue of proper waste management and controlling pollution from all sources must be included in any development policy in order to attain not only environmental but economic and social sustainability as well. The presentation discusses policy issues associated with waste management and pollution control and how adopting a zero-waste policy at all levels of activities—individual, industrial, and government—can assure a resilient and sustainable society that would endure the negative impacts of climate change.

Key words: climate change, zero waste, pollution, waste management, sustainability.

References

Brooks, N. and Adger, W.N., 2013. *Country level risk measures of climate-related natural disasters and implications for adaptation to climate change*. Tyndall Centre for Climate Change Research, U.K., Working Paper No. 26. 30 p. Available at: http://190.11.224.74:8080/jspui/bitstream/123456789/2029/1/Ranking%20of%20Country%20Risks.pdf Accessed September 3, 2014.

Hasan, S. E., 1996, *Geology and Hazardous Waste Management*, Prentice Hall, Upper Saddle River, New Jersey, USA; p. 40-66.

IPCC. 2013*Climate Change 2013: The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 p.

Rome, A., *The Genius of Earth Day: How a 1970 Teach-In Unexpectedly Made the First Green Generation*, Hill and Wang, New York, NY, USA; 346 p.

ENGAGING GLOBAL WARMING
ENERGY INNOVATION & CLIMATE CHANGE

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The expanding research on the issue of global warming has established that (i) there is a remarkable increase in Green House Gases since the middle of the 19th century; (ii) that most of the increase in the GHGs is man-made, caused by excessive use of fossil fuels, deforestation and changing land-use patterns; and that (iii) increase in GHGs is matched by a progressive increase in global temperature since the middle of the 19th century.

The progressive rise in global temperature pauses a serious threat to the very existence of humanity and its productive systems. We have two options to break away from the cobweb: (A) Either retreat from the energy-intensive growth model or (B) workout harmless (green) energy sources.

While the developed countries are in no mood to surrender their comforts, increasing energy demand, especially from the developing economies, is a big challenge before world leaders. In the most conservative estimates with business as usual (BAU), world electricity demand will rise by 85 percent by 2020, and total energy demand by 57 percent. While industrial and infrastructural needs of expanding economies are at the core of these projections, a major share will be consumed by a vast expense of people living in complete darkness.

Cutting back on fossil fuels means a return to the pre-industrial rural life pattern no country could afford to dream about. Any nation which cuts back on its emissions within the available energy options is doomed to forfeit its right to growth. Even the most vocal of the climatologists agree that cutting on emissions is not a solution. Putting your money in R&D is.

Taking stock of available energy options and growing energy demands of emerging economies, India especially, this paper/presentation will address the issue of energy innovation as a viable option to achieve the envisaged material growth.

STI PRIORITIZATION IN NEPAL: PROCESS AND FINDINGS

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With the beginning of 21st century, Nepal observed historic transformation in its social and political set-up, which has also ushered escalated aspiration for economic prosperity and national progress among the people. The role of Science, Technology and Innovation, thus, has tremendously increased to meet this aspiration of rapid social and economic transformation. Nepal now possesses a sizeable number of science and technology manpower, basically due to the open and flexible policy adopted by successive Governments since 1990. However, there is increased 'brain drain'. Similarly, with an investment on R&D of less than 0.4 per cent of GDP, it is still too low for it to make a visible impact towards national economic development. It is essential that Nepal now develop a visionary national policy of consensus and strategy to implement it, with commitment at the highest level of governance, so that STI can be used as a vehicle for the all round development.

In 2009, Nepal Academy of Science and Technology with the support of UNESCO undertook a project to support priority determination consultation, and organize a seminar-workshop on R&D project formulation and evaluation. The project carried out consultations with researchers, academicians, opinion leaders of STI to determine major areas for R&D projects. Emphasis was given more on applied part of scientific research and technological development covering important areas such as agriculture, environment, information, alternate energy, and technology. After an elaborate deliberation five areas for brain storming: i) Biotechnology Application and Bio-safety, ii) Biodiversity Assessment and Utilization, iii) Information and Communication Technology, iv) Science Education and Popularization, and v) Energy and Climate Study.

In its exercise, firstly series of brainstorming sessions in each of the identified areas were organized. The brainstorming aimed to chart key issues in the sector and identify possible field opportunities as well as potential research and development projects that can generate visible impact in the society within next five years. This involved participation of subject experts and young research scientists who contributed to list out the priorities within the area. Some 200 research scientists, academicians and managers actively participated in the sessions. The outcome of consultations through interaction suggested that there were: i) policy gaps in the selected prioritized areas, ii) weak institutional mechanism: no clearing house or data processing unit with respect to researches and research outputs, and iii) few research and development projects funded and almost negligible research that support industries and commercialization of technological products especially in the area of biodiversity and biotechnology.

