"Road-map for R &D and Innovation in Higher & Technical Education "

Dr. V. K Sethi

VC, RKDF University

Opening Remark

- India's Higher & Technical education system is on the threshold of major institutional reforms.
- It is the right time to envision a bright future and create the culture of Research & Innovation in the Universities to transform them as Centres of excellence in Teaching & Learning

The Quality Spread

- The prime reason for disparity between leading technological institutions such as the IITs, a few State Technological universities and other engineering colleges in the country is in respect of the very nature of Research & Innovation activities pursued in these institutions.
- India's higher technical education is predominantly dominated by the self-financing institutions some of them have received recognition as deemed to be universities. In fact, almost 90% of India's higher technical education (degree level onwards) is under private ownership.

The Quality Spread

- Worldwide the private ownership has promoted quality and relevance much better than in the Institutions under the public ownership system which is predominantly dominated by the Government and public policy.
- The Quality Spread is however limited in Indian scenario
- Therefore the focus is on the major concerns & the way out

Major Concerns in Indian Scenario

- **Quality of Graduates and Post Graduates.**
- **Quality of Research Publications, Research Integrity.**
- **Quality of Faculty, Integrity and preparedness for Integration into the Knowledge Revolution.**
- **Proper Environment of Creativity and Innovation.**
- **System heavily oriented towards local textbooks driven examinations.**
- **The low employability of engineering graduates and the relevance of the capabilities nurtured in them for the purpose of employment in today's knowledge intensive, quality and productivity conscious, technology savvy industry environment are matters of serious concerns**

The Pathway Ahead - Desired Attributes Structure & Linkages

Attributes

1. Industry relevant and driven by technology.
2. Network Powered by Intelligent Knowledge Management System.
3. Innovation in Curriculum Design and Delivery Systems.
4. Promoting Collaborative Teaching, Collaborative Research with strong Industry Interface.
5. Overall system for Knowledge Creation and Industry Relevant Innovation – Operating like a Global Knowledge Enterprise.

The Pathway Ahead - Desired Attributes
Structure & Linkages

Structure

1. Breaking the Mould of Traditional Departmental Boundaries for Curriculum Design and Degree Programs.
2. Promote a Seamless Environment of Synergy between Science, Engineering and Human Values.
3. Mix of Open Learning and Expert Orientation through Live and Virtual Classrooms and Labs.
4. A truly 24 X 7 Knowledge University as ‘Knowledge Enterprise’

The Pathway Ahead - Desired Attributes Structure & Linkages:

The Connections for Excellence in R&D

- It is the right time for India's higher & technical education to strengthen the following vital connects to achieve quality, relevance and excellence.

1. Connection to Knowledge Network

Connection to the vast body of knowledge is most important connect . This will ensure that the power of connectivity and power of networking is fully utilised by the students and faculty in comprehending the state-of-art as also to develop capabilities to work in today's knowledge intensive tech-savvy environment.

2. Connection to the Industries

This connect to the industries should further result into institutions and industries working together on new challenges of product innovation and technology development. The pathway lies in Industry partnership in delivering expert lectures, conducting technology workshops, joint guidance of live projects and for internship to the students.

The Connections for Excellence in R&D

3. Connections to National and Global Professional Societies:

This vital connect ensures the flow of information and knowledge on latest happenings, enhances institutions out reach to the vast body of research and knowledge resources and strengthens the academia industry interface. Institution on its part can set up portals for curriculum update, knowledge sharing, technology and innovations watch which can be developed in partnership with the professional societies.

4. Connections to the Society

It is important that the institutions begin to focus on the society and rural belt around it so that they can share the fruits of knowledge & progress. The major problems of society that could be resolved include, energy availability, environmental concerns, water quality management besides creating skilled manpower in areas of emerging and new technologies and as also partnering with local bodies to create the atmosphere of social wellbeing & uplift.

The Connections for Excellence in R&D

5. Connections to Local and Global Systems of Tech Education:

This vital connect promotes collaboration, cooperation and alliances with R&D organisations and universities at national as well as global levels.

5.1 Affiliation

Our affiliation to 'Association of Universities of Asia & the Pacific (AUAP) is worth mentioning here through which we can take advantage of the peer group in these institutions / universities for strengthening its internal peer review so as to constantly assess and focus on quality and excellence.

