



KARNATAKA RESEARCH, DEVELOPMENT AND INNOVATION POLICY



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BASAVARAJ BOMMAI
CHIEF MINISTER
NO:- CM/HOK/291/2022



VIDHANA SOUDHA
BENGALURU - 560 001

Date : 27-07-2022

Message

Government of Karnataka has always strived to lead the wave of Research and Innovation. In this spirit, we present to you the visionary policy, to encourage Research, Development and Innovation in the State.

The aim of this policy is not only to finance research based infrastructure and institutions, but also to provide support for robust and well-connected ecosystem, including easy access to skilled talent base, support for university-based cutting-edge research. The Policy also aims at fostering cooperation between industry and academia for innovative business start-ups.

With this in mind, the policy embraces five key focus areas; viz., Strengthening the governance and financial outlay of the research and innovation system, Strengthening the capacity for research and innovation, Research and innovation to drive the regional ecosystem, R&D and innovation to support entrepreneurship and MSMEs as well as for Promoting R&D and innovation in priority sectors for societal transformations.

I would like to extend my appreciation to the Task Force headed by Prof. Ashok Shettar, Vice-Chancellor, KLE Technological University for their knowledge partnership in curating this policy. I hope this policy enables Karnataka to spearhead contribution towards India's R&D economy as well to help scale the State's Research and Development to greater heights.


(BASAVARAJ BOMMAI)

**Dr. ASHWATH NARAYAN C.N**

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Electronics and Skill Development,
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Date: 27.07.2022

Message

Research is very important for an economy as it leads to overall progress and growth of a nation. The future economic progress of any country will be driven by the invention and application of new technologies.

Karnataka, over the years, has developed a flourishing Research and Innovation ecosystem. In order to achieve greater heights in the field of R&D, Government of Karnataka has taken the lead in coming up with a progressive R&D Policy. The policy emphasises “knowledge with impact”. It has a dedicated focus on a wide range of programmes, funding and incentives to support not just the creation of knowledge but also its translation into applications. The policy provides impetus to interdisciplinary research through inter-institutional collaborations in cutting-edge technologies to solve complex societal problems. It also plays a critical role in determining the regional competitiveness by attracting new-age industries that can trigger the socio-economic development of our State.

Department of Electronics, IT, BT and S&T has deep dived into the academic needs, industry trends and specific requirements, to come up with this holistic policy. I would like to place on record my appreciation for the Task Force Members in providing valuable inputs for the Policy. I am confident that the Policy will take State's R&D to the next levels.

(Dr.Ashwath Narayan C.N)



ಡಾ॥ ಇ.ವಿ. ರಮಣ ರೆಡ್ಡಿ, ಭಾಷಣೆ
ಸರ್ಕಾರದ ಅಪರ ಮುಖ್ಯಾಯ್ದರ್ಶಿ

DR. E.V. RAMANA REDDY, IAS
Additional Chief Secretary to Government



ವಿದ್ಯುನ್ಯಾನ, ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ, ಜ್ಯೋತಿಕ ತಂತ್ರಜ್ಞಾನ
ಹಾಗು ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಶಿಲಾಖೆ

Department of Electronics, Information Technology
Biotechnology and Science & Technology

ITD 38 ACS 2022

27/07/2022

Message

Research and Innovation ecosystem is a complex set of relationship among enterprises, universities, research institutes, intermediaries and governments. India is making significant progress in multiple innovation parameters such as university–industry collaboration, access to the latest technology and capacity for innovation. The fundamental challenge is a seamless end-to-end synergy, focus and target orientation of the involved entities and individuals. The Policy focuses on addressing these challenges through various funding schemes, encouraging partnership and cooperation with business/industry as a core activity of Higher Education Institutions, national and international collaborative research, capacity building, enabling and equipping schools to build a culture of discovery and innovation, creating a well-connected regional ecosystem where need-driven inventions feed basic research and vice versa. It also elaborates on strengthening the research and innovation support system for MSMEs as well as to strengthen the interdisciplinary research and innovation ecosystem to create impactful solutions in priority sectors.

