IMPRINT
An Education Policy and Research Road Map to Dream India

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Abstract

IMPRINT is a joint initiative to developed by the Ministry of Human Resource Department (MHRD), is a roadmap for research and to bring the solution or to solve the major engineering and technology challenges in ten and its allied domain relevant sectors. It has been originated in the RETREAT with the Directors and Chairpersons of IITs in Goa on June 28-29, 2014. This programme includes 17 institutions, 10 domains and one objective i.e. accelerating innovation and research, contributing to the success of national campaigns and million challenges and billion minds creating the IMPRINT for India. It creates single window clearance systems for research funding. Science-engineering-technology-society nexus is a continuous and complementary cycle and the backbone of the eco-system through which humanity thrives and progresses. IMPRINT is a road map of it.

Key Words: Health Care, ICT, Nano Technology, Sustainable Habitat, Water and River Systems, Advanced Materials

Introduction: If science tells about 'Know-Why" i.e. Fundamental Knowledge, then engineering provides the basic Principles i.e. Know-how to convert scientific knowledge into practicable solutions and overcome challenges while technology i.e. Know-What Sell make such development commercially viable and sustainable. Science discovers the truth of the nature through curiosity driven act or necessity inspired effort, engineering invents and replicates by applying the fundamental laws and principles. Technology ultimately innovates new practices to translate a selected few of such discoveries and inventions into useful products and processes because the society needs, demands and consumes. While scientific knowledge is universal, engineering and technology often originate from local needs and aspiration. Thus science-engineering-technology-society nexus is a continuous and complementary cycle and the backbone of the eco-system through which humanity thrives and progresses. IMPRINT is a road map of it.

Impacting Research Innovation and Technology (IMPRINT) is a joint initiative developed by the Ministry of Human Resource Department(MHRD) is a roadmap for research and to bring the solution or to solve the major engineering and technology challenges in ten and its allied domain relevant sectors. The govt. of India launched the IMPRINT which is a Pan-IITs and IISc Bangalore joint initiatives to develop a roadmap for research to solve the major challenges of engineering and

technology in ten fields like health care, computer Science and Information Technology, Advanced materials, water resources and river systems…

The Concept of IMPRINT has been originated in the RETREAT with the Directors and Chairpersons of IITs in Goa on June 28-29, 2014. The passionate discussion led to the resolution that *India today should aspire to be a knowledge and innovation driven economy for employment generation and prosperity, and IITs and industries should join hands to solve the national challenges* and it is scheduled and launched by the Honourable President and Prime Minister of India on November 5, 2015 at the Rashtrapati Bhavan during the Visitor's Conference in presence of Directors and Chairpersons from all major science and technological educational institutions of the country (IITs, IISc, IISER, NITs, IIEST, etc) funded by Ministry of HRD.This includes 17 institutions, 10 domains and one objectives i.e. accelerating innovation and research Contributing to the success of national campaigns and million challenges and billion minds creating the IMPRINT for India. The imprint India initiative will pull in industries and create single window clearance systems for research funding.IIT Kanpur's director Prof.Indarni Manna has been designated as the national Co-coordinator and Prof A K.Singh of IIT Kanpur designated as convenor to lead the team of IMPRINT-India Comprising all IITs and IISc.The main aim of this blueprint which is prepared by the Ministry of HRD is to solve the major engineering and technology challenges in selected domains needed by the country. The corresponding e mail id of IMPRINT is imprint@iitk.ac.in and it website's URL is www.imprint-india.org. Prof V Kamakoti of IIT Madras, the Security and Defense theme leader, said, "I have been associated with IMPRINT right from its initial meetings in 2014. It gives us a multi-institutional and multi-disciplinary framework. We will know how to deploy problems, whom to approach, which will use it. Under IMPRINT we will get different views, and focus properly on what we want to solve."

The logo of IMPRINT represent by a stylish visual peacock, which is our national bird. It explains the different features of Indian i.e. grace beauty, prosperity and plurality of our tradition and culture. Five wings with ten colours, which is symmetry and balance represents the ten important domain of research. The logo of IMPRINT represents the true spirit of Indian.

Scope and Objectives: The 1st phase of IMPRINT is dedicated to creating policy documents which define the scope, strategy and mandate for pursuing engineering challenges in the country and the real engineering pursuit will be started in the second phase. There will be a project advisory committee (PAC) formed in the Dept. of Science and Technology and Rs.1000 crore would be made available in 2016-17 for the project under this imitative. This novel imitative comprises two fold identity i.e.

