

TWO BEST PRACTICES

BEST PRACTICE 1

INNOVATION BASED LEARNING FOR INCUBATION AND ENTREPRENEURSHIP

Objectives of the Practice

Towards inculcating an innovative culture and creative thinking leading to a start-up ecosystem, the curricula and syllabi were restructured with emphasis on application through mini and major projects, internships, industry connect, product development, technology transfer and establishment of an incubation cell. The best practices to achieve the objective include:

- Adopting experiential learning through enriched academic curricula to solve societal problems
- Imparting practical skills to students utilizing the well-equipped infrastructure meeting the industrial standards
- Developing indigenous technologies and products for a self-reliant India (*Aatma Nirbhar Bharat*)
- Enabling Karunya community to incubate their ideas leading to start-ups and entrepreneurship.

The Context

The justification for introducing this best practice arise from the need to:

- Meet the demands of Industry 4.0
- Achieve the Sustainable Development Goals (SDGs)
- Face the challenges of food, water, healthcare, energy security and livelihood
- Fill the gap in the area of practical training in the present curricula
- Connect between academia and industry - presently a weak area
- Provide a new dimension to the existing education system
- Make the student community solve practical problems
- Take technology from lab to land
- Expose the student community to global standards in learning
- Create confidence among the student community to solve problems on the floor and field
- Contribute to the theme of Self-reliant India (*Aatma Nirbhar Bharat*)
- Develop a model for entrepreneurship ecosystem in an educational institution

The Practice

In a phased manner, KITS introduced the best practices in teaching and learning with respect to innovation and entrepreneurship from 2016 down to 2029, by making changes in the curricula and syllabi, assigning more credits for practically oriented learning process, establishing KIIC and

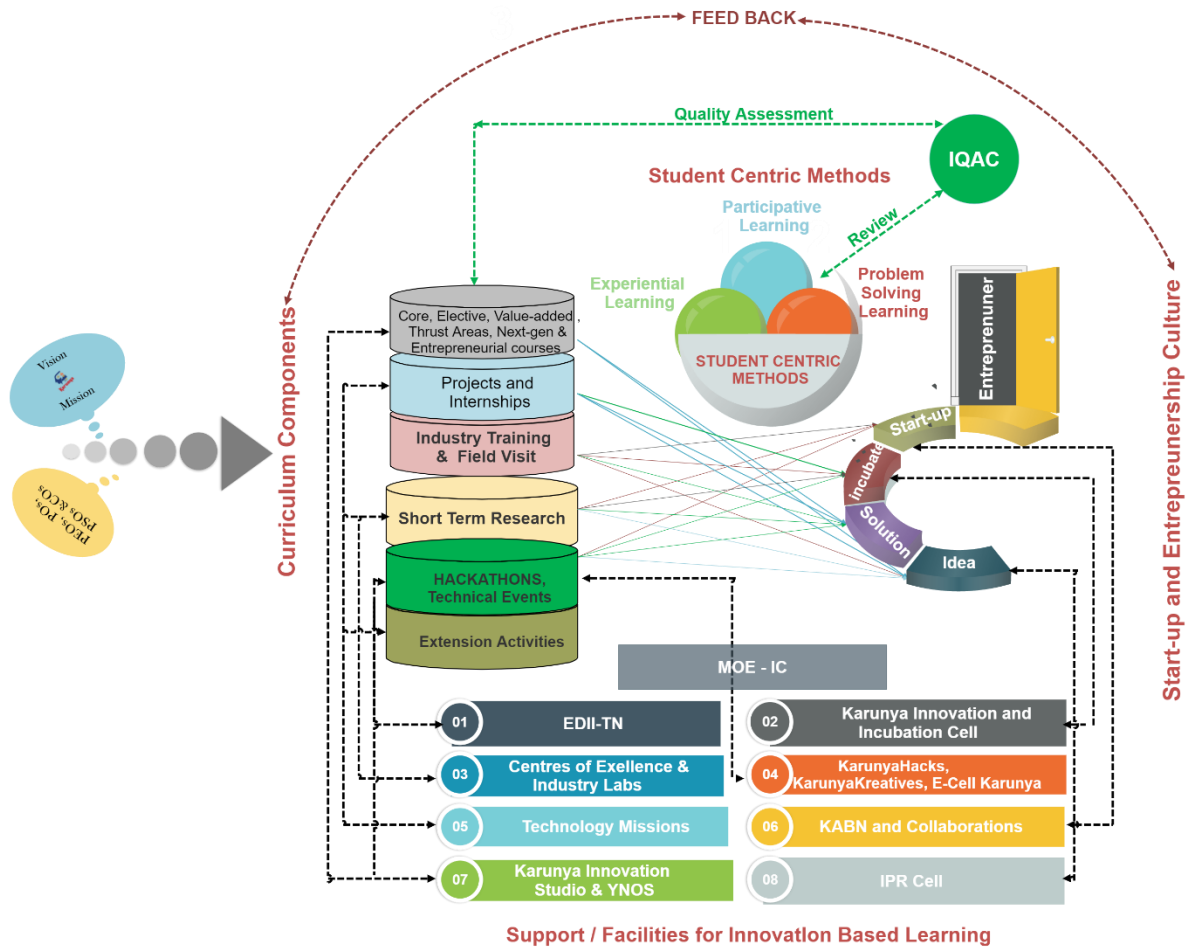
connecting students with the industry for internship and project work, providing industry exposure to the faculty during summer, conducting specific training programmes, introducing considering mini project, literature review, seminars and model making in the Quality Assessment component of evaluation.