The Task Force has done a commendable job in the formulation of the Policy. The Department of Electronics, Information Technology, Biotechnology and Science & Technology will work towards making the State of Karnataka the premier hub for Research, Development and Innovation and thereby contribute to the overall economic development of the State.

(Dr. E.V. Ramana Reddy)

ನೇ ಮಹಡಿ, ಗೇಟ್ ನಂ.5, ಬಹುಮಹಡಿಗಳ ಕಟ್ಟಡ, ಡಾ.ಬಿ.ಆರ್.ಅಂಬೆಡ್ಕರ್ ವೀಡಿ, ಬೆಂಗಳೂರು-560001, ಭಾರತ.
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**INNOVATE
KARNATAKA**



Prof. Ashok S. Shettar

Vice-Chancellor, KLE Technological University, Hubballi
Chairman, Karnataka R&D Policy Task Force

Message

Research and development are critical to fuel innovation and discoveries that transform our economy and address socio-economic challenges. Investing in research and innovation generates new knowledge, technologies, and jobs that power a vibrant economy and improve people's lives and opportunities.

A research and innovation system is a complex set of relationships among enterprises, universities, research institutes, intermediaries, and governments. Understanding the linkages among the actors involved is key to improving technology and its performance. The Karnataka Research, Development, and Innovation Policy attempts to take a systemic view of the research and innovation ecosystem to build a robust and enabling environment to grow the state's competitiveness and leadership in a knowledge-based economy. The policy aims to intervene in the innovation process as a whole -from knowledge production to the application of knowledge created, its introduction to the market, and its wide diffusion. The policy pays attention not only to the scientific and technological content of innovations but also to the institutional framework and the broader changes necessary for innovations to be introduced into the market and used.

The policy seeks to strengthen research and innovation capabilities across institutions and sectors, promote structures that nurture new enterprises (start-ups), and enhance the fluidity of knowledge flow among enterprises, universities, and research institutions. The recommended instruments are designed to engage & enable different actors to achieve the desired policy objectives.

As Karnataka is the first state in the country to come up with a comprehensive Research, Development, and Innovation Policy, we believe the proactive initiative of the State-Government will help Karnataka to take a leap in the global competitive landscape

(Prof. Ashok S. Shettar)



ಕರ್ನಾಟಕ ಸರ್ಕಾರದ ನಡವಳಿಗಳು

ವಿಷಯ: ರಾಜ್ಯದಲ್ಲಿ ಹೊಸ ಸಂಶೋಧನೆ ಮತ್ತು ಅಭಿವೃದ್ಧಿ ನೀತಿಯನ್ನು (Research and Development Policy) ರೂಪೀಸಲು ಕಾರ್ಯಪಡೆಯನ್ನು ರಚಿಸುವ ಕುರಿತು.

ಒದಲಾಗಿದೆ: ವ್ಯವಸೂಪಕ ನಿರ್ದೇಶಕರು, ಕೆಸ್ಟ್‌ಪ್ರೋವಿಂಟ್ ರವರ ಪತ್ರ ದಿನಾಂಕ: 12.10.2021 ಮತ್ತು ಇ-ಮೇಲ್ ದಿನಾಂಕ: 18.11.2021 ಹಾಗೂ 19.11.2021.