1. Developing new engineering education policy and
2. Create a roadmap on infrastructure

The main objectives of IMPRINT are

1. To identify areas which have immediate relevance to society requiring innovation.
2. To direct the scientific research into identified areas.
3. To ensure higher funding support for research into these areas.
4. To measure the outcomes of the research effort with reference to impact on the standard of living in the urban/rural areas.

IMPRINT India will focus on ten themes with each to be co-ordinated by the Professors of IITs and IISc.The details about the coordinator,convenor,domains,their coordinator and the e mail id of them are mentioned in the below Table.

Sl No	Theme	Institution	Coordinators(s)	E.Mail ID
	IMPRINT Co-Ordinator	IIT Kanpur	Pro.Indrani Manna	director@iitk.ac.in
	Convernor	IIT Kanpur	Pro.A K.Singh	amrendra@iitk.ac.in
1	Health Care	IIT Khargarpur	Prof. Suman Chakraborty & Prof. Goutam Saha	suman@mech.iitkgp.ernet.in gsaha@ece.iitkgp.ernet.in
2	Info. & Comm.Tech.	IIT,Khargapur	Prof. Anupam Basu & Prof. P. K. Biswas	anupam@cse.iitkgp@ernet.in pkb@ece.iitkgp.ernet.in
3	Advanced Materials	IIT Kanpur	Prof.Monica Katiyar Prof. A K Singh	mk@iitk.ac.in amrendra@iitk.ac.in
4	Water Resources and River Systems	IIT Kanpur/IISc.Bangalore	Prof. Vinod Tare & Prof. P. P. Mujumdar	vinod@iitk.ac.in pradip@civil.iisc.ernet.in
5	Sustainable Habitat	IIT Rookie	Prof. Pradipta Banerji	director@iitr.ac.in
6	Security & Defense	IIT Madras	Prof. V Kamakoti & Prof.Naresh Bhatnagar	kama@cse.iitm.ac.in naresh@mech.iitd.ac.in
7	Manufacturing	IIT Madras	Prof.M.S. Shunamugham Prof.N.Ramesh Babu	shun@iitm.ac.in nrbabu@iitm.ac.in
8	Nano Technology and Hard Ware	IIT Mumbai	Prof. V. Ramgopal Rao	rrao@ee.iitb.ac.in
9	Environmental Science and Climate Engineering	IISc.Bangalore	Prof. G. Bala & Prof. Ravi S Nanjundiah	gbala@caos.iisc.ernet.in ravi@caos.iisc,ernet.in
10	Energy	IIT Mumbai	Prof. Rangan Banerjee & Balsubramian Kavaipatti	rangan@iitb.ac.in bala.ramanathan@iitb.ac.in

The following Professors are representative of their concerned institutions. The name of the Professors and their e mail Id are represented below.

Sl No	Institution	Representatives	E.Mail ID
1	IISc.Bangalore	Prof.G Bala	gbala@caos.iisc.ernet.in
2	IIT BHU	Prof Prabhat Kumar Singh	psingh.civ@itbhu.ac.in
3		Pr.B Mishra	bmishra.phe@itbhu.ac.in
4	IIT Bhubaneswar	Prof.R.K.Panda	deanrd@iitbs.ac.in
5	IIT Mumbai	Prof.V.Ramgopal Rao	rrao@ee.iitb.ac.in
6	IIT Delhi	Prof.Kushal Sen	kushal@textile.iitd.ac.in
7	IIT Gandhinagar	Prof.Vikrant Jain	vjain@iitgn.ac.in
8	IIT Guwahati	Prof.SRM Prasanna	prasanna@iitg.ernet.in
9	IIT Hyderbad	Prof.Zafar A Khan	zafar@iith.ac.in
10	IIT Indore	Dr.Bupesh K Lad	bklad@iiti.ac.in
11	IIT Jodhpur	Dr.V.Narayanan	vnara@iitj.ac.in
12	IIT Kanpur	Prof.A .K.Singh	amarendra@iitk.ac.in
13	IIT Khargpur	Prof.Goutam Saha	gsaha@ece.iitkgp.ernet.in
14	IIT Madras	Prof.V Kamakoti	kama@cse.iitm.ac.in
15	IIT Mandi	Dr.Bharat Rajpurohit	bsr@iitmandi.ac.in
16	IIT Patna	Dr.Preetam Kumar	pkumar@iitp.ac.in
17		Dr.Arji Mondal	arjit@iitp.ac.in
18	IIT Roorkee	Prof.Arindam Biswas	arndmfap@iitr.ac.in
19	IIT Ropar	Prof.Subhendu Sarkar	sarkar@iitpr.ac.in

The Projects proposed under this would be subject to the following protocols,

1. Every IIT/NIIT/IISER/IIIT may form domain-specific, inter-disciplinary centers for addressing the challenges listed under each domain, before forming the domain they should give focus on the substantial strength.

