Government of India
Ministry of Communications & Information Technology
Department of Electronics & Information Technology

ICT&E R&D and Innovation Framework 2013

1. Introduction:

Technological changes through innovations and R&D have been the main driving force for increased productivity, economic growth, social transformation, and for reshaping and redefining almost every aspect of our lives and environment. Technological leadership is one of the major factors in achieving global leadership economically.

The Information, Communication Technology and Electronics (ICTE) is the world's largest and fastest growing industry and is increasingly finding applications in all sectors of the economy. With its impact in raising productivity, increasing efficiency in delivery of services and improving life style, it has come to the accepted as a key enabler in development and is globally being accepted as a "Meta-resource". The competitiveness of various industries is increasingly being determined by their ability to integrate ICTE in their business processes.

India's strength in Information Technology (IT) industry has played a key role in putting it on the global map in a relatively short time. India has had a profound effect on the global software industry, from modest beginnings with low-end activities, like code-testing and bug fixing, to system building. The IT industry continues to be one of the sunshine industries of the Indian economy, showing rapid growth and promise and this advantage needs to be systematically nurtured, maintained and enhanced so as to catapult the country into areas of high value addition.

Towards this end, developing new products, solutions and services with a view to monetize the Intellectual Property (IP) (to be referred to here as "product development,") needs to be the strategy of Indian IT industry. While promoting IT for the export market is obviously important, it is equally important to address domestic requirements and domestic societal challenges.

The Electronics sector in India, with burgeoning demand, is another sunrise sector. However, we are heavily dependent on imports to meet the domestic demand. Current weaknesses in electronics manufacturing can be overcome to a significant extent by leveraging existing strengths in ICT, electronics design, R&D and domestic market demand. Effective research, design and development in the ICT & Electronics development for growth of Indian economy is paramount, and necessary for achieving wide ranging innovations, product development, import substitution and system engineering and technology development in selected sectors of ICT&E. The draft National Electronics & IT Policies attempt to optimally leverage the global edge that the country has in ICT to advance national competitiveness in other sectors. Innovation and R&D occupy a pivotal place in both these draft policies particularly those of importance to the country as well as the economy in general.

In India, most of the research is being conducted by academic, public and private research institutions. The premier academic institutions like IITs, IIITs, NITs, some universities, autonomous societies of DeitY, R&D institutions of other Scientific Departments are conducting both basic and applied research. There is a growth of new academic institutions as well. Many State level Universities and technical institutions which have come up in the last one decade are running undergraduate and postgraduate courses in ICT&E. However, most of the newly established institutions have minimal research activities, attributed to shortage of faculty. There is a need to encourage faculty to pursue doctorates and take up research challenges.

In order to promote an inclusive vibrant and sustainable eco-system for R&D and innovation, Government, industry, NGOs and academia have to work together on a common platform to find solution for the growing societal needs and challenges. We require a strong research eco-system consisting of governmental support, right policies, strategic frameworks, private industry participation, encouraging start-ups and SMEs, academic and industrial research institutions and a pool of talented researchers. The expenditure on R&D in India is about 0.9 % of the GDP while in the most developed countries it is 2-4% of their GDP. Globally the share of private sector R&D expenditure is about 70% while in India it is about 30%.

DeitY has always acknowledged the R&D and promotion of innovation as an integral part of Electronics & ICT ecosystem and it has been supporting the entire value chain of R&D activities in the country ranging from the basic components to sophisticated product development. Department has taken various initiatives towards promotion of Research and Development in the different areas of ICTE including Communication, Convergence and Broadband Technologies, Microelectronics , VLSI, Nanotechnologies, electronic materials, industrial electronics, High Performance Computing, Networking, Cyber Security, medical electronics, strategic electronics, RF/Microwave and millimetre technologies, free and open source software, Language Computing and development of technologies for common man. The promotion of R&D activities has mainly been done through the programmes undertaken by several R&D Groups/divisions and R&D organizations of DeitY such as Centre for Development of Advanced Computing (CDAC), Society for Applied Microwave Electronics Engineering and Research (SAMEER), Centre for Materials for Electronics Technology(C-MET) and Media Lab Asia(MLAsia). DeitY has also supported innovation and incubation activities through schemes like Technology Incubation and Development of Entrepreneurs (TIDE) and promotion of technology development through collaborative R&D between

industry and academic institutions through Multiplier Grants Scheme (MGS). Through the above activities supported by the Department over the years, a number of technologies and products have been developed and some of them have also been transferred to the industry. The support provided by the Department has also helped in building R&D infrastructure and design capabilities at a large number of academic and research institutions in the country. DeitY has created sizable R&D base, growth of competencies in emerging areas of technologies, in addition, the sponsored R&D projects have resulted in generation of trained technical manpower & expertise which is required to take up R&D activities in the academic & research institutions and the industry, publication of paper and filing of patents.