The different components of the practice are listed below:

- Transdisciplinary studies and related activities, knowledge application and broadening of the expertise of faculty and students, in the context of NEPA
- Entrepreneurship oriented courses and development of products and processes integrated with practicals
- Digital learning leading to innovation and extension
- Funded research projects, product development and consultancy involving students
- Peer learning to promote healthy interaction and inculcate a team spirit
- Active blended learning and project based learning

Specific Initiatives:

- Experiential learning encompassing project based, participative and problem solving approaches
- 1 to 3 credit programme-specific skill-oriented courses namely Entrepreneurship Development to Business Management; Biomedical Engineering Entrepreneurship; Concepts of Entrepreneurship; Entrepreneurship and Product Development; Entrepreneurship, IPR and Biosafety; Basic Course in Entrepreneurship and Advanced Course in Entrepreneurship
- Utilizing the inter-departmental facilities in project work and research
- Exchange programme in learning and research with institutions in other countries under the aegis of International Association for the Exchange of Students for Technical Experience (IAESTE)
- Establishment of Institute's Innovation Council (IIC) and Advisory Committee as per the Central, National and State guidelines, collaborating with MoE/AICTE and Entrepreneurship Development Innovation Institute, Tamil Nadu (EDII-TN)
- Induction of Karunya Alumni Business Network (KABN) to mentor and support students and faculty in entrepreneurship development
- Training of faculty members in entrepreneurship by NEN and AICTE
- Establishment of Karunya Innovation and Design Studio (KIDS) to sow the seeds of innovation in the minds of students
- Formulation of 25 Technology Missions to develop innovative and emerging technologies and applying them for socially relevant research and product development
- Utilization of YNOS software of IITM to promote entrepreneurship
- Establishment of a Company under Section 8 within Karunya to provide students an opportunity for startups and entrepreneurship
- Trainings at the centers of multinationals such as Siemens Ltd., Bosch, IBM, NVIDIA, Seuz, and Tessolve Semiconductors Pvt. Ltd on campus