In follow-up, an intensive exercise of seminar-workshop was organized, which was learning cum doing exercise on proposal writing and aimed to the younger group of scientists keen to take up research as their professional career but desperately seeking fund support. During the seminar, beside invited lectures on the basics of proposal writing, presentations were also made on the perspectives of donors and partner organizations. The group coordinators, then, led group exercise which produced 44 themes for research proposals.

BRIDGING THE INNOVATION GAP

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Worldwide, scientific research and innovation have been recognized as key drivers of economic growth. India has long tradition of scientific research and over the years has been able to build a strong knowledge base across a wide range of sectors. With the continuing improvement in infrastructure of existing institutions and establishment of new research institutions, the scientific research output has been seeing a continuous improvement both in quality and quantity. The extent to which the knowledge generated in these institutions has reached the Indian society and industry and contributed to economic growth however remains a matter of concern. The traditional belief that inventions, which refer to some new idea or product, can be transformed to an innovation, which refers to the successful implementation of the idea or product for the economic or social benefit of the country, can occur seamlessly through a series of well defined steps is being increasingly discredited. It is becoming clear that the process of innovation is a fluid and complex one, involving a large number of players including the government, research institutions, SMEs, industry, entrepreneurs, venture capitalists and financiers. Creating an innovation ecosystem that balances the interest of each of these players is essential if the country is to draw the benefit of the knowledge being developed in our research institutions. In the absence of such an innovation ecosystem, there can be valley between the research institutions on the one hand and society on the other hand sometimes referred to the valley of death which many of the concepts and ideas fail to cross. This talk will discuss some of the issues which lead to the formation of such gaps and what could be done to bridge them.

INNOVATION AND POWER

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Innovation is defined as bringing about change in an existing order. This is a pure Schumpeterian version. To recall, any order is designed around a power or in other words, the power holds the incumbent structure. An innovation overturns this power and brings in a new power. Thus for a backward country or for a laggard business while an innovation might hold the hope of catapulting one into the seat of power, there remains albeit an even larger danger of falling down. The business and industrial history of recent decades evidenced that larger number of countries and businesses across the globe but especially from backward countries indeed suffered miserably from innovations.

This recent history has exhibited that new industrial and business power has gone more into the hands of advanced countries through innovations that were always backed up by several institutional support mechanisms especially of finance, regulatory structures including norms laid down through private certifications or best-practices or codes, and of business and competition laws and in cases also through trade laws. Finance backed up by new laws and regulations, such as on minority shareholders or of active shareholders or of disclosure regulations and financialisation of nearly all business process even deep within manufacturing plants have together wrested control of nearly all the actions of any business.

It is imperative for most countries and business to recognize this simple but important message that innovation is a strategic maneuver in games of power. Hence a country and all its business and finance and legal institutions need to come up together, and sometimes even undertake cross-country negotiations on strategies that help them unseat existing large business powers in very rich countries. Such strategies alone can ensure innovations benefitting most.

BUILDING NATIONAL CAPABILITY THROUGH S&T AND INNOVATION POLICIES- OPPORTUNITIES AND CHALLENGES IN DEVELOPING COUNTRIES (CASE STUDIES)

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The stunning advances in various fields of science and technology have had a profound impact on our lives in almost every sphere of activity, such as health, agriculture, communication, transportation, and defense. The world is today sharply divided by a technology boundary that separates the technologically advanced countries from the technologically backward ones. In this context, countries like India, China, Russia are struggling to achieve sustainable economic growth, self-reliance in technology development and gaining an important global position. In this context, in order to set and thereafter achieve the target, S&T policy of a country plays a significant role. More importantly studying the evolution of the S&T policy and other related policies also helps to build an understanding of how the S&T structure of a country is built. It also reflects several other aspects, such as infrastructural development, sectoral development etc. resulting into capability and capacity building through S&T and Innovation Policies in newly industrialized countries particularly.

In the present paper, we therefore attempt to understand the evolution of S&T policy in select countries like Russia, China, Korea and Nigeria vis-a vis India and trace the developments that had taken place as a consequent of adopting such policies. The aim of the paper is to highlight the role of polices in shaping the S&T system of the respective countries. Over the years, in general, what has been observed is that the science and technology policies pursued in India, China and Russia particularly since 1990s, have been very successful in reorganization and in reforming the science and technology infrastructure capabilities which is being utilized effectively for applications in different sectors of the economy in the changed scenario of globalization and competition, where there has been a distinct shift in S&T policies supporting the market culture to play a dominant role. This cultural change has moved from the dominant politico-bureaucratic and academic orientation (during 1970s and 1980s) towards dominant market orientation of science where market forces and Non-Government Organizations (NGOs) (factors external to science) have become dominant in policy decisions at the national level (Krishna, 2001)…. and so is reflective in India's new Science, Technology and Innovation policy (2013) aiming for a *strong and visible Science, Research and Innovation System for High Technology led path for India*. Being announced 2010-20 as the "Decade of Innovations" further aims to bring fresh perspectives to bear on innovation in the changing context of the cultural change mentioned above. In Korea, since 1962 the process of Science and Technology policies being formulated on a national scale started and thereafter various legislations were drafted in a systematic manner to support the development and the establishment of S&T system. In case of Nigeria, the first National Science and Technology Policy was announced in 1986. The policy aimed at ensuring a better quality of life for the people using S&T knowledge. In 1997, the policy was reviewed in order to place more emphasis on coordination and management of S&T system, sectoral developments, collaboration and funding. The policy went through another review in year 2003 to take care of some of identified lapses in the implementation of the 1997 policy. Recently, in 2012, a revised STI Policy was launched by the Federal Ministry of Science and Technology (FMST) to take care of the changing global policy of S&T and the emerging realities of knowledge-driven economy. Nigeria as a nation has progressed in policy making and formulation but has not effectively made use of its S&T policy in promoting national development. The structure of STI system in Nigeria has been identified to be weak and unable to link up with the productive sector, thereby limiting its impact on economic development (Ajoku and Onwualu, 2012).