The purpose of the R&D framework is to bridge the current gaps in the R&D ecosystem and take it to the next level of development.

Through this R&D framework, DeitY aims to identify innovations required for country's development, harmonize the ongoing efforts by focusing on the essential priorities of various sectors and to give a strategic direction and focus to its R&D initiatives and endeavors.

2. Vision:

The vision of the "ICT&E R&D and Innovation framework" is: "To attain global leadership in the ICT&E sector by building a vibrant eco-system to nurture, encourage, promote, facilitate and support research, innovation and product development for rapid, inclusive and sustainable growth of the country."

3. Mission:

To develop an effective and efficient R&D eco-system by channelizing the research efforts and resources into the priority sectors of the economy and by achieving excellence in ensuring that these efforts lead to design,

development and manufacture of high quality, world-class products in the ICT&E sector, providing significant value addition to the economy.

4. Objectives :

(i) To promote ICT&E research, innovation, system design and product development especially in cutting edge technologies in areas like Nanoelectronics, Microelectronics, VLSI, MEMS, NEMS, Electronics Materials, Photonics, Mobile Technologies, High Performance and Next Generation Computing including Cloud and Ubiquitous computing, Green computing technologies, Perception Engineering and Human Computer Interfaces, Free and Open Source Software , Convergent & Communications Broadband technologies, Mathematical Modelling, Software Engineering, GIS/Image Processing, Big Data, Strategic Electronics, RF/Microwave and Millimetre wave Technology, Indian Language Technologies, Networking, Cyber Security etc.

(ii) To leverage R&D in ICT&E for key social sectors like education, health-care, agriculture, energy, water, waste management, transportation, security, skill development & employment generation, and empowerment of differently abled to achieve inclusive, sustainable and affordable solutions through multidisciplinary approach.

(iii) To promote R&D for infusion of ICT&E in Industrial sectors all sectors of economy.

(iv) Improve the R&D expenditure as percentage of GDP and that of the Private sector

(v) To facilitate R&D led manufacturing in the entire value chain of ICT&E system design and manufacturing

(vi) To establish Centers of Excellence in thrust areas of ICT&E for intensified and focused R&D activity

(vii) To support and encourage entrepreneurship to develop innovative products in thrust areas

(viii) To promote creation of incubation facilities/ centers for innovative product development

(ix) To strengthen the institutional mechanism for protection of IPR and to promote patenting

(x) To promote collaboration between Government, industry, NGOs, academia and R&D institutions to identify innovation needs in different sectors and the ways to develop and deliver content

(xi) To enhance availability of qualified R&D manpower significantly by enhancing the availability of significant number of PhDs arising out of applied research in disciplines related to ICT&E

(xi) To indentify and promote long term research in emerging areas to enable India move towards attaining global competitiveness

(xii) To promote basic research towards achieving outstanding scientific contributions

(xiii) To identify and update thrust areas from time to time.

5. Scope:

The scope of the R&D and innovation framework encompasses the entire R&D life cycle, comprising of stages like the need assessment and idea generation, project/programme formulation, research and innovation, developing the proof of concept, prototyping and field testing, product development and technology transfer for commercialization. The R& D Life Cycle is depicted in the Annexure.

6. Strategies:

In order that the R&D and innovation framework is holistic and effective in accomplishing the Mission and in realizing the vision, a set of strategies are to be designed and implemented to comprehensively address the needs of all the stages in the R&D life cycle. These strategies are outlined below:

6.1 Identify & prioritize the right themes

The thematic areas of focus of R&D will be identified to meet the present & future requirements of national priorities and strategic sectors and also to cover the thrust areas to be targeted to achieve international competitiveness and leadership in ICT&E.

The existing mechanisms for assessing the R&D needs of the country would be strengthened and an institutional framework put in place to study the technology trends, to identify themes of relevance and importance to India, and to develop research programmes in such areas.

i. A few mega themes linking to line ministries shall be selected and a top down approach adopted. The specific R&D areas in a theme will be identified in workshops involving stakeholders.

ii. The themes shall be selected to serve both the short-term and long term goals. Service Innovation, especially one that impacts the bottom of the pyramid shall be of great significance.

iii. Some of the themes suggested are disaster management, management of water resources, point-of-care diagnostics, security systems for public transport systems, energy and precision agriculture. Focus shall be on a few products which can lead to large turnover.

