The Need for 'Coherent Synergy'
(in Globalization of R&D)

by

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Industrial Research Institute

Privilege to address this Annual Meeting of IRI, the 'Premier Organisation of Innovation Leaders' in the U.S., with an impressive range of activities related to R&D and to Innovation. This is also an opportunity for me to learn more about IRI and perhaps to help nucleate a dialogue between IRI and the proximate counterparts in India.

INDIA: Evolving as Knowledge Economy

(Some Views)

'INDIA: FUTURE FACTORIES'

"Lately India's manufactured exports have risen, from about $ 37 billion in 2002 to about $54 billion in 2004, and they could reach $300 billion by 2015... as multinationals invest more heavily in India as a manufacturing base. In India the early players are interested in the talent pool of chemists, designers and engineers, not low-skilled labour."

- **Newsweek, 7 March 2005**

INDIA - THE NEXT KNOWLEDGE POWER

"The impact of the IT Industry on the economy has been enormous.... And what's good for one science-based industry should be good for others. India has a thriving pharmaceutical industry. And biotech is taking off. The hope among some senior scientists and officials is that India can short-cut the established path of industrial development and move straight to a knowledge economy."

-**New Scientist, 19 March 2005**

Indian S&T Platform

Extensive

Mission-Oriented Laboratories (Nuclear, Space, Defence, Agriculture)

Council of Scientific and Industrial Research

Universities, Indian Institute of Science, Indian Institutes of Technology, etc.

Corporate In-House R&D structures (growing)

Industry Cooperative Research Associations

For India, to get the maximum mileage from this S&T platform, there must be what I call 'Çoherent Synergy' in the S&T system.

Indian Govt. also encourages cooperation with transnational corporates in industrial R&D – already many TNC's are having R&D projects in Indian academic institutions and national laboratories and quite a few – and this number is growing – have their own R&D Centres in India., and 'coherent synergy' must also embrace the R&D activities in India of the TNC's.

The Need for Coherent Synergy

('Coherent Synergy' is a new phrase I have defined in the S&T context!)

PROLOGUE(National)

The S&T System, to contribute maximally to national development, requires a variety of efforts - Human Resource Development, R&D with Prioritization, Academia – Industry Interaction, International collaboration, etc. But there must be:

Synergy among the concerned parties in every S&T effort. Synergy implies Cooperative interaction.

and

Coherence collectively among all the efforts. Coherence implies phase relationship and space-time synchronization

Every synergetic S&T effort gives a momentum for development. And momentum is a vector. All the vectors must point in the same direction for coherence. Synergy in any effort, of course, has local coherence; but in 'Coherent Synergy', I am talking about global coherence.

TECHNOLOGY FORESIGHT AND CRITICAL TECHNOLOGIES

Technology Foresight analysis indicates that the critical technologies for India today are strategic technologies (nuclear, space and defence-related); advanced manufacturing and process technologies; advanced materials technologies; knowledge-intensive technologies -- Information Technology (particularly hardware), Biotechnology and Nanotechnology (particularly nanoelectronics and nano-biotechnology); technologies used in Small & Medium Enterprises (SME's); and rural development-related technologies.

DEVELOPMENT as an OBJECTIVE

(from an Indian perspective)

"Developed Country" Status is not a single-point destination. Even already-developed countries want to develop further.

Development level in any field depends on the level of technology in use in that field. This level varies in different fields in the country: so we have to keep pace with the developed countries in some (e.g., Nuclear, Space), catch up in some (e.g., SME's), leapfrog in a few (e.g., rural-development-related). There are globalization opportunities in all of them.

Strengthening Academia-Industry Interactions:

Urgent Need. Easier if an industry sector is booming.

- "Core-group on Automotive Research" (C.A.R.) set up by my Office in April 2003; co-chaired by Prof. S. Mohan, IISc, Bangalore & Dr. S.M. Shahed, President (2002), S.A.E.
- Mandate: to create a user-friendly database of scientists, identify frontier technologies, so as to promote development of vibrant, world-class automotive systems, sub-systems & parts industry in India.
- Technology Information, Forecasting & Assessment Council (TIFAC) - secretariat for C.A.R., works closely with the Industry Associations (SIAM, ACMA), leading academics and other Govt. Departments.
- Would like to set up similar Advisory Groups in other areas

R & D TOPICS : CAR

More than two dozen topics were identified in:

- **Advanced Materials and their Recyclability (high strength steel, light metal alloys, plastics, composites)**