The present paper will be showcasing the changes reflective through need-based approach to boost economic development under the various S&T policy pronouncements in

select countries and assess the impact on sectoral development. The modest S&T advancements/development observed in case of Nigeria may be looked into setting up some examples on cooperation among developing countries on science, technology and innovation policy.

Keywords: Policy, S&T, Innovation, developing countries

References

Ajoku, K.B. and Onwualu, A.P. (2012), Unlocking Nigeria's potentials through Science, Technology and Innovation, Published by Raw Materials Research and Development Council (RMRDC), Nigeria.

FRN (Federal Republic of Nigeria) (2011), Science, Technology and Innovation (STI)

Krishna, 2001, Changing Policy in Science and Technology in India, Science and Technology Policy, Vol II.

Report on “The Internalization of Science and Technology in the earlier stage of Economic Development in South Korea” prepared by Science and Technology Policy Institute.

LINKAGES BETWEEN TRANSNATIONAL CORPORATE R&D UNITS AND INDIAN FIRMS AND INSTITUTIONS

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In the new form of Globalization of R&D, Multinational (MNEs) firms have established their R&D units in emerging Asian countries, particularly in India and China. There are more than 620 R&D units established in India by foreign MNEs in 2012. Firms very occasionally work in isolation to build their assets, but they work in association with the other actors of the host economy. This study investigates the linkage patterns of foreign firms in India from an in-house developed database. The ICT sector has taken to investigate the linkages of foreign firms with the Indian entities. The linkage maps are drawn using social networking software UCINET. The study observed that most of the foreign firms are collaborating with the other foreign firms in India. Firms are strongly attached with their parent unit or other subsidiaries located in the other global locations. Indian firms are more preferable entity then the university or government research institutes. Foreign firms' linkage and integration with the local innovation system is only by linking with the local firms. Also, most of the collaboration happens in peripheral (joint development) rather than core domain (joint R&D). Industry-academia linkages are weak in India. Also, India has very strong government research laboratories. These are not playing important role in collaborating with the foreign entities. From the policy perspective, Industry - academia linkages needs to be strengthened.

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ICMR INITIATIVES TOWARDS TRANSLATIONAL RESEARCH IN PPP MODE

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The Indian Council of Medical Research (ICMR) under the Department of Health Research, Ministry of Health & Family Welfare, New Delhi, Government of India the apex body in India has completed hundred years of journey with the prime objective for the formulation, coordination and promotion of biomedical research. Established in 1949, the Indian Council of Medical Research has a broad mandate of investigating causes, spread, prevention and treatment of various diseases, particularly those of communicable nature. To achieve these goals it could promote and assist other institutions, collaborate with them as well as coordinate medical research in specific broad directions. Apart from conducting and supporting basic research in trying to understand the mechanisms through which diseases appear and spread, it puts in enormous amount of scientific effort in resolving problems of direct and immediate relevance to the Indian population. In the era of globalization being a research based federal organization, the expectations from ICMR is more than to collect the data of epidemiological surveillance or to conduct clinical trials.

The county expects more in terms of innovative capabilities to deliver affordable and innovative and quality deliverables. The ICMR has proven its innovative capabilities and contributed proactively to combat the reduction of dual disease burden, strengthening of our innovative capabilities. To achieve this objective, public-private partnerships (PPPs) are an appropriate management strategy to build up and optimize national and international R&D efforts with indigenous pharmaceutical companies. These partnerships will also strengthen the growth of indigenous companies which ultimately give the positive impact on access of low cost and quality products. Innovative health technologies can be harnessed for the benefit to billion of people if these are successfully collaborated with the industry.