2. Each centre may propose a set of research projects to be taken up each year in the DST format and submitted before 31st January each year.

3. The project Advisory committee (PAC) formed in the DST is authorized to examine the proposals and make specific recommendation.MHRD will be represented in the PAC.

4. Each project will be funded by MHRD and DST and it is proposed that about Rs.1,000 crore could be made available for the projects. This fund would be released to the Institutions, who have to maintain a separate account for each research centers and submit UCs before the claiming the next installments.

5. The PAC will undertake monitoring of the projects periodically.
   Domains of IMPRINT

IMPRINT is a national programme functioned by the IITs and IISc.IIT Kanpur act as a national coordinator of IMPRINT. Each domain of IMPRINT is divided into some themes and sub themes, target and topics for educational, orientation, research and innovation.

1. Health Care: According to World Health Organization (WHO) India has made developed in the health care but not to a satisfactory level. The IMPRINT India health care road map building exercise centres around educational and research perspectives on the concept of health living, prevention, diagnosis, treatment, after care management, legal issues and innovation ecosystems. IIT Kharagpur's Prof Suman Chakraborty, the Healthcare theme leader, said, "My job is to find a road map for education and research activities to address Healthcare challenges. We will work with the interface between medical applications and engineering technologies."

This domain includes health literacy and healthy living, prevention and primary community healthcare,diagnoistic imaging ,wearable devices and embedded systems, health care ICT,drug discovery and delivery, regenerative medicine, surgical and operative solutions, traditional health care, reducing communicable diseases burden, reducing non communicable disease burden, assistive technology and self management, health care management and legal issue and accelerating healthcare innovation.

This domain team is consisting of around121 faculty members from different IITs and IISc Bangalore who are act as core members of this domain.

2. Information and Communication Technology: Information and Communication Technology (ICT) and Communication Systems (CS) pervade all walks of life and this domain have classified into four thematic layers.

Ist layers is known as data acquisition and processing which includes sensors, bio sensors and MEMS, multimodal data, multilingual data and novel interfaces.2nd layer is known Communication, which includes data communication and networks, spectrally efficient communication, secured communication, THz technology and wireless frontends.

3rd layer is known as computation which includes data analytic, text analytics, cognitive computing, digital humanities, speech and language processing and 4th layer is known as computation infrastructure includes embedded systems and VLSI, verifiable and reliable systems, encryption and security and power aware design.This domain team is consisting of renowned professors of IITS and IISc Bangalore. This programme aims to Identify the gaps and the "things to be done" in India to make self-reliant in these aspects.

3. Energy: The IMPRINT energy imitative plans to create a roadmap to enhance the competitiveness of Indian industry in the energy sector by collaborative research, design and development, devise grand challenges for multidisciplinary research missions and enable disruptive technologies. This theme includes energy education, conventional energy resources, like coal, oil, natural gas and nuclear. Renewable energy resources include solar, thermal, solar PV, Biomass/Biofuel, and wind/Hydrogen. Energy storage includes electrochemical, mechanical, chemical, thermal energy storage and hydrogen, energy systems and efficiency.

4. Sustainable Habitat: A recent discussion organized by IIT Rookie touched on variety of issues and concerns reading sustainable habitat. The themes of this domain includes architecture and built form urban planning and design, physical infrastructure, social infrastructure, water and sanitation, transportation, economy, energy and environment, governance, housing and resilience. The aim of

this domain is provide livability accommodation to 250 millions in urban area by the end of 2030 and develop an education policy and framework to achieve a sustainable habitat in India.

This domain will establish a pragmatic index to measure the progress of the proposed education and research policy; it may be short term or long term.

5. Nano-Technology Hardware: The IMPRINT programme is expected to lay down a roadmap for India to achieve a leadership position in nanotechnology product development. In the development of Nano-technology India occupies third position in research publication and 2nd interms of patent filling. It gives importance to five problems areas like Security Healthcare, agriculture, Pedagogy and Environment and which is known as SHAPE. This is indeed the areas where India faces a grand challenges program can shape the country's future and make significant impact through clearly defined goals and objectives. The five problems area to be addressed through the IMPRINT India will be based on the concepts of high technologies at an affordable cost addressing to the social needs. The IMPRINT Nano-technology program will be led by National coordinator (a leading researcher with expertise in transactional research) who reports to the IMPRINT India chief coordinator of the ministry.Prof. V Ramgopal of IITB is the theme leader of this domain.