ಪ್ರಸ್ತಾವನೆ:-

ರಾಜ್ಯದಲ್ಲಿ ಸಂಶೋಧನೆ ಮತ್ತು ಅಭಿವೃದ್ಧಿ ನೀತಿಯನ್ನು (Research and Development Policy) ರೂಪೀಸಲು ಕೆಲ್ಲಾಗೂ ವಿಶ್ವವಿದ್ಯಾಲಯದ ಕುಲಪತಿಗಳಾದ ಪ್ರೌ. ಅಶೋಕ್ ಎಸ್. ಶಟ್ಟರ್ ರವರ ಅಧ್ಯಕ್ಷತೆಯಲ್ಲಿ ಕಾರ್ಯಪಡೆಯೊಂದನ್ನು ಸಾಮಾನ್ಯ ಸಾಂಸ್ಕೃತಿಕ ಮುಖ್ಯಮಂತ್ರಿಗಳು ಘೋಷಿಸಿರುತ್ತಾರೆ. ಮುಂದುವರೆದು, ಸದರಿ ನೀತಿಯು, ಎಲ್ಲಾ ವಲಯಗಳಲ್ಲಿ ಅದರಲ್ಲೂ, ವಿಶೇಷವಾಗಿ ಕೃಷಿ ಮತ್ತು ಆಹಾರ ವಲಯದಲ್ಲಿ, ನಾವಿನ್ಯತೆಯನ್ನು ಉತ್ತೋಜಿಸುವುದಾಗಿ ಮಾನ್ಯ ಮುಖ್ಯಮಂತ್ರಿಯವರು ತಿಳಿಸಿರುತ್ತಾರೆ.

2. ಮೇಲೆ ಒದಲಾಗಿರುವಂತೆ, ಸಂಶೋಧನೆ, ಮತ್ತು ಅಭಿವೃದ್ಧಿ ನೀತಿಯನ್ನು (Research and Development Policy) ರೂಪೀಸಲು ಪ್ರೌ. ಅಶೋಕ್ ಎಸ್. ಶಟ್ಟರ್ ರವರ ಅಧ್ಯಕ್ಷತೆಯಲ್ಲಿ ಕಾರ್ಯಪಡೆಯನ್ನು ರಚಿಸಲು ವ್ಯವಸೂಪಕ ನಿರ್ದೇಶಕರು, ಕೆಸ್ಟ್‌ಪ್ರೋವಿಂಟ್ ರವರ ಪ್ರಸ್ತಾವನೆಯನ್ನು ಸಲ್ಲಿಸಿರುತ್ತಾರೆ. ಸರ್ಕಾರವು ಸದರಿ ಪ್ರಸ್ತಾವನೆಯನ್ನು ಪರಿಶೀಲಿಸಿದ್ದು, ಈ ಕೆಳಕಂಡಂತೆ ಆದೆತಿಸಿದೆ.

ಸರ್ಕಾರದ ಆದೇಶ ಸಂಖೆ: ಖಚಿತಿ 242 ಎಸ್‌ಟಿಎಸ್ 2021 ಬೆಂಗಳೂರು, ದಿನಾಂಕ: 20.11.2021

ಪ್ರಸ್ತಾವನೆಯಲ್ಲಿ, ವಿವರಿಸಿದ ಅಂಶಗಳ ಹಿನ್ನಲೆಯಲ್ಲಿ, ಕರ್ನಾಟಕ ರಾಜ್ಯಕ್ಕಾಗಿ ಸಂಶೋಧನೆ ಮತ್ತು ಅಭಿವೃದ್ಧಿ ನೀತಿಯನ್ನು (Research and Development Policy) ರೂಪೀಸುವ ನಿರ್ದೀನಲ್ಲಿ ಡ್ಯೂಬ್ಲೀಯ ಕೆ.ಎಲ್.ಇ. ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ಕುಲಪತಿಗಳಾದ ಪ್ರೌ. ಅಶೋಕ್ ಶಟ್ಟರ್ ರವರ ಅಧ್ಯಕ್ಷತೆಯಲ್ಲಿ ಈ ಕೆಳಕಂಡ ಸದಸ್ಯರನ್ನೂ ಉಗ್ರೋಹಿಸಿದ್ದು, ಈ ಕೆಳಕಂಡಂತೆ ಆದೆತಿಸಿದೆ.