The Scientists at ICMR Institutes and Scientists funded by ICMR alone or in collaboration have been involved in various innovations related activities and have been successful in developing new drugs/devices and technologies. These products/devices/ technologies after validation and testing were promoted for commercialization for the benefit of the society. ICMR in collaboration with DHR has been successful in launching of 8 new technologies in the area of vector borne diseases, diabetes, nutrition, Genetic disorders, cancer, *etc.* during 2013-14. Many other technologies are ready for launch. During 2009 & 2010 Translational research cells were established at 27 ICMR's Institutes/Centres with a co-ordinating cell at ICMR Hqrs. Of the leads received from various ICMR's Institutes/Centres, about hundred flagship technologies/programmes were identified. Out of these 75 leads/programmes in addition to three special initiative programmes (diagnostics for diabetes mellitus, facilitating the production of H1N1 reagents and Indigenous H1N1 vaccines) of Ministry of Health & Family Welfare have been taken forward.

Technologies selected for development include new tools for vector control, diagnostic methods for various infectious diseases including dengue and chikungunya, lung fluke, tuberculosis; new treatment methods to improve the treatment of tuberculosis, leprosy, cancer, malaria, diabetes mellitus, and prevention of occupational hazards, nutrition and vaccines.

R&D EXPENDITURE IN INDIAN STEEL INDUSTRY: A MODEL

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The Indian Steel industry has gone through several transformations. The industry is adding capacity to become the second largest steel producer in the world within 2020. The easy availability of raw materials, labor and access to market aids the industry in this massive expansion but industrial R&D in these large steel producers is not given the due importance that is due. Many large producers invest nothing on R&D and over the years show zero expenditure on R&D. Those that have R&D setup rely mostly on foreign technology. The government of India in its policy in 2005 and in the draft policy 2012 has aimed a lofty goals to kick start R&D in this industry in a big way. However, these goals will remain on paper unless the industry is convinced about the value of domestic R&D in enhancing the competitiveness of the industry. In this paper a Random Effects model is developed on a panel dataset of eight select large steel producers in India who have substantial investment in R&D. The data is taken from annual financial reports of the select companies from 2003 to 2013.

Key words: steel industry, India, research and development, policy

PRESIDENTIAL LEADERSHIP ON STI POLICY

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Until the early 1990s, science, technology, and innovation (STI) policies had been a matter of less importance than the economic and industrial policies. However, the status and scope of STI policies began to increase in the late 1990s. As innovation played a major role in inducing socio-economic development, displacing investment ability, the impact of STI policies grew from just specific sectors to all major matters across the country. After experiencing the enormous impacts of science and technology on national progress, Korea started to pursue scientific and technological development in earnest by enacting related laws. After 2000, the government established the Framework Act on Science and Technology in order to reinforce the legal ground for its advocacy of science and technology, and has devised and implemented a Basic Plan for Science and Technology every five years.

The significance of STI policies are reflected in government slogans, such as the term ‘knowledge-based economy’ during the Kim Dae-jung administration (1998-2003), and the term ‘innovation-driven economy’ during the Rho Moo-hyun administration (2003-2008). These STI policies began to be taken into consideration in order to shift the policy paradigm from an imitative catch-up mode for technological innovation to one based on pioneering innovation and creativity.

Entering the Lee Myung-bak administration (2008-2013), the pioneering innovation continued to be emphasized. The National Science and Technology Commission (NSTC) determined the Basic Plan for Science and Technology (known as the 577 Initiative) in 2008. This plan outlined the country’s goals to increase domestic R&D investment to 5% of the GDP by 2012, accelerate the development of 7 key R&D areas, enhance the quality and efficiency of 7 system areas, and thereby make Korea one of the top 7 global powers in science and technology by 2012. The plan also presented more detailed policy objectives and strategies for various segments, such as boosting the quantity and effectiveness of R&D investment, attracting and nurturing world-class talent, rebuilding the morale of scientists and engineers, and spreading the use of science and technology in daily life.

The STI policy directions of the Park Geun-hye administration (2013-present) are, ⅰ) increasing of national R&D expenditure up to 5% of GDP by 2017, ⅱ) reforming of the national R&D system creatively, ⅲ) promoting creative industries through a new fusion technology combined between brain-ware and national welfare technology, ⅳ) launching the Ministry of Science, ICT & Future Planning (MSIP). Also, the creative asset that combines creative idea, imagination and ICT plays a pivotal role in stimulating startups. New growth strategies can be mapped out to create many high-quality jobs through the convergence with existing industries, which in turn leads to the emergence of new markets and industries. The role of STI to promote Creative Economy are:

ⅰ) achieving the $30,000 per capita GDP within 2017

ⅱ) improving the quality of life of people

ⅲ) shifting the paradigm to the 'First Mover' strategy.

In order to realize the creative economy, Korean government expanded the scope of the Third Basic Plan for Science and Technology from the Second Basic Plan such as job creation, development of new industries and etc. The vision of Third Basic Plan is 'A New Era of Hope Fueled by Creative Science & Technology'. The objective are raising the R&D contribution to economic growth to 40%, creating 640,000 new jobs, and joining the Top 7 most innovative nations in science and technology.