5.2 Collaboration

In today's knowledge age we must focus on collaboration and co-operation to maximise the impact of efforts invested in an activity.

FUNDING AGENCIES FOR R&D IN SCIENCE & TECHNOLOGY

Dr V K Sethi, VC RKDF

Ex Director MOP (GOI) & UIT RGPV

Educational Institutions:

- **Teaching**
- **Creating Learning Resources**
- **Carrying-out Research works/ Projects**
- **Guiding people for research**
- **Conducting Extension Programmes**
- **Carrying-out Consultancy services based on research output**

Research Needs….

- **Interest**
- **Motivation**
- **Academic support**
- **Administrative Support**
- **Financial Support**
- **Subordinates' support**
- **Family level support**
- **Health, Age,**

Funds for Research:

- **Institutional**
- **Local level bodies**
- **State Government level bodies**
- **Central government bodies**
- **International Bodies**
- **Company based R&D**
- **NGOs**

Government of India bodies

- **Building Material & Technology Promotion Council (BMTPC)**
- **Ministry of Education**
- **Ministry of Environment**
- **Ministry of Human Resource Development**
- **Ministry of Non-conventional Energy Sources**
- **Ministry of Rural Development**
- **Ministry of Science and Technology**
- **Housing and Urban Development Corporation (HUDCO)**
- **Indian Council of Philosophical Research (ICPR)**
- **Indian Navy**
- **Indian Renewable Energy Development Agency (IREDA)**
- **National Wasteland Development Board (NWDB)**

DST Schemes:

- **Science and Engineering Research Council (SERC)**
- **Intensification of Research in High Priority Areas (IRHPA)**
- **Deep Continental Studies (DCS)**
- **- Himalayan Seismicity Programme (HSP)**
- **Monsoon and Tropical Climate (MONTCLIM)**
- **Technology Systems Development (TSD)**
- **Science and Technology application for Rural Development (STARD)**
- **Science and Technology for Women**
- **Science and Technology for Weaker Sections (STAWS)**

DST Schemes:

- **Scheme for Young Scientists (SYS)**
- **Tribal Sub-Plan (TSP)**
- **Special Component Plan for SC Population (SCP)**
- **Natural Resources Data Management System (NRDMS)**
- **Instrument Development Programme (IDP)**
- **Opportunities for Young Scientists (YS)**

DST Schemes:

- **Application of Science and Technology for Conservation of Cultural Property/ Heritage (ASTECH)**
- **Critical Technology Programme (CTP)**
- **Grants-in-aid Programme of India Meteorological Department**

DST's NEW SCHEMES

- Funds for Infrastructure in Science and Technology (FIST) for PG depts.
- TIFAC- CORE- Technology Infusion Projects in industries
- Science and Society related Projects

All India Council for Technical Education (AICTE)

- **Research & Institutional Development Schemes**
  - **Modernization & Removal of Obsolescence Scheme (MODROBS)**
  - **Research Promotion Schemes (RPS)**
- **Industry-Institute Interaction Schemes**
  - **Industry Institute Partnership Cell (IIPC)**
  - **Entrepreneurship Development Cells (EDC)**
  - **National Facilities in Engineering & Technology with Industrial Collaboration (NAFETIC)**
  - **Nationally Coordinated Project (NCP)**

Council of Scientific and Industrial Research (CSIR)

- **Research Schemes /Sponsored Schemes**
- **Emeritus Scientist Scheme**
- **Research Fellowships/Associate-ships**
- **Other Science and Technology Promotion Programmes**
- **Areas of research support: Science and Technology including agriculture, engineering and medicine.**

CSIR -Emeritus Scientist

- **Professors/Scientists and other experts in regular employment in Universities, IITs, Post Graduate Institutions, Colleges, recognized R&D laboratories etc.**
- **Emeritus Scientist Scheme-To provide support to superannuated outstanding scientists to pursue research in their respective field of specialization and having relevance to the programmes of CSIR.**

CSIR:

- **Junior Research Fellowships (JRF) provides opportunities to bright young men and women through an all India examination, for research and training under experienced researchers/ investigators of repute in the various fields of science.**
- **The selected research scholars are appointed initially as Junior Research Fellows for a period of two years and subject to satisfactory performance on assessment at the end of this period, they can be given higher stipend for the remaining period in the form of Senior Research Fellowship.**