1. Dr. Ashok S. Shettar

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2. Prof. Rajesh Sundaresan

- Member

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3. Ms. Srivardhini K. Jha,

- Member

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4. Prof. S.M. Shivaprasad

- Member

Professor JNCASR/
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6. **Mr. Madhusudan V. Atre** - Member
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7. **Mr. Balaji Srinivas Holar** - Member
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Head of Multimedia Team,
Samsung R&D Institute Bangalore (SRI-B),
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8. **Mr. Anant R. Koppar** - Member
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9. **Prof. Meenakshi Rajeev** - Member
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10. **Managing Director** - Member Secretary
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ಮೇಲ್ಯಂದ ಟಾಸ್‌ಪ್ಲೋಸ್‌ಎಂ ಕನಾರ್ಟಿಕ್ ರಾಜ್ಯಕ್ಷಾಗಿ ಸಾರ್ವಜನಿಕ ಮತ್ತು ಖಾಸಗಿ ವಲಯಗಳನ್ನು ಒಳಗೊಂಡ R&D ನೀತಿಯನ್ನು ರಚಿಸುವುದು. ಶಾಲಾಮಟ್ಟಿದಿಂದ ಕಾಲೇಜುಗಳವರೆಗೆ ಮತ್ತು ವಿಶ್ವವಿದ್ಯಾನಿಲಯಗಳವರೆಗೆ ಸಂಶೋಧನೆ ಮತ್ತು ಅಭಿವೃದ್ಧಿಯನ್ನು ಉತ್ತೇಜಿಸುವತ್ತು ಗಮನ ಹರಿಸುವಂತೆ ಸದರಿ ನೀತಿಯನ್ನು ರಚಿಸುವುದು. ಇದಲ್ಲದೆ, ವೈಜ್ಞಾನಿಕ ಸಂಸ್ಕೃತಿ, R&D ಸಂಸ್ಕೃತಿ ಮತ್ತು ಉದ್ಯಮದ ಸಮನ್ವಯದೊಂದಿಗೆ, ವಿಶೇಷವಾಗಿ ಕ್ಷೇತ್ರ ಮತ್ತು ಆಹಾರ ಸೇರಿದಂತೆ ಪ್ರತಿಯೊಂದು ವಲಯದಲ್ಲಿ ಭವಿಷ್ಯದ ತಂತ್ರಜ್ಞಾನ/ನಾವೀನ್ಯತೆಗಳ ಅಭಿವೃದ್ಧಿಯನ್ನು ವರ್ಧಿಸಲು R&D ನೀತಿಯನ್ನು ರೂಪಿಸುವುದು. ಬೆಂಗಳೂರು ಅಲ್ಲದೇ, ಹುಬ್ಲಿ-ಧಾರವಾಡ, ಕೆಲ್ವತ್ತಾರ್ಗಳು, ಮಂಗಳೂರು, ಮೈಸೂರು ಮತ್ತು ರಾಜ್ಯದ ಇತರ ಪ್ರದೇಶಗಳಲ್ಲಿ ಆರ್ & ಡಿ/ಇನ್‌ಲೂವೇವೇಶನ್ ಕೇಂದ್ರಗಳನ್ನು ಸ್ಥಾಪಿಸುವುದರ ಮೇಲೆ ಸಹ ಸದರಿ R&D ನೀತಿಯು ಗಮನ ಹರಿಸುವುದು.

ಕಾರ್ಯವಹಿಗೆ ಅಗತ್ಯ ಸೆಕ್ರೆಟರಿಯೇಟ್ ಸೇವೆಗಳನ್ನು ಕೆಸ್ಪ್‌ಪ್ಲ್ಯಾಸ್ಟಿಕ್ ಸಂಸ್ಥೆಯು ಒದಗಿಸುವುದು ಮತ್ತು ಈ ಉದ್ದೇಶಕ್ಕಾಗಿ ಕೆಸ್ಪ್‌ಪ್ಲ್ಯಾಸ್ಟಿಕ್ ಹಂಚಿಕೆ ಮಾಡಿರುವ ಸರ್ಕಾರದ ಅನುದಾನದಿಂದ ಅಗತ್ಯ ವೆಚ್ಚನನ್ನು ಸಹ ಪೂರ್ಣಗೊಳಿಸುವುದು.