We discussed several presidential leadership and STI policies in Korea and concluded these experiences in Korea show various policy implications that will render especially for developing countries.

Reference:

Sung-Goo Han (2014), "The Effects of Institutional Accountability on the Outcomes of Technology Innovation in Korea", European Conference on Economics, Politics, and Law (ECPEL) 2014, Brighton (UK)

Sung-Goo Han (2013), "Inter-ministerial Competition and Cooperation in Korea: Focusing on Emerging Technology Policy", 2013 AGPA Annual Conference, Singapore

Ministry of Education, Science and Technology (2013), "Education, Science and Technology in Korea 2012"

Ministry of Science, ICT and Future Planning (2013), “The Third Science and Technology Basic Plan: Opening a new era of hope fuelled by the strength of science and technology.

PANDORA OR CORNUCOPIA? STRENGTHENING THE INTERFACE BETWEEN SCIENCE AND POLICY

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This paper argues that a policy document, whether it is for Science, Technology, Science and Technology or Science, Technology and Innovation (a steady progression since the 1956 till 2013), is but a mere step in the right direction. To enhance excellence and relevance of India’s scientific endeavour, to build the capacity of science to deliver development goods and to shape the nature and content of development increasingly demands a dynamic facility within, to conduct research in and facilitate constructive dialogues on the relationships between science and development policy. Contrary to being relegated to “science policy” as one among several policies, this facility is meant to ensure the engagement of science with every policy relevant to every aspect of our economy, society and ecosystem. What are needed are social scientists who understand development imperatives as well as the policy and institutional frameworks that govern organizations, especially research organizations, who can initiate *research on the science-policy interface*.

The purpose of a research team within the S&T organizations, to work on the science-policy interface is (i) to ensure that the voice of scientific knowledge gets an authentic democratic space to shape policy making and implementation in all walks of life, and (ii) to enable socially and ecologically responsible research in the physical and natural sciences, responsive to the demands for knowledge from our complex and evolving economic sectors. In a century poised to be formed by the biological and social sciences, an institute that hosts the best scientific expertise in the country needs social science expertise to play the role of an interlocutor between science and society.

Increasingly, conventional policy makers within government figure as one among other important policy makers. Strategic plans and investments by industry and venture capitalists, drawing upon and in some cases directing or funding experimental research into certain issues, brings some domestic and international private policies and practices into the arena of research decision-making and public policy making in specific sectors. In this era of transnational treaties, corporate ownership, regulations and collaborations (in response to crises like climate variability and change, avian flu or a tsunami), several individual, organizational and national technology questions have to be addressed within research management and policy circles. Polarising these debates are the articulate and strong voices in the civic space; with each political or value-based position presenting their own scientific evidence as absolute truths. In a country like ours, we also have millions whose demands for knowledge for a marginal improvement in the quality of life are not articulated by only a few of the above. While scientists themselves are not a homogenous value neutral community of subject matter specialists, these multiple stakes and positions that influence research decision-making demand that they should at the very least have the opportunity to air their concerns, interests, lines of enquiry or any scientific issue with economic, political and ethical implications. A research team that can face some of these questions, or find the resources and expertise to provide valid answers, is a crucial requirement.

The paper analyses a few attempts to build such research teams/ facilities, presents its findings and poses questions about the willingness to establish anticipatory, inclusive and introspective capacities within the S&T and Innovation establishments. These capacities are far more important for the advancement of excellence and social relevance of science in a democracy than mere technology forecasting.

CONTRASTING POLICIES AND TECHNOLOGY CAPABILITIES OF 34 SCIENTIFICALLY LAGGING OIC STATES, LESSONS FROM SOUTH KOREA

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The 34 member states of the Organization of Islamic Conference (OIC) classified as scientifically lagging countries (OIC SLCs) include 22 least developing countries. These 22 countries are home to some of the poorest people in the world with the lowest per capita income. The resource-based economies of OIC SLCs are faced with several challenges of transition to knowledge-and innovation-based economies. The key challenges, however, are attributed to their low human capital and weak technological capabilities. This article reviews the existing human capital, technology and innovation capacity of OIC SLCs to identify policy, institutional and knowledge gaps. Comparisons are made with the development strategies of East Asian Countries, in particular South Korea, which helped their economies to successfully transition from resource-based to knowledge-based and innovation driven in a relatively short period. Lessons are drawn from the contrasting innovation policies and plans of OIC SLCs and of South Korea. Key recommendations and best practices from South Korea are discussed for bridging the huge technology and innovation gap of OIC SLCs if their economies are to develop and compete in an increasingly competitive, knowledge intensive, technology driven global economies.