CSIR- SRF:

- **The Council has also a Scheme for the award of Senior Research Fellowship [SRF/Associate ship (RA)] to encourage young research workers having good quality published work to their credit to pursue research work in science, engineering, technology, and medicine on specific research programmes.**

CSIR- Shyama Prasad Mukherjee Fellowship:

- **To nurture budding scientific talent towards pursuit of scientific research.**
- **Who can submit a proposal- The scheme is open to top 20 per cent CSIR/UGC JRF, NET Scholars along with top 100 GATE qualified candidates with percentile 99 and above.**
- **When and how to submit a proposal- Once a year examination on 2nd Sunday of July every year.**
- **Areas of research support- Basic sciences (5 fellowships each in Life Sciences, Chemical Sciences, Earth Sciences, Physical Sciences & Mathematical Sciences).**

CSIR: Senior Research Associateship

- Ph.D, M.Tech, MD/MS with two years research/teaching experience and publication(s).
- The application in the prescribed format can be submitted any time of the year.
- Science and Technology including agriculture, engineering and medicine.

Defence Research and Development Organisation (DRDO)

- Extramural Research Scheme
- Aeronautics Research & Development Board

Department of Atomic Energy (DAE)

Department of Atomic Energy supports research programmes in Nuclear Science and Technology through the Board of Research in Nuclear Sciences (BRNS). BRNS support the following schemes:

- **R&D Project**
- **Symposium/Conference/Workshop**
- **DAE Young Scientists Research Award**
- **Dr. K.S. Krishnan Research Associate ship**
- **Raja Ramanna Fellowship**
- **Visiting Scientists**
- **Homi Bhabha Chair Professorship**
- **DAE Graduate Fellowships**
- **DAE Graduate Fellowships for Ph.D.**
- **DAE-SRC Award**

DAE -Areas of research support

- Basic Sciences (Physics and Chemistry)
- Life and Medical Sciences
- Engineering Sciences
- Material Science
- Electronics and Instrumentation
- Isotopes Applications in Industry
- Food and Agricultural Sciences
- Radiation and Environmental Sciences

UGC schemes:

- **Research Awards/ J.R.F. (New)/ Career Awards/ National Fellows / Emeritus Fellows**
- **Utilization of services of Retired Teachers / Educational Administrators.**
- **Cultural Exchange Programme- Area studies / Exchange programme/ Networking of Universities/ Modernization of teaching./ Teacher Fellowship**

UGC schemes:

- **Schemes for Women - Woman's Hostel/ Day Care Center/ Infrastructure for women student /teachers- Scholarship for Women in Professional Courses/ Women Study Centre**
- **Gender sensitivity programme in Universities and colleges/ Data base on Women**

UGCs- New Schemes:

- E-content Development Projects
- www.cec-ugc.org

International Organisations

- **European Commission (EC)**
- **ICEF (India – Canadian Environment Facility)**
- **OECD/Hunger Campaign**
- **United Nations Centre for Human Settlements (UNCHS)**
- **United Nations Food and Agricultural Organization (FAO)**
- **UNESCO**

Foreign Governments & Governmental Organisations

- **BELGIUM : Algemene Belgische Ontwikkelingssamenwerking (ABOS)**
- **CANADA : Canadian High Commission in India - CIDA**
- **DENMARK : Danish International Development Agency (DANIDA)**
- **FRANCE : Ministère des Affaires Etrangères**
- **GERMANY : Bundesministerium für Wirtschaftliche Zusammenarbeit**
  Deutsche Welthunger Hilfe (FAO)
  Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ)
  Foerdergemeinschaft Rotary Ludwigshafen
  German Agro-Action
  German Appropriate Technology Exchange(GATE)
  Kreditanstalt für Wiederaufbau (KFW)
  Ministerium für Bundes- und Europa-

Foreign Governments & Governmental Organisations

- **JAPAN : Japanese Embassy in India**
- **NETHERLANDS: Royal Netherlands Embassy in India**
- **NEW ZEALAND: New Zealand High Commission in India**
- **SPAIN : Government of Navarra Municipality of Pamplona**
- **SWITZERLAND : SWISSAID**
- **U.K. : Overseas Development Administration (ODA now DFID)**
- **USA : V.I.T.A. (Volunteers in Technical Assistance)**