ಕನಾರ್ಟಿಕ್ ರಾಜ್ಯಪಾಲರ ಆದೇಶಾನುಸಾರ
ಮತ್ತು ಅವರ ಹೆಸರಿನಲ್ಲಿ,

ರಮಣ. B.S.
೨೦/೧೧/೨೦೨೧
(ಸುಮಾ ಬಿ. ಎಸ್.)

ಸರ್ಕಾರದ ಅಧಿನೇ ಕಾರ್ಯದರ್ಶಿ,
ವಿದ್ಯಾನಾಳ್ವಿತ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ, ಜ್ಯೋತಿಕ ತಂತ್ರಜ್ಞಾನ
ಹಾಗೂ ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಇಲಾಖೆ,
(ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ).

ಇವರಿಗೆ:

- ಪ್ರಥಾನ ಮಹಾಲೇಖಾಲರು(ಜಿ&ಎಸ್ ಎಸ್ ಎ)/(ಇ&ಆರ್ ಎಸ್ ಎ), ಕನಾರ್ಟಿಕ್, ಬೆಂಗಳೂರು-560001.
- ಪ್ರಥಾನ ಮಹಾಲೇಖಾಲರು (ಎ&ಇ) ಮುಖ್ಯ ಕಟ್ಟಡ, ಬೆಂಗಳೂರು - 560001.
- ಎಲ್ಲ ಅವರ ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿಗಳು/ಪ್ರಥಾನ ಕಾರ್ಯದರ್ಶಿಗಳು/ಕಾರ್ಯದರ್ಶಿಗಳು.
- ಮಾನ್ಯ ಮುಖ್ಯಮಂತ್ರಿಗಳ ಪ್ರಥಾನ ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು.
- ಮಾನ್ಯ ಉನ್ನತ ಶೈಕ್ಷಣಿಕ, ವಿದ್ಯಾನಾಳ್ವಿತ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ, ಜ್ಯೋತಿಕ ತಂತ್ರಜ್ಞಾನ, ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಹಾಗೂ ಕೌಶಲ್ಯಾಭಿವೃದ್ಧಿ ಮತ್ತು ಜಿವನೋಪಾಯ ಸಚಿವರ ಆವು ಕಾರ್ಯದರ್ಶಿಗಳು, ವಿಕಾಸಸೌಧ, ಬೆಂಗಳೂರು.
- ಮುಖ್ಯ ಕಾರ್ಯದರ್ಶಿರವರ ಆವು ಕಾರ್ಯದರ್ಶಿ, ವಿಧಾನಸೌಧ, ಬೆಂಗಳೂರು.
- ನಿರ್ದೇಶಕರು, ವಿದ್ಯಾನಾಳ್ವಿತ ಮಾಹಿತಿ ತಂತ್ರಜ್ಞಾನ, ಜ್ಯೋತಿಕ ತಂತ್ರಜ್ಞಾನ, ನಿರ್ದೇಶನಾಲಯ, ಶಾಂತಿನಗರ, ಬೆಂಗಳೂರು.
- ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕನಾರ್ಟಿಕ್ ಸಾರ್ವಜನಿಕ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ಸೂಕ್ಷ್ಮಿ, ಶಾಂತಿನಗರ, ಬೆಂಗಳೂರು.
- ವ್ಯವಸ್ಥಾಪಕ ನಿರ್ದೇಶಕರು, ಕೆಸ್ಪ್‌ಪ್ಲ್ಯಾಸ್ಟಿಕ್.
- ನಿರ್ದೇಶಕರು, ಬಣಿಎಸ್‌ಸೆ/ಬಣಿಎಂಬಿ/ಜೆಎನ್‌ಸೆಎಸ್‌ಆರ್/ಸೆಎಸ್‌ಬಾಆರ್-ಸೆಎಫ್‌ಟೀಆರ್‌ಎ ಮತ್ತು ಬಣಿಎಸ್‌ಇ.
- ಅಧ್ಯಕ್ಷರು, ಸಾಫ್ಟ್‌ವರ್ಸಂಗ್ ಆರ್ & ಡಿ ಸಂಸ್ಥೆ, ಬೆಂಗಳೂರು.
- ಅಧ್ಯಕ್ಷರು, KTwo ಟೆಕ್ನಾಲಜಿ ಸಲ್ಲೂಟಿಷನ್ಸ್, ಬೆಂಗಳೂರು.
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ಕರ್ನಾಟಕ ಸರ್ಕಾರ

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೧೫/೧೨/೨೦೨೧*

(ಸುಮ.ಬಿ.ಎಸ್.)