DRUGS, DEVICES AND DELIVERY SYSTEMS FOR DIABETES: THE NEED FOR STRENGTHENING OUR STRENGTHS

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Diabetes mellitus is now taking its place as one of the major threats to human health in the 21st century. Peripheral insulin resistance of insulin signalling and action combined with impaired pancreatic ß-cell function finally leads to the clinical manifestation of Type 2 diabetes. New horizons in drug development for diabetes are expected from pharmacological interventions that are dependent on physiological responses and adequately target underlying defects, such as obesity, insulin resistance, inflammation, increased glucose output from the liver, alterations in the fat-derived factors, distinct changes in gut micro biota composition and microbial metabolite activity, defective glucose transport, secretory dysfunction, or apoptosis of the ß –cell, endoplasmic reticulum (ER) stress, mitochondrial dysfunction and autophagy.

The increasing prevalence of diabetes, with no cure on the horizon, continues to provide biopharmaceutical companies with an incentive to develop novel therapies and improve existing compounds. A wide range of pharmaco therapies for glycemic control is now available; however, management of type 2 diabetes remains complex and challenging due to its variable pathogenesis, progressive natural history, and limiting side effects of current therapies, including weight gain, hypoglycaemia, fluid retention, and gas-trointestinal side effects. Therefore, the quest to develop therapeutic agents with novel mechanisms of action, which are expected to fulfil the unmet needs of current therapies, continues with ever demanding potential.

India, with pluralistic health care system, having extensive expertise in modern medicine, Indian systems of medicine, and sustained research capacity building in life & pharmaceutical sciences, should march towards new herbal drug development for diabetes and other metabolic disorders. One should think about the success of metformin (the first-line treatment drug for diabetes worldwide) whose origin is from *Galega officinalis*, the Nature's gift that keeps on giving more.

An integrated herbal drug development & standardization model should be developed with an amalgamation of classical approach of Ayurvedic therapeutics, reverse pharmacological advances and evidence based modern technologies combined with the Indian advantage of biodiversity potential.

Another important and recent technological advancement also focuses on the development of non-invasive point-of-care (POC) medical devices for both the prevention and treatment care for diabetes and other associated disease-states. Very recently, using a non-invasive POC devise that could measure the skin collagen fluorescence as an indicator of accumulation of advanced glycation end products (AGEs), we have successfully demonstrated that it could be used in population screening for the detection of abnormal glucose tolerance and diabetes. The latest advent of artificial 'bionic pancreas' is a best example for how multi-disciplinary technologies converge and contribute to the diabetes care and treatment. While there are limitations in the use of conventionally available drug delivery systems viz., lack of target specificity, altered effects and diminished potency due to drug metabolism in the body, cytotoxicity of certain pharmacological agents, nanotechnology appears to be a potential rescue. The application of various types of nanoparticles for insulin delivery in the treatment of diabetes is also a thrust research area of research & development. In all the areas of drugs, devices and delivery systems - not only for diabetes but also for other metabolic diseases, India should capitalize on research and development with futuristic investment as it has the potential scientific strengths and trained human resource capacity and this should become one of the prioritized STI policies of Government of India.

EMERGING GLOBAL NETWORKS: SYSTEMIC TECHNOLOGY AND KNOW-HOW TRANSFER FROM MULTINATIONAL COMPANIES TO SMALL AND MEDIUM-SIZED ENTERPRISES

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Major part of the global intellectual property (IP) is owned by a small number of multinational companies (MNC). Most of the small and medium-sized enterprises (SME) do not have access to the IP. Tekes Technology and Ecosystem Access Program is piloting how a technology and knowhow can be efficiently transferred from the ecosystem driven by MNCs to be adopted and used by SMEs. In addition to "reinventing the wheel" by SMEs, SME would gain by 1) conducting R&D more inexpensively, 2) conducting R&D more rapidly, 3) thus accessing market faster. The MNC benefits from outsourcing part of the development risks and licensing out the unused IP. In order to create the new innovation platform, government facilitation seems to be needed.

INNOVATIONS IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY IN THE DIGITAL AGE

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This century has brought significant transformation in education, where the role of Information Communication Technology (ICT) has been enormous. The face-to-face learning, which has been prevalent for centuries, has been supplemented with e-learning and mobile learning. The emergence of e-books, e-magazines, e-journals and e-libraries has greatly simplified the life of learners and researchers. The journey from Open Educational Resources (OERs) to Massive Open Online Courses (MOOCs) has been short, but quite promising, with the accessibility of quality education at affordable cost to millions of students throughout the world. The cloud technology and data analytics are expected to give a major boost to education in the foreseeable future. Among all disciplines, the sciences and engineering has been the major beneficiary of all such ICT-based developments in education and research.