6. Water Resources and River Systems: The main focus of IMPRINT initiative is to evolve an appropriate educational and research policy that carries complement effort to overcome the critical challenges of water resources and river systems. The main theme of the river systems are river basin, water in urban systems, water in rural eco systems, water and agricultural, spatial real time data infrastructure. The major challenges of this domain are maintain and improve the health of water bodies, convert rapid flows to sluggish flows to increase water availability for human and eco systems. Disseminate traditional knowledge and practices regarding management to water and water bodies and increase water uses efficiency through cost effective technology.

7. Advanced Materials: The main objective of this domain of IMPRINT is to come up with research and education policies which will provide the development path for advanced materials of our nation. Advanced materials are the heart of many technological developments that touch our lives.

Generally materials are divided into two themes i.e. structural and functional.

Structurural materials include steel, cement, light metals and alloys which are needed in huge quantities for development of the nation. Functional materials include electronic materials, energy materials, optoelectronics materials and devices, earth abundant element based functional materials.

8. Manufacturing: Literally manufacturing means converting ideas into useful products. It refers to the application of enabling technologies in manufacturing. Manufacturing intensive sectors are automobile, space,health care,energy,textile and defence.It is a wealth creating activity and efforts should be made to develop small and micro scale industries. This domain of manufacturing includes process for shape changes, process for property changes, verification of manufacturing parts, manufacturing equipments and tooling, develop manufacturing strategy, and develop the education policy on manufacturing education.

9. Security and Defence: The IMPRINT India initiative will attempt to develop a blueprint of the framework including education policy aimed to generate skilled manpower needed to work on the challenges posed. This domain has classified into four themes (1) Life Sciences, (2) Materials (3) Electronics and Communication Systems and (4) Combat Engineering Systems.

Life Sciences include the health care and nuclear biological chemical defence.Materials includes smart materials, sensors. An electronics and communication system includes hardware design and its application. Systems software and application software. Last but not least i.e. combact engineering systems which includes aircraft and submarines, battle tanks, autonomous systems, armaments and engineering support systems.Prof. V.Kamkati of IIT Madras and Prof.Naresh Bhatnagar of IIT Delhi are working as domain team leaders with a group of members and all are belongs to the different IITs.

10. Environmental Science and Climate Changes: It is a major concern of 20th century because of growing population and industrialization, there is a tremendous increase in demand of energy, water, food and other products are an increase which is highly essentials for the increase of standard of living. The theme of this domain includes aerosols and clouds, air quality, carbon cycles, clean energy materials, climate modeling, coastal zones, data assimitation,drought analysis, foresting, geo engineering,glaciers,hydro geo chemistry, mitigation policy, natural hazards assessments, rainfall design and manufacturing ,tropical cyclones, urban foods, water pollutions, water resources and wind energy. These domain members are consisting of the professors of IITs and IISc Bangalore.

"It's important to look towards affordable technology," PM Modi said, adding that "science is universal but technology has to be local." 'Imprint India' is an Inter Ministerial Group that is set up as a single-window mechanism to screen research proposals from India's research and technology institutes. It is a single window funding clearance mechanism to get Indian technical institutions to conduct original research in areas where the country heavily dependent on foreign technology. Science and technology secretary Ashutosh Sharma said the 10 areas that have been identified for research focus "will need convergence of all sorts of intellectual capabilities and interdisciplinary approach."Higher education secretary V.S. Oberoi said "IMPRINT as a national movement will provide an opportunity for higher education institutes of the country to integrate with all grass root level institutes, industry and organizations, mutually complement and deliver what the country demands and aspires.'

Conclusion: IMPRINT is a national movement of MHRD which provides ample no of opportunities not only to IITs and IISc but also to policy developers, researchers and scholars. It is a single window mechanism to screening the different research proposals. Thus it plays a very dominant role in the development of the nation particularly in the field of research. Currently, 200 faculty members are a part of IMPRINT. The MHRD & IMPRINT has published in different regional and national newspapers for the preliminary project proposals latest by Feb 20,2016. Prof Bala Govindaswamy, Coordinator from IISc expressed, "I am excited about it. This initiative will make a huge difference to society. There are a billion minds to solve a million problems."

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