6.2 Maintain the Right Balance between basic research, applied research and product development

The thematic areas and projects in R&D fall in three categories viz. basic research, applied research and product development. Efforts in all the three categories are important for the overall impact to promote competitiveness. The allocation of R&D funds among the three categories will be decided at the beginning of each financial year. The indicative allocation among the three categories of R&D activities of DeitY is : 30% on Basic research (including blue sky /applied research), 50 % on

application development, and 20% on product development. The rate of allocation between the three categories will be reviewed periodically and readjusted.

6.3 **Enhance the quality and quantity of R&D**

(i) Networking of R&D institutions/groups will be strengthened in each thematic area for undertaking R&D and for generating Ph.Ds in each sub-theme.

(ii) Sub-critical funding to large number of organizations shall be discouraged as it leads to frittering away of scarce resources.

(iii) A cluster/consortium approach shall be followed, where relevant, so that the groups of researchers work collaboratively on each theme for having reinforcing effect.

(iv) Experts will be sourced to help create and mentor the R&D groups across Indian academic and R&D organizations.

(v) Industry will be associated in evolving and designing the R&D projects and steering the execution of the same, as applicable.

(vi) The respective Ministries and Departments of GoI dealing with the identified thematic areas will be associated with identifying specific areas of R&D and in translating the research into production.

(vii) A scheme of Awards will be instituted to promote excellence in R&D in ICT&E.

6.4 Focus on Product Development

A sizeable amount of research is undertaken at academic and R&D organizations with good research results. Any early-stage research outputs are, by their nature, broadly enabling. The Indian industry is unable to exploit these research results due to their priorities and various others factors. There is a need to encourage Industry to participate in collaborative R&D and for commercialization of the research outputs

from academic and R&D organizations. Further development activity on the research outputs may be required to transform them into products/field prototypes.

The following approaches will be adopted in Product Development:

(i) Product Development Centres will be established in the identified thematic areas in the R&D organizations within the fold of DeitY with financial support from DeitY. They will develop products using their own research and also using the relevant research results of academic and R&D organizations under the projects supported by DeitY. DeitY organizations may co-locate some of such product development centres at other organizations (academic or R&D).

(ii) DeitY will support academic and national R&D labs and technology parks in setting up product development/incubation centres in specific identified thematic areas with grant in aid. These product development centres will be involved broadly with following activities :-

- Assessment of Research results and identification of their potential for development of new technology and products
- Commercialization efforts through TOT and other means

(iii) DeitY will consider supporting innovative product development projects at academic, R&D institutions in respect of products required by an industry when the development activity is also co-funded by the industry with the aim of commercialization by them.

(iv) Academia, industry, entrepreneurs meets will be encouraged to showcase the research results and to understand the requirements of each.

6.5 Develop Entrepreneurship through promotion of Start ups, SMEs

Incubation activities will be strengthened for promotion of product development, entrepreneurship, start ups, SMEs etc. These activities include:

(i) Establishing incubation and product development centres/facilities co-located at academic/ R&D institutions and technology parks.

(ii) Mentoring entrepreneurs to develop technologies and products

(iii) Engaging faculty and researchers as advisers/consultants to entrepreneurs for developing technologies/products.

(iv) Enabling mechanism to support for promotion of innovation at early stage of education

6.6 Protect Intellectual Property Rights and Patents

(i) DeitY recognizes the importance of creating a framework for IPR protection. To this end, DeitY proposes to create a framework for protection of IPR and for promotion of technology transfer to industry from the academia and R&D organizations.

(ii) DeitY will continue to provide facilitation and financial support to DeitY societies and grantee institutions to enable them to protect IPRs and register patents.

(iii) DeitY will continue providing support to SMEs and start ups in protection of IPRs in the area of ICT&E.

(iv) The terms & conditions governing financial grant will be suitably modified so as to encourage/explore IPR creation.

6.7 Strengthen R&D Infrastructure

R&D infrastructure includes Centres of Excellences in specific areas, incubation centres and product development & test centres, R&D centres in

public private partnership for product development and networked R&D labs in specific areas.

(i) Centres of Excellence for R&D in cutting edge and emerging areas of ICT&E: These centres will be accessible to researchers at host institutions and researchers from academia, R&D institutions and industry for research development purposes

(ii) Incubation Centres : will be set up at DeitY institutions, academic and R&D institutions and technology parks, to support SMEs & Start ups

(iii) Product Development Centres: will be established at DeitY institutions, academic and R&D institutions.