Starting with a brief introduction of the above-mentioned ICT developments, we have particularly discussed in this paper about worldwide efforts in developing e-resources in sciences, including simulation experiments and virtual labs. We have also discussed about the MOOCs, which started about two years back, and is now spreading like wildfire, with more and more universities joining it. There has been an interesting debate on MOOCs worldwide, which has also been critically examined. Another important theme that we have discussed, is ‘flipped classroom' that has received wide attention in recent years. The role of 'big data' in education, which is expected to play a very important role in the coming years in deciding the education policy, has also been briefly discussed. Based on the ERP data available from our own university on various programmes in sciences and engineering, it has been shown that how such data could be utilized in decision making.

The innovative project of the Ministry of Human Resource Development, Government of India in connecting 687 universities and 22,000 plus colleges, and integrating ICT with education through its National Mission of Education through ICT

(NMEICT) are briefly discussed. We have also discussed about our own initiatives in developing ICT infrastructure in our university with the aim to enhance the quality of education, bringing transparency in the university system, facilitating research, and ICT-based initiatives in the empowerment of the students, faculty and other staff, which is extremely important for proper growth of a university.

ENHANCING PRIVATE SECTOR INVESTMENT IN R&D, TECHNOLOGY AND INNOVATION

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Development over the last two centuries world over has been built on innovation and technology development. There have been well coordinated efforts in developed countries among scientists, academic institutions, private industry and government to fund such efforts.

In the last century, US had been in the forefront of such efforts. There have been handsome endowments by the federal and state governments to encourage innovation and development through research. Higher institutes of learning have been receiving wide support from government and private industry. Each of the top ten universities in the US had spent over a billion dollars on R&D. John Hopkins University in Baltimore tops this list with a spend of $ 2106 million with major contributions by the federal government ($ 1857 million), State and local government ($ 5.1 million), institution funds ($ 81 million), businesses ($ 47 million), non-profit organisations ($ 114 million)

Such research and innovation have also flowed from expenditure on defence and space exploration. The fall out on civilian use has been massive.

In the closed economy of India characterised by licence, permit and quotas till 1991, there had been very limited scope for innovation or R&D. With capacities limited by the state, private industrial units have been content, by and large, to rely on technology through collaboration. There was a multiplicity of technology imports from different collaborators and for decades there had been little efforts to synthesise and evolve technology on our own.

Even large companies that flourished in that milieu, spent very little on R&D. Ashok Leyland and Bajaj Auto, for instance, which had a comfortable run through the licence – permit - quota era, spent around 0.17 per cent of their sales on R&D. This was in stark contrast to the R&D spend by engineering industries in developed countries. Automobile companies in Germany, Japan and Korea, which all bounced back into flourishing economies in the post-war era spent 8-10 per cent of their much larger sales volumes on R&D.

In that era the only R&D spends of some significance was made by Indian defence production units, CSIR, ICAR and several public sector undertakings. Even in the case of most PSUs, such spend was around one per cent of sales. Obviously, these are far below the R&D spend of giant corporations in the corresponding fields globally.

With severe constraint of resources, academic research was also funded poorly. Unlike in the developed countries, there has not also been much support from private industry for academic research.

It should not, therefore, be surprising that the record of India in terms of innovation of products and processes or patents had been extremely poor.

Some fresh air was noticed in regard to the drugs and pharmaceutical industry. Here again the efforts were largely on reverse engineering of processes leading to widespread complaints and litigation on violations of intellectual property rights.

Things started changing from the 1990s after the economy opened up for competition. A culture for innovation and R&D so perceptibly noticeable in the developed countries in Europe, US, Japan or Korea is still absent. A survey conducted by *Industrial Economist* showed large prosperous companies in several sectors spending next to nothing on R&D. The flourishing cement industry provides the most glaring example of such R&D spend from nil to 0.3 per cent of turnover for six large cement companies. It is no better for steel, IT, large oil corporations or FMCG companies. Some significant expenditure is noticed in the pharma sector.

While large academic institutions and universities in the US are in the vanguard of innovation and R&D, their counterparts in India have very little to their credit. Excepting perhaps Indian Institute of Science, even other well-known institutes of higher learning like the IITs have poor record of patents or innovations. A consequence is a very little collaborative effort between industry and such institutes, characteristic of the US.

China which was in a comparable state of non-performance in this area until a couple of decades ago, has been recording a spectacular change. The thrust on R&D spend has expanded rapidly and the country is estimated to be the second largest R&D spender, just behind the US. A recent report estimates the total global R&D expenditure in 2011 was

$1435 billion with the US accounting for $ 424 billion (around 30 per cent) and China $ 208 billion (around 14.5 per cent).

The rapid rise of China as a global economic power, understandably, is built on its manufacturing prowess, again powered by the massive increase in the expenditure on innovation and R&D.

There are welcome signs; over the last eight years the country has witnessed a new thrust towards science education. The INSPIRE programme introduced by the Department of Science & Technology has contributed to increased interest in science education. The liberal funding for this has been resulting in a wider interest in science. Hopefully this would trigger innovation and development through research.