- **Alternate propulsion system (Hybrid Electric Vehicles, Hydrogen, etc.)**

- **Electronics: Embedded Control Systems, engine control system, "intelligent" sub- systems, MEMS/Telematics in (Public) Transportation systems**

- **Road Safety (suitable options for India, pedestrian safety, ventilated helmets, safer bus fronts, biomechanics studies)**

R&D Topics (Contd.) -1

Implementation Mechanism

Interdepartmental Programme Advisory Committee set up in March 2004; chaired by Dr. P. Rama Rao, former Secretary, DST – funds pooled by three departments: Heavy Industries (DHI), Science & Technology (DST) & Office of PSA

Public-Private Partnership: Government research funding to academia; Industry will contribute manpower, facilities/equipment & domain knowledge.

Two-phase development plan: Results of 1st Phase will be shared among consortium members. Participating companies will adapt them in a 2nd Phase to implement commercially

R&D Topics (Contd.) -2

Telematics – 1 - at Koyembedu Bus Terminus, Chennai Ground Traffic Control & Vehicle Tracking for 50 city buses & 50 long route buses. Use off-the shelf technology (GSM/GPS) to make it work in India. Coordinated by IIIT, Bangalore; funding by Department of Heavy Industries.

Telematics Pilot project – 2 Telematics using WiFi- playing with something new; using potential of hot-zone (connectivity) and mesh-networks. Project implementation by Amrita Vishwa Vidyapeetham, Coimbatore; funding by TIFAC

R&D Topics CAR (Contd.)- 3

Low Cost engine management system for small engines

(Gasoline direct injection for 2/3 wheeler). A model based paradigm adopted instead of "look-up tables". Partners: IIT Madras, IIT Bombay, TVS Motors Ltd., and UCAL Fuel Systems; funding by Office of PSA

Advanced High Strength Steel and modern metal-forming processes. Builds on existing capabilities in laser welding(ARCI), formability (IIT Bombay) & simulation (ProSIM). Full-scale software models that will be given to OEMs including entire tooling design etc. Partners: ARCI, Hyderabad, IIT, Bombay, Pro-SIM along with Tata Motors and Mahindra; funding by Office of PSA

Academia-Industry Interactions:SMEs and Rural Technology Delivery

Incubators in academic institutions, in particular those proximate to SME clusters, is a possible mechanism for academia-industry interaction. Department of Small Scale Industry and Confederation of Indian Industry(CII) are working with my Office and TIFAC. SME's often tend to accept innovation more readily than large corporates! Here there is a huge opportunity.

For rural technology delivery, there are many initiatives of the Govt. For example, my Office has nucleated Rural Technology Action Groups (RuTAGs) to provide higher level of technology interventions in situations where some technology delivery has already been attempted successfully.

Mission REACH
(of TIFAC, DST)

TIFAC-CORE (Centres of Relevance and Excellence)

- ✓ **triangular partnership (Academia-Industry–Government) Most of the Industry partners are SMEs**
- ✓ **in diverse disciplines of relevance**
- ✓ **geographically dispersed**
- ✓ **provides development support**
- ✓ **develops quality manpower**

Two Dozen TIFAC-COREs established so far in the last five years, in areas like industrial safety, product design and optimization, environmental engineering, pervasive computing, network engineering, information security, new drug delivery systems, pharmacogenomics, diabetic retinopathy,agro-biotechnology, etc. We welcome participation from industries, academic institutions and academics from abroad.

Globalization

(Indian Perspective)

Globalization encompasses India in Manufacturing, Basic Research and in some other areas. Examples of the latter are agriculture (dwarf wheat varieties – green revolution), medicine (Tuberculosis , Malaria, etc), natural hazards (e.g. tsunami detection and mitigation) and environment (global climate change).

India is active in Coordinated Research Projects of International Agencies like FAO, WHO and IAEA. India also participates in global "Mega-Science" Projects (for example, Large Hadron Collider, Plant Genomics etc.). There are beginnings in the context of Industrial Research – R&D Services, Contract Research, R&D Centres in India of Transnational Corporates. Large Indian Corporates are also beginning to reach out to R&D resources abroad. Future possibilities are enormous.

