## 1. Technology Assessment at TRL 6 and Above

The Department of Scientific and Industrial Research (DSIR) sponsored a study under the A2K+ Studies programme, which was conducted by the Technology Information, Forecasting and Assessment Council (TIFAC). This investigation aimed to evaluate and compile original technological advancements within the domains of chemicals, pharmaceuticals, medical sciences, and healthcare. The study focused on technologies developed by laboratories, academic institutions, and start-up ventures. To achieve these objectives, stakeholder engagement, data collection, and assessment were performed by TIFAC. The study adopted a comprehensive and participatory methodology.

It involved the circulation of a questionnaire via Google Forms to various organizations, including public-funded institutions, private entities, laboratories, Technology Business Incubators (TBIs), and Atal Incubation Centers (AICs) for collect information on technology development. Additionally, interactive workshops were organized in collaboration with nodal organizations in various geographical hubs. These workshops consisted of two sessions: technology scouting, presentations and assessment, followed by panel discussions on the challenges, barriers, and optimum solutions to accelerate technology transfer and licensing. These workshops served as a platform for stakeholders to share insights and information on technologies developed by labs, academia, and start-ups, enabling a thorough analysis of their maturity levels and commercial potential. Expert-led panel discussions during these workshops facilitated the identification of issues, challenges, and barriers faced by innovators and researchers in technology transfer. The insights and recommendations gathered from these interactions form a vital part of the study. The assessment of Technology Readiness Level was done following BIRAC guidelines because it varies from sector to sector, industry to industry, and in many cases, technology to technology. During the assessment, it was observed that various technologies are hovering around TRL 3, 4, 5 or 6. It is either because they have to undergo a series of pre-clinical trials or demonstration in a relevant environment which is time and money consuming and stalls their reach in market.

To analyze the current R&D ecosystem in the Chemicals, Pharmaceutical, Medical Sciences and Healthcare sectors and to identifying barriers associated with technology licensing and commercialization, this study was sponsored by the Department of Scientific and Industrial

Research (DSIR), New Delhi, under the A2K+ study program to the Technology Information, Forecasting and Assessment Council (TIFAC), an autonomous body under the Department of Science & Technology.

For assessing the TRL, guidelines provided by Biotechnology Industry Research Assistance Council (BIRAC) were utilized, given the predominant focus of the scouted technologies on biotechnology, drugs, healthcare, and medical equipment / devices. Additionally, panel discussions were conducted to identify issues and challenges related to technology commercialization.

**Study conducted centers: (07)**

- CSIR-IICT Hyderabad Workshop (August-2022)
- CSIR-IICB Kolkata Workshop (September-2022)
- NIPER-Guwahati Workshop (November-2022)
- C-CAMP Bengaluru Workshop (December-2022)
- CSIR-CDRI Lucknow Workshop (January-2023)
- JSS College of Pharmacy Ooty Workshop (July-2023)

These workshops facilitated interaction with over **400 researchers/innovators** from different research labs, industries/startups and academia. Directors of various research labs, business development heads of institutions, and heads of Atal Incubation Centres actively contributed to the successful conduction of these interactive sessions. The technology presentation session included presentations by the innovator or researcher explaining the details of the technology they developed, respective readiness levels, the status of transfer, and commercialization issues, followed by a question-answer session and discussion on the technologies by the attendees/domain experts. The workshops concluded with panel discussions comprising leaders from the technology transfer and business development divisions.

About 70 best **researchers/innovators where selected from different part of the country.**

Department of Scientific and Industrial Research (DSIR) conducted six studies on "Techno-commercial assessment of TRL-6 and above technologies developed in India in academia, research labs and industry" for the best 71 innovation survey book conducted by Government of India, In domains of Chemical, Pharmaceutical, Healthcare and Medical Sciences. About six centers have been identified such as IIT Roorkee, IIT Jammu, TIFAC core in Herbal Drugs JSS College of Pharmacy-Ooty, FITT IIT Delhi, ICCW (IIT Madras) and IIT ISM Dhanbad. Centers studies were successfully completed and the report was released in a joint event organized by The Foundation for Innovation and Technology Transfer (FITT) and DSIR at IIT Delhi in the presence of Director-IIT Delhi, Dean (Corporate Relations)-IIT Delhi, Director Development Monitoring and Evaluation Office (DMEO), NITI Aayog, MD-FITT along with DSIR and FITT officials, innovators, entrepreneurs and PIs of different studies. Wisdom created by each PI was shared with others.