CAREER OPPORTUNITIES FOR WOMEN IN SCIENCE, TECHNOLOGY AND BIOTECHNOLOGY

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S&T sector has shown sustained growth over the years despite great challenges. The women technical force has been the greater contributor to this sector in persuasion of R&D and biotechnology as such. India’s economic policy has further supported the avenues for women and youths. Apart from having opportunities in teaching and education their active role in S&T sector has been recognized with the initiatives of Government of India on ‘Gender Budgeting’ as a tool for empowering the women. Each government organization has formed a Gender Budgeting Cell (GBC) to address the gender equality issue through adequate resource allocation and gender sensitive programme formulation and implementation. In an attempt, Government organizations are identifying specific schemes for women benefitting in their higher education and witnessing their entry in different science disciplines, including engineering, arts and humanities. Women potential has been harnessed in the educational system and in managerial positions. They have been involved in teaching, scientific research and extension activities from lab to field and in every sphere of S&T. Educated women are working as bio-scientist in R&D labs and pharmaceutical companies. Awareness activities through training and counseling programmes for teachers and trainers are widely disseminated by state S&T councils through qualified women folk. However, their adequate representation at different levels is yet to reach at optimal level.

GOVERNMENT INTERVENTIONS IN PROMOTING INNOVATION DRIVEN ECONOMIES IN ASIA FOCUSING ON INDIA

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India and China are the fast emerging economies in the world. It is more based on technological improvements rather than by using factor inputs such as labor and capital. Recent estimates of total factor productivity growth lend some empirical support to this hypothesis. There are also reports of number of innovations emanating from the two countries. Both the countries have become increasingly integrated with the rest of the world although China has a better record than India. In China the post 1993 acceleration was concentrated mostly on industry, which contributed nearly 60% of China's aggregate productivity growth. In contrast 45% of the growth in India in the second sub-period came from service sector. The presentation discusses science and technology policies of India over the period and analyzes its impact on the growth of Indian economy in various sectors like drugs and pharmaceuticals, aeronautics, R&D services, architectural and engineering services and communication services.

Globalization and internationalization of R&D has also played an important role in the economic growth with the large number of foreign companies who have established their R&D Centers in India are filing their patents in India and US.

MOBILE GOVERNANCE IN INDIA: INNOVATIVE SUSTAINABLE BUSINESS MODELLING

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Mobile Seva is a United Nation's award winning, pioneering initiative in India aiming to enhance the reach and assess to public services and information for the benefit of Indian citizens. The project was conceptualized, formulated and launched in 2011 by Department of Electronics and Information Technology (DeitY), Government of India. The results of the project in terms of its performance in service delivery, clearly suggest the project's success. However, the project has proved to be a cost-intensive project running on government funding. This seems justified when evaluated from the perspective of social costs and benefits. However, in this paper we try to identify whether the Mobile Seva project can drive revenues and not just generate costs. If yes, what can be incorporated in its model to make it self-sustainable? We start by analyzing the effectiveness of each mobile governance services in terms of its scope, reach and drawbacks. Later, we identify some major infrastructure/service specific costs and suggest some cost optimsation and revenue generation solutions. These insights can be used to create a self-sustainable business model for mobile governance in the years to come.

LEVERAGING WEB AND MOBILE TECHNOLOGIES TO ENHANCE ACCESS TO AND APPLICATION OF ONLINE LEARNER COMPETENCIES: A PROJECT OF THE INTERNATIONAL BOARD OF STANDARDS FOR TRAINING, PERFORMANCE, AND INSTRUCTION (IBSTPI)

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The International Board of Standards for Training, Performance and Instruction (ibstpi®) was established in 1977. The Board grew out of a task force, which was composed of more than 30 practitioners and academics with expertise in training, performance, and instruction, all of whom were actively involved in two US-based organizations – Association for Educational Communications and Technology and National Society for Performance and Instruction (now the International Society for Performance Improvement). Over the years, more than 60 exemplary professionals have served as Directors in the Board.

All ibstpi activities are conducted to achieve its educational mission of promoting high standards of professional practice in fields of training, performance, and instruction through the systematic development, validation, and dissemination of competencies. ibstpi defines a competency as "a knowledge, skill or attitude that enables one to effectively perform the activities of a given occupation or function to the standards expected in employment" (Richey, Fields, & Foxon, 2001, p. 31).The Board believes that education on the competencies and performance statements creates better providers, users, and scholars in the fields that the Board serves.

SCIENCE, TECHNOLOGY, EDUCATION, ENVIRONMENT AND SOCIETY: THEIR RELEVANCE TO LEATHER

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The Central Leather Research Institute (CLRI) was founded in 1948 with a hope that industrial research in leather will provide technology tools for social empowerment of the country. Today, the CLRI is acknowledged as the largest leather research institute in the global arena. In this talk, I would like to highlight the importance of leather, paradigm shift from chemical to bioprocessing of leather, rural development, cleaner technology initiatives in leather industries, healthcare products, environment and society at large.

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