COMMONWEALTH FACILITIES-

- **Commonwealth Higher Education Support Scheme/Association of Commonwealth Universities Awards./Awards and Fellowship /Development Fellowships/Academic Exchange Fellowships.**
- **Women's Programme/Shared Scholarship Schemes/Memorial Foundation Scholarships**
- **British Marshall Scholarships.**

FUNDING AGENCIES- STATE

- **MPCST, MPUVNL, MP PCB**
- **Waste land development Board/ Rural and Zilla Panchayat**
- **Pollution Control Board/ Agricultural Marketing Research**
- **Mines and Geology, Environment and Forests./ Irrigation Engineering.**
- **Conventional and Non-Conventional energy sources./ Rural water supplying.**
- **Urban waste water treatment./ Kannada and Culture.**
- **Department of Sports and Youth Affairs.**

OTHER NATIONAL FUNDING AGENCIES

- **ICAR/ ICMR/ ISRO**
- **Department of Environment and Forests/ Department of Electronics**
- **Dept of Ocean Development/ Department of Biotechnology**
- **Dept. of Rural Development (Land)**
- **Human Resources- all fellowships**
- **Ministry of Defence (DRDO) / Ministry of Water Resources/ Steel and Mines**
- **Birla Foundation/ Rajiv Gandhi Foundation/ CP Ramaswami Iyer Foundation**
- **Pants Foundation / Pylee Foundation**

DEPARTMENT- OF BIOTECHNOLOGY (DBT)

- **Areas of research support** **Animal Biotechnology- Aquaculture and Marine biotechnology - Basic research in biotechnology- - Bioinformatics- - Biological control of plant pests, diseases and weeds- Biotech process engineering and industrial biotechnology - Biotechnology of medicinal and aromatic plants- Biotechnology of silkworms and host-plants- - Crop biotechnology- Environment and conservation biotechnology -Food biotechnology-- Human genetics- Integrated manpower planning - Medical biotechnology- Microbial biotechnology - Plant tissue culture**

DEPARTMENT OF ELECTRONICS (DOE)

- **Technology Development Council (TDC) - - National Radar Council (NRC)**
- **Electronic Materials Development Council (EMDC) - - National Microelectronics Council (NMC)- Technology Development for Indian Languages (TDIL)**
- **Technology Development Council (TDC)-**

DEPARTMENT OF ELECTRONICS

- **Supports Research and Development projects in the area of**
- **computer and computer communication, control and instrumentation,**
- **broadcasting and telecommunication, electronic components,**
- **consumer electronics and**
- **rural electronics.**

DEPARTMENT OF OCEAN DEVELOPMENT (DOD)

- **Subjects considered for support under the fund include physical and chemical oceanography, ocean engineering, marine ecology, marine meteorology, marine instrumentation etc.**
- **Assistance is also extended to projects which have Politico-geographic or Social Dimensions of the Indian Ocean and Antarctica.**

MINISTRY OF ENVIRONMENT AND FORESTS

- **Nationa1 Natural Resources Management System (NNRMS) --- Man and Biosphere Research Scheme (MAB)**
- **Environment Research Scheme (ERS)**
- **Action Oriented Research Programme for Eastern and Western Ghats**
- **Biosphere Reserves (BR)**
- **National Natural Resources Management System (NNRMS)**

MINISTRY OF NEW & RENEWABLE ENERGY (MNRE)

- **Rural energy**
- **Solar energy**
- **Urban industrial waste**
- **Power from wind, biomass, bagasse, small hydro, solar thermal**
- **New technologies**

MINISTRY OF URBAN AFFAIRS AND EMPLOYMENT

- **Pesticides in potable water - development of removal technology**
- **Waste water recycling and groundwater recharge by natural methods**
- **Rapid evaluation of performance of waste water treatment by Dip slide technique**

MINISTRY OF WELFARE (MOW)

- **S&T Project in Mission Mode**
- **Suitable and cost-effective aids and appliances**
- **Methods of education and skill development leading to enhancement of opportunities for employment, easier living and mobility, communication, recreation and integration in society.**

Social Sciences:

- **ICSSR- New Delhi- Provides funds for Major Research Projects**
- **CIIL- Language Research**
- **Indira Gandhi National Centre for Arts**
- **International Bodies**
- **Concerned Govt. Departments & industries, UGC**

How to prepare?