Dr.Shanmugam.R, Coordinator, TIFAC CORE in Herbal Drugs received Rs 83,600 from TIFAC New Delhi, Government of India (DST) and Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology to Conduct a Joint Workshop on "Techno-commercial Assessment of TRL 6 and above Technologies" In domains of Chemical, Pharmaceutical, Healthcare and Medical Sciences on 13th July 2023. About 16 following products were submitted for the best 71 innovation survey book conducted by Government of India. Out of 16 projects about 8 projects has been selected and the details are as follows,

1. Dr.R.Shanmugam & Dr.S.P.Dhanabal- Natural Insole Preparation from Banana Plant
2. Dr.R.Shanmugam &Dr.S.P.Dhanabal- Natural Insole Preparation from Coconut Plant
3. Dr.D.L. Priyanka & Dr.S.P.Dhanabal - Poly herbal gel formulation for psoriasis
4. Dr.K.Gowthamarajan- Curcumin Based Nanogel For The Management Of Diabetic Retinopathy
5. Dr. Karri V V S Narayana Reddy- Nano fibrous Scaffolds for diabetic wound healing
6. Dr. Karri V V S Narayana Reddy- Terbinafine HCl Nano emulsion gel
7. Dr.N.Krishnaveni- Instant chutney powder rich in vitamin D2 and Vitamin K1

8. Mr.G.Ramu- Stone off Herbomix: An Novel Pashanabheda

**Institutions/ University wise split up for the total 71 inventions selected under TRLs**

| S.No | Institutions | Projects Selected under TRLs |
|---|---|---|
| 1. | JSS College of Pharmacy, Ooty | 8 |
| 2. | Indian Institute of Science, Bengaluru | 5 |
| 3. | Institute of Chemical Technology, Mumbai | 4 |
| 4. | IIT Bombay, Mumbai | 4 |
| 5. | CSIR- National Institute for Interdisciplinary Science and Technology (CSIR-NIIST), Thiruvananthapuram | 4 |
| 6. | IIT Madras, Chennai | 4 |
| 7. | CSIR-Central Drug Research Institute, Lucknow | 3 |
| 8. | NIPER, Guwahati | 2 |
| 9. | S N Bose National Centre for Basic Sciences, Kolkata | 2 |
| 10. | E-Spin Nanotech Pvt. Ltd., Kanpur | 2 |
| 11. | Ekosight, New Delhi | 1 |
| 12. | B K Birla College, Kalyan | 1 |
| 13. | Spookfish Innovations Private Limited, Bengaluru | 1 |
| 14. | Jajal Medical Services OPC Pvt Ltd., Vadodara | 1 |
| 15. | Carepath, Bengaluru | 1 |

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| 16. | CSIR-Indian Institute of Toxicology Research, Lucknow | 1 |
| 17. | Eras Lucknow Medical College and Hospital, Lucknow | 1 |
| 18. | IIT Guwahati | 1 |
| 19. | Neuranics Lab Pvt Ltd., New Delhi | 1 |
| 20. | Embedded systems and robotics laboratory, Tezpur University, Tezpur | 1 |
| 21. | Sephirah Innovations Pvt Ltd., Kolkata | 1 |
| 22. | VIR Naturals P Ltd, Kochi | 1 |
| 23. | Avay Biosciences Pvt Ltd, Bengaluru | 1 |
| 24. | Dhanvantri Biomedical Pvt Ltd, Coimbatore | 1 |
| 25. | ETA Purification Pvt Ltd, Coimbatore | 1 |
| 26. | Salcit Technologies Pvt Ltd, Hyderabad | 1 |
| 27. | Primary Healthtech Pvt Ltd, New Delhi | 1 |
| 28. | Neukelp Innovation Technology Pvt. Ltd., New Delhi | 1 |
| 29. | Nutri genetics Life Science Pvt Ltd., Madurai | 1 |
| 30. | Comofi Medtech Pvt Ltd, Bengaluru | 1 |
| 31. | Pareto Tree Pvt Ltd., Gurgaon | 1 |
| 32. | Prantae Solutions Pvt Ltd (OPC), Bhubaneshwar | 1 |
| 33. | Venture Centre, Pune | 1 |
| 34. | C-Camp Bengaluru | 1 |
| 35. | Foundation for Neglected Disease Research, Bengaluru | 1 |

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| 36. | Rmmedi Innovations Pvt.Ltd., Kottayam | 1 |
| 37. | Halder Rehab Pvt Ltd, Cuttack | 1 |
| 38. | Chemical Sciences and Technology Division, CSIRNIIST, Thiruvananthapuram | 1 |
| 39. | Indian Institute of Technology (BHU), Varanasi | 1 |
| 40. | LVL Alpha Pvt Ltd, Pune | 1 |
| 41. | Ameliorate Biotech Pvt Ltd, Bengaluru | 1 |
| 42. | Mediklik Webhealth Pvt. Ltd., Pune | 1 |
| 43. | Miraqules Medsolutions Pvt Ltd, Bardhaman | 1 |