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Executive Summary

Research is the key driver of innovation and discoveries that transform our economy, build new industries, increase productivity and enhance competitiveness in the global knowledge economy. The current COVID-19 crisis highlights the fact that the State need to put more emphasis on research and innovation than ever before. Investing in research and innovation generates new knowledge, technologies and jobs that power a vibrant economy and improves peoples' lives and opportunities.

Research and innovation systems are a complex set of relationships among stakeholders, including enterprises, universities, research institutes, intermediaries and governments. The interdependence of various components of the research and innovation system needs every subsystem to work at a reasonable level of efficiency and effectiveness, and since innovation is largely co-produced, the links among the components also need to function well. Hence, a policy mix needs to be designed to achieve this and ensure balance among the different components.

A broad summary of the Karnataka Research, Development and Innovation Policy is given below:

1. Strengthening the governance and financial outlay of the research and innovation system

To develop a robust research and innovation ecosystem in the state, governance mechanisms need to be more coordinated administratively and financially. Currently, our research and innovation governance is faced with challenges related to intra-institutional architecture and interlinkages. There is a need to build synergy and improve coordination among various ministries/departments/organisations to strengthen the prevalent research and innovation ecosystem. The policy envisages a "Karnataka State Research Foundation" to formulate and execute strategies that meet the objectives outlined in the document.

To expand the financial landscape of the research and innovation ecosystem, it is proposed that each department in the state government will earmark a minimum budget for research and innovation activities. The aspirational goal of funding from state government agencies is proposed to be enhanced by 0.1% of the state GDP and enhanced periodically to attain the national average of 0.7% of GDP in the next five years, based on the availability of funds and ability to spend.

2. Strengthening the capacity for research and innovation

As centres of knowledge, expertise and learning, higher education institutions (HEIs) are crucial actors in the research and innovation ecosystem. There is a need for enhanced support for foundational and applied research. Our HEIs are still not adequately succeeding in translating research discoveries into economically and socially viable innovations. In addition to supporting basic research, the policy emphasises "knowledge with impact". A wide range of programmes, funding and incentives have to be established



to support not just the creation of knowledge but also its translation into applications. The policy provides impetus to interdisciplinary research through inter-institutional collaborations in cutting-edge technologies to solve complex societal problems. HEIs must increasingly be seen as anchors of the regional innovation system, and the policy envisages geographically targeted research and innovation investments to seed the emergence of regional research clusters. HEI research should also contribute to training the researchers of tomorrow to build a pipeline of promising research talent for future growth. The policy charts pathways to support undergraduate and postgraduate students, doctoral scholars and early-stage researchers to undertake high-quality research and gain the requisite skills and experience. The policy will work towards the adoption of "Open Science and Research" by HEIs, provisioning open access to publicly-funded research results, facilities and research data wherever permitted as per prevailing rules/regulations.

3. Research and innovation to drive the regional ecosystem

The research and innovation capacity plays a critical role in determining the regional competitiveness in attracting new-age industries that can trigger the socio-economic development of geographical regions of our state. While Bengaluru, with its unique science and technology ecosystem, will continue to be the most significant technology innovation hub, leveraging the talent pool available across Karnataka can be a force multiplier for driving innovation to provide the impetus for the growth of other regions. This requires a well-connected ecosystem that is enabled by the coexistence of educational and research institutions, industry research and development (R&D) enterprises, government labs, business incubators and technology/business mentors in one place, popularly known as science and technology parks. The policy aims to nucleate such ecosystems by creating multiple science and technology parks and significantly increasing investments in R&D. Five interdisciplinary science and technology parks will be set up, four of which will be in Tier 2 and Tier 3 cities spread across Karnataka. The parks will work closely with each other and with regional HEIs. To encourage companies and R&D labs to locate beyond Bengaluru, special incentive schemes will have to be created.