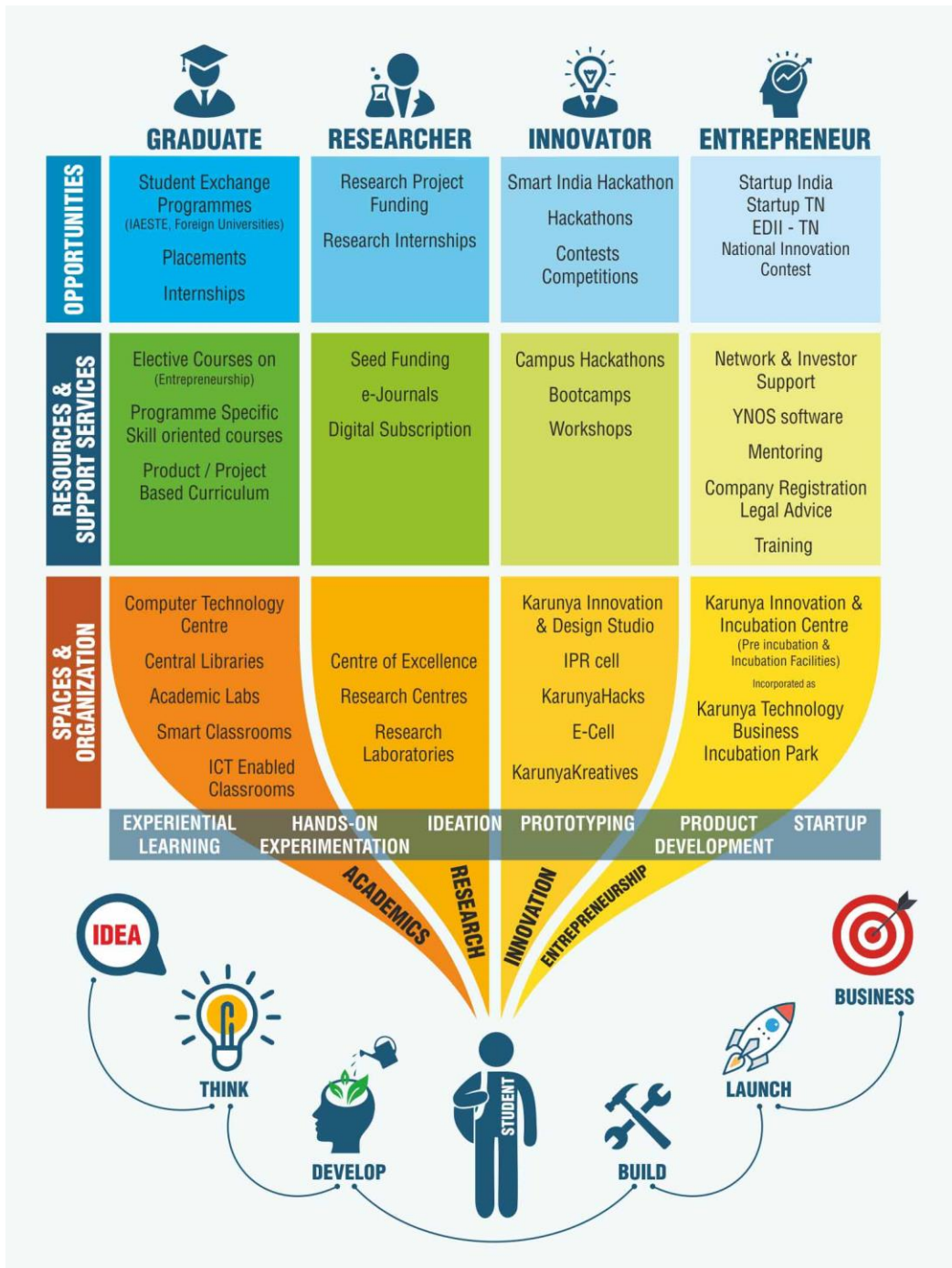


Evidence of Success

Activity	2015-2020
Incubation Entrepreneurship Cell	Established in 2016
No. of incubatees	13
No. of start-ups (by students)	38
No. of Courses on Entrepreneurship	7
No. of faculty trained in Entrepreneurship	7
No. of students undertaken courses	3746