MNC-owned R&D Centres in India

Adobe Alactel Bell Labs Cisco D-Link Hewlett-Packard Honeywell IBM

Intel LG Lucent Microsoft Motorola Nokia

Oracle Philips Samsung Siemens

Sun Microsystems Texas Instruments

Astrozeneca BASF

Boeing Daimler-Chrysler Delphi

Du Pont General Electric General Motors

Glaxo Smithkline Honda Huwei Hyundai Mitsubishi

Proctor & Gamble Rockwell SABIC Seagram Unilever

150 of the FORTUNE 500 Companies

Present scenario of IPR in India and its suitability for collaborative S&T programmes

- India's IPR regime is fully TRIPS compatible including product patents for drugs, food items and chemicals. Patent offices have been modernized
- Member of WIPO, WTO, Berne Convention, Paris Convention, Patent Cooperation Treaty & Budapest Treaty
- Laws are in place for all forms of IPR
- Judiciary is sensitized about IPR and courts are issuing injunction orders based on merits. IPR tribunals are also in place (Indian jidicial system has a long and excellent tradition of independence).
- S&T Policy 2003 gives great deal of importance to IPR
- India has agreements on IPR with EU, Russian Federation and France under the bilateral and multilateral S&T umbrella agreements.

Indo-US Collaboration

- **Government-driven Initiatives:**

  -Department of Science & Technology- National Science Foundation programme

  (- Asia Pacific Materials Network

  - High Technology Commerce Initiative: Nanotechnology, Biotechnology, Space Technology, Defence Technology)

  -Indo-U.S. S&T Forum(established 2000)

  (Bilateral Workshops in wide spectrum of themes: Weather & Climate Modeling to Nanotechnology, Fuel Cells and High performance Computing to Futuristic Manufacturing)

- **Other Initiatives :**

  -Inter-Academy, Inter-Institutional- e.g., Indian Institute of Technology-Faculty Academic Network(US)

  -Visits, Exchange Progammes, Symposia Post-doctoral students. etc.

  - Joint Development Projects between Industrial Partners (Programme for Advertisement of Commercial Technology)

These initiatives focus on Basic and Applied Research. Increase in industry participation possible which can change orientation and mindsets.

More Possibilities

Advanced Manufacturing

Pharmaceuticals, Biotechnology, Speciality Chemicals

Nanoelectronics & Nano-Biotechnology

(Conditions suitable for major players to think of setting up nanofab facilities in India)

Energy Technologies – Environmentally benign

(Including Nuclear)

Advanced Instruments – Analytical, Medical Diagnostics (India's IT Software strength could be leveraged; today more than half the cost of advanced instruments is generally in software and this, unlike hardware, is changing very rapidly and becoming continuously more user-friendly).

Product Design and Development (Appliances, Consumer Durables)

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The Large Hadron Collider Model

(for R&D Collaboration)

The world's largest accelerator is being built in the Centre for European Nuclear Research(CERN) in Geneva – a more than 2.5 Billion U.S. Dollars machine. India is contributing more than 25 Million U.S. Dollars – worth hi-tech equipment like a thousand superconducting sextupole magnets, etc. and advanced control software. Half of this contribution will be put into an 'India Fund' which will support Indian scientists who will work with the Accelerator after it is completed in 2007 or so. Indian scientist groups are also participating in the construction of two giant Detector systems – CMS and Alice.

This is a good mutually – beneficial model for international R&D collaboration. Today's India wants collaboration on an "equal-partner" basis.

Relativistic Heavy Ion Collider(RHIC)

(Brookhaven National Laboratory)

Collaborators

from: www.bnl.gov/rhic updated 5/12/05

Motivations of Transnational Corporates

(for decentralization of their R&D abroad)

Could be *inter alia*

- **To Leverage Specific Knowledge Base in host country,**
- **To fill Gaps in R&D Personnel Base in home country**
- **More Efficient R&D Investment**
- **Part of strategy of business internationalization (for example, adapting new technology for satisfying local market demand)**

Higher the level of R&D introduced, Greater is the added value to the host country's S&T System.

Possible Benefits of R&D Globalisation to Host Country

Inter Alia

- Exposure to World-Class R&D Effort when interfaces are created with Host Country's Academic System
- Technology Diffusion,
- Job Opportunities
- Help in Attracting Foreign Direct Investment in related Manufacturing Sector
- Nucleation of Indigenous Entrepreneurs (Accessory/Competitive)

The Need for 'Coherent Synergy'

EPILOGUE (Global)

Globalisation of Industrial R&D is valuable, and its growth is perhaps inevitable. The synergy needed for globalisation of R&D is, I think, sustainable in those cases where there is coherence between the motivations of the transnational corporates and the technology needs – existent and latent – of the host country.


THANK YOU