- **BACKGROUND INFORMATION: - FUNDING AGENCY**
- **PROPOSAL FORMAT**
- **THRUST AREAS LIST**
- **INVESTIGATORS / COLLABORATORS**
- **AVAILABLE INFRASTRUCTURE**
- **BUDGET & REQUIREMENTS**

PROPOSAL FORMAT AND PREPARING THE PROPOSALS:

- **Introduction (Precise)-specify the Problem and the need for the present study**
- **Concrete Aims & Achievable Objectives- limit to three or maximum four**
- **Current National & International Status/ your capabilities to do this project**
- **Methodology – materials and methods – field and lab investigations- Work Elements**
- **Time-Frame of Activities- PERT chart – simultaneous / sequential activities**
- **Summary - expected contributions to R & D in your subject**
- **Requirement Men / Material / Available Facilities**

BUDGET :

- **Staff - no of scholars and man hours to be used / no office assistants**
- **Permanent Equipment – essential items – instruments. Portable kits**
- **Travel - hiring charges - no purchase of a jeep / car / admissible taxi fare**
- **Overhead for the institution – furniture + electricity + water supply + space**
- **Contingency- for stationary, fuels, office items, wiring , postage, etc**
- **Consumables- tracing sheets, data forms, chemicals, ink cartridges, ribbons, etc**
- **Justification For Budget**

Typical Research Areas in Energy & Power

The list given below is pertaining to identified thrust areas of Research in Energy and Power for Electrical Civil & Mechanical Engineering disciplines and have been given here for reference of Research scholars & Faculty in Engineering

R&D in Energy and Power - Strategic Planning

- The R&D in generation sector needs a collaborative approach between Power industries and Universities and Research departments like DST, CPRI, MNRE, ***etc.*** for pursuing various research projects both in conventional and renewable energy sectors. These include amongst others:
- Ultra-supercritical (USC) and advanced USC Plants
- IGCC Technology
- CCS – both in post combustion conventional coal fired plants and in pre combustion mode on IGCC plants, Pressure Swing Application (PSA), Mono – Ethanol Amine (MEA) based pilot plants
- Waste heat recovery systems - vapor absorption air conditioning both for thermal and solar thermal plants, aqua ammonia cycle and organic Rankine cycles
- Artificial neural network for plant optimization, advisory and supervisory control
- NDT base diagnostic and inspection tools for condition monitoring
- Microalgae for CO_2 fixation
- Boiler combustion control, CFD for USC and SC units
- Integrated cascade hydro plants
- Pump storage plant units
- Split runner technology for hydro turbines
- Shaft seals for silty water in hydro units, on-line silt monitoring
- Cavitations studies, coating nano materials
- Thorium based nuclear power technology
- Isotope application in medicine, pharmacy and agriculture

The main areas of R&D in renewable and distributed generation

- Primary converters: Enhancement of efficiency and cost reduction
- Energy storage devices
- Micro-grid
- End use equipments
- Low wind area wind machines
- Solar thin film technology
- Nano-optimized cells
- Nano-composites
- Nano-structured materials for waste heat recovery
- Nano-catalysts for H_2 production
- Fuel cell technology and other new technology routes in renewable energies
- Thermo-photo voltaic Generation (TPV)

R&D & Cost Intensive Impact Projects in Green Power (RE & Conventional)

- Carbon Capture & Sequestration with minimized energy penalty in regeneration through Solar Thermal
- Solar Thermal Integration with Wind Power generation
- Bio gas operated Thermo photovoltaic generator
- Low silicon materials for Solar Cells together with alternative Poly Silicon Technologies with direct energy consumption below 165 kWh/ kg
- Thin film solar modules using CdTe, CIGS with over 10% efficiency and life over 20 years
- Concentrating Solar PV modules
- Low velocity Wind turbine designs
- Solar Energy beaming through Satellite
- Solar for Distillation, AC, Cooling & De-oxification of waste
- Bio-fuels from Algae