No. of patents filed and published/ No. of students involved	66/50
No. of patents granted	5
No. of COVID specific products of faculty and students	10
No. of internships abroad	238
No. of technologies commercialized	3
Student projects from Harvard funding for innovation in health sector	32
Company registration under Section 8	Initiated and registered in 2021

The success of this practice can be mapped to the changes brought about in the curriculum, syllabi, credits and motivation and capacity building among the faculty and student community by Karunya Competency Development Cell established in 2016.



Problems Encountered:

- Limited industry-academia connect in the Indian context
- Gestation period for training the faculty and students
- Initial resistance by academicians to change the curricula and syllabi
- Lockdowns and containment did not permit the students to physical classes from March 2020 to the present

Notes

The formation of a Section 8 Company under The Companies Act, 2013 to promote innovation based learning, leading to incubation and entrepreneurship is recognized as the need of the day in the light of the initiatives taken up by the GoI, such as Startup India, Make in India and Self Reliant India (*Atma Nirbhar Bharat*). The changes brought about in TLP, establishment of KIDS and the funds received from Harvard Medical School and Boston Children's Hospital have helped the students of KITS in their pursuit of incubation and startups. The revision of syllabi of the order of 20% have been well received by the student community, equipping them for demands of Industry 4.0. The other HEIs may emulate these practices, if they have not already ventured into these areas

BEST PRACTICE II

KARUNYA TECHNOLOGY MISSIONS IN EMERGING RESEARCH DOMAINS

Objectives of the Practice

The main objective of the Technology Missions (TM) is to develop innovative technologies and apply emerging techniques for socially relevant research and product development by ensuring team work among students and faculty members. The pathways followed to realize the objective are:

- Achieve outcomes in the shortest possible time on a Mission mode
- Initiate capacity building activities, adopt technological and scientific interventions in the four focal areas, namely water, food, healthcare and sustainable energy to develop techno-economic solutions
- Disseminate knowledge through research publications, develop technology and products, generate IP and collaborate with academia and industry
- Create scientific temper and spirit of enquiry among students by evolving an ecosystem to ideate, innovate and incubate.

The Context

Aligning with Industry 4.0, the technologies such as DA, Cloud Computing, AI, ML, Block Chain, DL, Sensor Applications, IoT and IoE have become part of the curriculum of all disciplines. In order to enhance its practical application, the need for a Mission mode to address them has been adopted by KITS. Apart from applying these technologies to solve societal problems in the Indian context, the lessons learnt by the application of these technologies in advanced countries can be introduced through collaborative ventures. To effectuate this, several relationships with international institutions have been established. In this context, the main thrust has been to develop modern tools in mathematics, computer science and electronics, and apply them in agriculture, food processing, healthcare, water resources management and sustainable energy. In addition, some of the enabling technologies to bolster the indigenous strengths of the country and the environmental implications of development have been identified.

The Practice

Of the 25 Technology Missions, five are in the area of Agriculture and Food Processing: Smart Technology for Precision Farming, Food Security, Indigenous and Herbal Medicine, Millets for Nutrition and Drone Technology. The objectives are to develop IoT and AI based management along with application of drones for smart farming, crop management, soil and plant health. It is also envisaged to popularize the health benefits of millets and develop millet processing technologies.

Two Missions related to water are executed by the Water Institute and the Department of Civil Engineering. Water treatment focuses on development of cost-effective methods for treatment of drinking water and grey water. Wetland conservation concentrates on the restoration of select Ramsar sites, in particular Point Calimere.