4. R&D and innovation to support entrepreneurship and MSMEs

MSMEs and start-ups are the prime drivers behind India's growth story, and they play a crucial role in the country's socio-economic development. Despite having substantial potential for growth, the Indian MSME sector is grappling to adopt the innovation route. With the increasing importance of knowledge and technological complexity, MSMEs need knowledge networks to convert their innovations into commercially viable products. The existing clusters need to be strengthened with the requisite infrastructure for R&D that makes MSMEs more productive, stimulates innovation and presents opportunities for entrepreneurial activity. The policy provides renewed impetus to strengthen and modernise the cluster support system through technology acceleration programmes and cluster innovation centres.



Karnataka has earned the tag of being the startup hub of the country, however large part of the growth is centered around Bengaluru. Therefore, the steps taken towards the startup revolution to spread beyond Bengaluru to the other regions of the State needs to be expedited. The policy envisages initiating a new incubation programme, "Karnataka-Technology Innovation and Entrepreneurship (K-TIE)", in line with the "Technology Incubation and Development of Entrepreneurs (TIDE) 2.0" programme of the Government of India to strengthen the entrepreneurial ecosystem beyond Bengaluru. The policy aims to create a digital e-platform to ensure that the benefits of R&D reach all people and regions of Karnataka.

5. Promoting R&D and innovation in priority sectors for societal transformations

The importance of focussing on priority sectors (agriculture, environment, natural resources, health and nutrition, etc.) in India's economic and social fabric is significant. The issues to be addressed in priority sectors are complex, systemic, interconnected and urgent, requiring insights from many perspectives. Engaging researchers and innovation actors across disciplines and multiple sectors (public and private) to find viable solutions is the need of the hour. Leveraging digital technologies—such as the Internet of Things, artificial intelligence, data-driven decision science and advances in materials and manufacturing—can give a big boost to sectors. The policy intends to build multidisciplinary collaborations within and across institutional boundaries to undertake complex, high-impact research projects in priority sectors to transform society. The policy charts pathways for a mission-oriented innovation programme approach to mobilise science, technology and innovation to address important societal challenges. The policy outlines mechanisms that need to be put in place to promote digital technology as the enabler for driving priority sector innovations.

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1. Introduction – Research and Innovation Framework





1. Introduction

As an emerging force in the global research and innovation landscape, India has tripled its research and development (R&D) expenditure in the last decade. However, the investment as a percentage of gross domestic product (GDP) is a low 0.7% compared with the United States' 2.8%, China's 2.1%, Israel's 4.3% and the Republic of Korea's 4.6%¹. This small proportion of GDP that India invests in R&D is reflected in the small number of researchers per lakh of the population. India has 25 researchers per lakh compared with 441 researchers in the United States², 130 in China, 834 in Israel and 749 in the Republic of Korea³. India's share of scientific publications stood at 5.4% (Scopus database) in 2016 while the United States and China published approximately four times as many articles. Though India is fifth in the world in terms of the number of publications, the nation is 11th in terms of citation impact, with only 15.8% of the total publications in the top ten journals compared with 36.2% for the United States and 27.6% for China⁴.

India is making significant progress in multiple innovation parameters such as university–industry collaboration, access to the latest technology and capacity for innovation. However, the visible outcome and targeted impact of the efforts are in silos and not sufficient to address local needs and societal challenges. India made 46,582 patent applications (of which approximately 68% were made by non-resident Indians) in comparison to the United States' 6,06,956 and China's 13,81,594⁵.

Research and innovation systems are complex set of relationships among enterprises, universities, research institutes, intermediaries and governments. Understanding the linkages among the actors involved is key to improving technology and its performance. While formulating policies, it is essential to take a systemic view to understand the challenges faced by each of these actors and the shortcomings of interlinking mechanisms that may impede the whole system's innovation capacity.