(iv) R&D labs will be established for product development in specific cutting edge areas in public -private partnership

(v) R&D grid will be created for sharing of knowledge and facilities leveraging the National Knowledge Network (NKN) and other networks.

(vi) Support for product development to industry led research institutions

(vii) Enabling access to existing facilities of R&D institutions/organizations to academia.

6.8 Develop Human Resources

Programmes will be evolved for human resource development for R&D and product development in cutting edge areas, entrepreneurship and start-ups, project and programme management etc. These include the following:

(i) Programmes will be created for scientists of DeitY and its institutions for improving their skills in project and programme planning & management, continuous updation of their technical knowledge in the areas of their specialization by participation & interaction in the national and international events, short term assignments at expert organizations, specialized courses in IP generation, protection and technology transfer etc.

(ii) Specific programmes will be evolved to enhance R&D human resources in specific areas by increasing number of academic and R&D organizations to work in those areas and networking them.

(iii) Enhancing entrepreneurship and start-ups in specific areas involving Industry associations and R&D organizations.

(iv) DeitY will consider evolving a scheme of exchange of researchers between its societies and the Industry

(v) Incentives/awards for R&D achievements

(vi) Support for creation of central facilities at few institutions in niche areas accessible to other institutions across India

6.9 Promote public-private partnership for R&D

Existing measures will be strengthened and new measures will be initiated to develop public-private partnerships for R&D and technology/product development on the following lines:

(i) Academic /R&D organizations will be encouraged to design projects with participation by industry

(ii) Industry experts will be encouraged to participate in R&D at academic and R&D organizations on short term assignments and vice versa

(iii) Industry will be encouraged to utilize the major R&D facilities at the academic and R&D institutions for prototyping and product development

(iv) Suitable changes shall be made, if required, in the rules for funding to private entities and industries for conducting research in areas considered priority by the Government

(v) Academia and R&D institutions will be encouraged to setup incubation facilities to promote entrepreneurship and start-ups

(vi) R&D labs will be established for product development in specific cutting edge areas in public -private partnership

(vii) Establish linkages with the industry bodies

6.10 Promote International collaborations

Research and technology development need coming together of best brains and sharing of thoughts for achieving best results. International collaborations will be established in cutting edge technology areas of ICT&E for achieving best R&D results. The following initiatives are proposed in this direction:

(i) Bilateral/multilateral collaborations between the DeitY and the corresponding Ministry/Department in other countries based on mutual interest with due diligence for protection of innovation in cross-border research

(ii) Collaborations between specific academic and R&D organizations in India with identified academic and R&D organizations abroad for research and technology development.

(iii) Engaging international experts in R&D activities at/with Indian organizations

(iv) Providing international exposure to Indian R&D students, scientists and technology managers through participation in short term training programmes, exchange programmes, important conferences and study tours etc.

6.11 Focus on Translation :Transfer of Technology & Commercialization

R&D translation is very important aspect of the R&D cycle. The R&D translation includes filing for patents, technology transfer to industry, product development, incubation, enabling mechanisms for technology transfer to industry etc. The following are the measures proposed for translation:

(i) The academia and R&D organizations will be encouraged to file for patents before publication of their research results, wherever applicable

(ii) Process of technology transfer to industry/user agencies shall be simplified and encouraged.

(iii) A Venture Capital like model shall be followed for technology transfer.

(iv) Support for further development of selected research results from proof concept into technologies/products, if feasible, leading to subsequent technology transfer to industry

(v) Support to prototyping and pilot production for selected technologies in cutting edge areas provided through the incubation centres to start up companies and entrepreneurs

(vi) Establishing R&D labs for product development in specific cutting edge areas in public -private partnership

(vii) Setting up of a dedicated organization/institutional mechanism for promotion of technology transfer to industry from the academia and R&D organizations. This involves introduction of appropriately qualified professionals with management/marketing skills

7. Governance & Administration:

7.1 The existing governance mechanisms within DeitY will be appropriately reformed to enhance efficiencies, effectiveness, transparency and accountability.

7.2 A web-based portal will be established for managing the entire life cycle of R&D, sharing relevant guidelines, government initiatives (laws, schemes) etc. A dynamic database of researchers and with the areas of their research shall be created and made available.

7.3 A precise R&D manual will be designed to govern and regulate all aspects of R&D project management including

performance/outcome management and financial management etc

7.4 Timeline based methodologies shall be established for receiving and processing R&D project proposals**.**

Annexure

The R & D Life Cycle