To promote interdisciplinary research, three Technology Missions have been initiated by the Departments of Agriculture, Aerospace, Chemistry and Civil Engineering. Isotope Application utilizes stable isotopes in hydrology and agriculture. Satellite and GIS mission maps spatial and temporal changes in environment, develops early warning systems for disaster management and creates database of natural resources. Drone Technology develops efficient drones for LULUC detection and spraying fertilizers in agriculture fields.

Four Technology Missions have been identified to find solutions to human health problems. Virology Mission led by the Department of Biotechnology is developing a screening platform for anti-viral agents against Japanese Encephalitis and Dengue. Stem Cell Mission has linked up with a Canadian expert to take up joint project. Nanotechnology for Healthcare Mission develops nanomaterials for drug delivery, nano-formulations for bacterial and viral diseases and drug eluting implants. Medical Devices Mission led by the Department of Biomedical Engineering develops cost-effective devices for the diagnosis of diabetes, cardiovascular diseases, orthopedic and neurological conditions.

To re-engineer the green energy technology programme, redefine the manufacturing processes in industries and develop a sustainable manufacturing environment; five Technology Missions, namely Green Energy, Green and Sustainable Manufacturing, 3-D Printing and Additive Manufacturing, Smart Intelligent Buildings and Smart City have been identified by the Departments of ECE, Civil and Mechanical Engineering.

Missions on Data Analytics and Block Chain, Cyber Security, ML for Societal Problems, Smart Vehicles and Robotics in Everyday Life have been launched by Circuit branches and Robotics Engineering Department. Mission on Rural Development has been setup to achieve the targets of SDGs.



Evidence of Success

The Technology Missions were initiated as part of the activities in the thrust areas of Karunya right from 2017. All the faculty members and staff were involved in the activities in one thrust area or other related to academics, research, consultancy and extension; a few alumni also enrolled under different thrust areas. Subsequently, it was decided to have Technology Missions with a leader and team to integrate next-gen and sustainable technologies to solve problems in the thrust areas.

After the introduction of this best practice, reviews have shown notable results as given below against the annual targets of 2020:

Sl.No.	Activities	Projections	Achievements
1	Awareness Programs/Seminars/Workshops	25	87
2	Project Proposals	25	25
3	Research Publications	25	27
4	Products and Patents	25	21
5	Collaborations (National & International)	7	5
6	Field Applications of Technology	12	14

- Development of drones for spraying fertilizers in sugarcane fields in Andhra Pradesh by Drone Technology for Agriculture Mission.

- Design and fabrication of a UV based product to sanitize vegetables and fruits to combat microbial contamination by Medical Devices Mission
- Fabrication of polyhouse for the semi-arid zones of India in collaboration with ARO-Israel by Precision Farming Mission
- Development of Python toolkit for calculating the schedule of rates for Time and Motion Study under MNREGA for NIRD, Hyderabad and RDPR of GoTN, by Rural Development Mission
- Fabrication and demonstration of electrocoagulation treatment for textile dye effluent by Water Treatment and Desalination Mission
- Development of sustainable technology for recycling the metallic wastes for Boeing company, USA by Green and Sustainable Manufacturing Mission
- Development of nanofibre incorporated masks for use during the pandemic time by Nanotechnology for Healthcare Mission

Problems Encountered and Resources Required

- The major problem encountered was the lockdown caused by COVID-19. However, it was an opportunity to develop several products under the Mission on Medical Devices to fight against COVID
- The short-term research grant from Boston Children's Hospital, USA enabled faculty members to take up product development under Medical Devices Mission.

Notes (Optional)

- The Technology Missions were initiated to apply existing and newly developed technologies in the thrust areas of KITS.
- The Mission mode has proved effective in achieving the scientific and research goals in a time-bound and efficient manner.
- Missions have contributed considerably to innovation, IP and application of modern technologies.
- Missions have led to more scientific papers and patents in the focal areas and had the involvement of maximum number of faculty and students.
- In the light of the advantages highlighted, it is felt that Mission mode activities can be adopted by other HEIs if they have not already taken up such Missions.