First MHRD Supported Pan-IIT + IISc Joint Initiative

- Identify engineering challenges faced by the nation
- Relevant to society’s demand and aspiration
- Directed/translational research to develop viable technology
- Create opportunities crowd sourcing and onus sharing
- Overall aim: Inclusive Growth and Self-reliance
- Engineering challenges identified under 10 technology domains (two areas: living and material world)
- Enhanced funding for research projects
  - Convergent action by Ministry/Government Agencies
  - Industry participation is most desirable

Phase I: Policy document
Phase II: Technology development
COMPONENTS ESSENTIAL FOR SOCIETAL GROWTH

SET [Science - Engineering - Technology] PATH TO PROSPERITY:
(a) Knowledge (data to wisdom); (b) Opportunity (job and business)
Academia creates/disseminates **KNOWLEDGE**

**MODERN INNOVATION ECO-SYSTEM**

Society **CONSUMES** and **DEMANDS**

Research organization pursues **INVENTION** in S E T

Industry produces/provides Innovative solutions as **Viable Technology**
Why is engineering education important in India?
- Majority of India’s challenges/demands are of engineering origin
- Education that promotes innovation/entrepreneurship needed
- Huge demand/scope for infrastructure augmentation, harnessing mineral/material resources, capacity enhancement
- Significant scope for manufacturing of engineering goods/service
- Engineering manpower needed (degree, diploma, trainee, labor)
IMPRINT – Part A

Education Policy for Inculcating Scientific Temperament and Innovation Skills

- School (STEM)
  - Interest in S&T

- University (UG/PG levels)
  - Engineering Branches

- Research Univ + R&D Labs (PDF/PhD/Projects)
  - Interdisciplinary

- Technology aided education
- International component

Manpower + Knowledge

Solution to India’s own problems
IMPRINT – Part B

Research Roadmap for Technology Domains

Competence and Capability

Infrastructure

Technology

Product

Process

Goalposts

10 Domains and Related Themes/Targets/Topics

Targets

Gap

Map

Bridge

Technology Manpower Infrastructure
HEALTHCARE

Themes:
- Campaign on health and healthy living
- Affordable diagnostic tools and imaging
- Prosthesis and implants
- Innovative devices, embedded systems
- Point-of-care diagnosis
- ICT solutions for healthcare
- Regenerative medicine
- Surgical and operative solutions
- Traditional healthcare
- Reducing communicable diseases
- Healthcare management and legal issues
- Accelerating healthcare innovation

Objective:
Making health care effective and affordable for all
Objective: Affordable and sustainable habitat for all in India

SUSTAINABLE HABITAT

Themes:

• Architecture & built forms
• Urban planning & design
• Physical infrastructure
• Housing for all
• Social infrastructure
• Water & sanitation
• Transportation
• Smart city
• Energy & environment
• Disaster mitigation
• Governance
Objective:
Attain energy security and make alternative and renewable energy affordable

Themes:
- Fusion technology
- Clean coal technology
- Renewable energy
- Hydrogen based energy
- Energy storage
- Energy systems & efficiency
- Revise energy strategy
Objective: Address critical challenges of water resources and river systems

WATER RESOURCES AND RIVER SYSTEMS

Major Themes:
- River Basins
- Water in Urban Systems
- Water in Rural Ecosystems
- Water & Agriculture
- Water & Industry
- Spatial Real-time Data & Infrastructure

Complementing Science and Technology Measures:
- Valuing water
- Governance
- Knowledge & Capacity Development
Objective:
Growth and prosperity without adverse impact on environment

ENVIRONMENTAL SCIENCE AND CLIMATE CHANGE

- Climate science
- Monsoon prediction
- Ocean studies
- Air pollution
- Aerosols and climate
- Water resources and pollution
- Forests and climate change
- Glacier retreat
- Capacity development
Objective: Achieve leadership in hardware though advanced materials

ADVANCED MATERIALS

- **Structural Materials**
  - Steel
  - Light alloys
  - Advanced composite materials
  - Particulate materials
  - Ultrahigh temperature materials

- **Functional Materials**
  - Electronic materials
  - Energy materials
  - Optoelectronic materials and devices
  - Smart materials
  - Earth abundant element based functional materials.

- **Emerging Materials**
  - Nanomaterials
  - Biomaterials and devices
  - Polymeric and soft materials
  - Glassy and amorphous materials
  - Bio-inspired and patterned functional materials.

- **Integrated Computational Materials Engineering (ICME)**

IIT Kanpur
Objective: To improve the competitiveness of Indian manufacturing industry

MANUFACTURING

- Manufacturing Processes
  - Processes for Shape Changes
  - Processes for Property Change
- Verification of Manufactured Parts
- Manufacturing Equipment and Tooling
- Enabling Technologies
- Manufacturing Strategies

IIT Madras
Objective: Nanotechnology product/hardware development for improving quality and security of life

NANOTECHNOLOGY HARDWARE

Improving quality and security of life
Objective: Lend an edge and indigenise the country’s security and defence capabilities

SECURITY AND DEFENCE

- Combat Engineering Systems
  - Aircrafts and Submarines
  - Battle Tanks
  - Autonomous Systems
  - Armaments and Engineering Support Systems
- Cyber security
- Electronics and Communication Systems
  - Hardware Design
  - System Software
  - Application Software
- Strategic Materials
  - Thorium technology
  - Smart materials
  - Rare earths
INFORMATION AND COMMUNICATION TECHNOLOGY

Objective:
Global leadership in information & communication technology

Themes:
- Data acquisition and processing
- Communication
- Computation
- Computational infrastructure
Synergy with National Missions

Clean Ganga
Rashtriya Avishkar Abhiyan
SWAYAM
Clean India
PMMM-NMTT

UNNAT BHARAT ABHIYAN
Digital India
Power To Empower
IMPacting Research INnovation and Technology (IMPRINT)  
Guideline for Research Proposals under IMPRINT

- IMPRINT for translation of innovative ideas/knowledge into viable technology (product or process)
- IMPRINT is not meant for only open ended fundamental research
- Manpower training is desirable for sustainability
- New capacity building should be avoided as far as possible
- Funding may be utilized for small equipments, scholarship, honorarium, contingency, consumable, travel, communication, information dissemination, and pilot scale demonstration
- Partnership with industry and stakeholders are strongly encouraged
- Submission/appraisal/approval mechanism: Project team ⇒ R&D office/Dean ⇒ IMPRINT Domain coordinator ⇒ IMPRINT national coordinator ⇒ DST-PAC/Ministry ⇒ Approval
- Strong monitoring (by domain wise peer group) needed
- Information dissemination by periodic e-Newsletter and website
- An annual exhibition/fare and conference of IMPRINT desirable
Million challenges, Billion minds

The second largest population of the world which will soon be the youngest, now aspires and deserves a better quality and security of life.

Engineering can and should provide solutions for societal demands, challenges and aspirations of young India.

Thank you very much!