2. Research and Innovation Framework

Across the world, the concept of a national innovation system (NIS) is employed by governments and developmental organisations—such as the Organisation for Economic Co-operation and Development (OECD), the United Nations and the World Bank—to understand the complex set of relationships among actors producing, distributing and applying various kinds of knowledge.

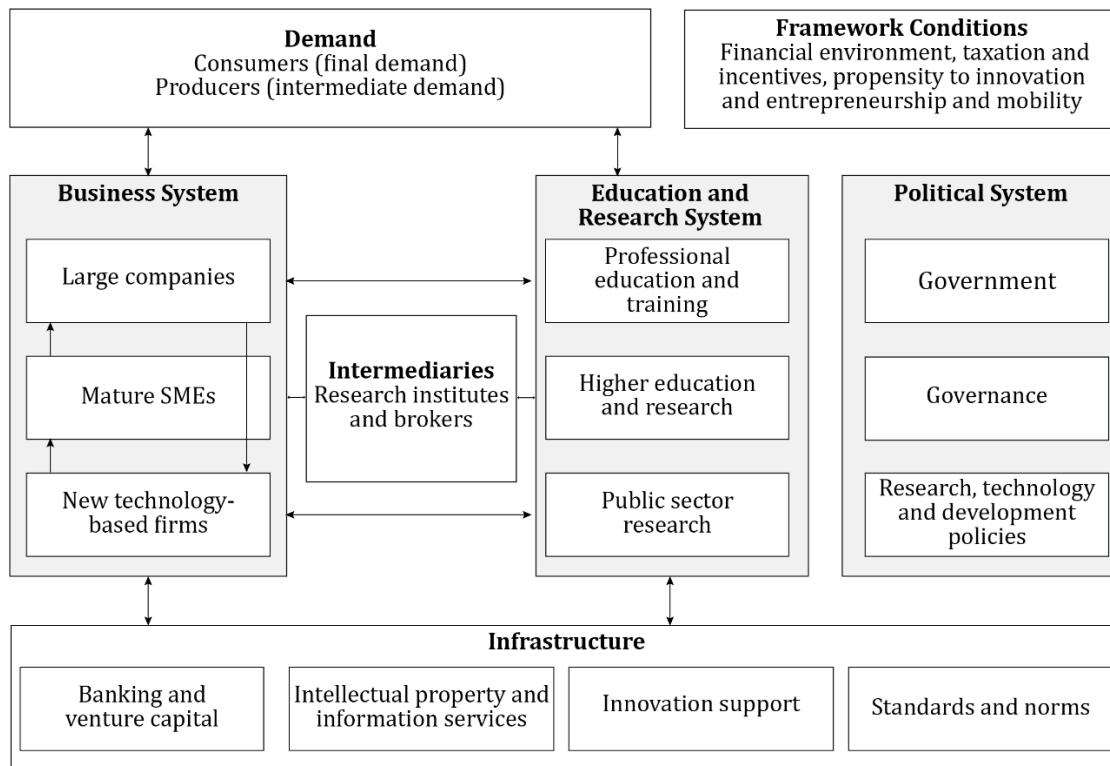
¹ https://dst.gov.in/sites/default/files/Research%20and%20Development%20Statistics%202019-20_0.pdf

² <https://data.worldbank.org/indicator/SP.POP.SCIE.RD.P6?locations=US>

³ https://dst.gov.in/sites/default/files/Research%20and%20Development%20Statistics%202019-20_0.pdf

⁴ <https://sntd.ac.in/pdf/downloads/circulars/2019/equip-report.pdf>

⁵ https://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2018.pdf



Note: The image is recreated from Kuhlmann and Arnold's report in 2001 on *RCN in the Norwegian Research and Innovation System*.

The innovative performance of a country, state or region depends largely on how these actors relate to each other as elements of a collective system of knowledge creation and diffusion. Because different parts of the NIS work together, they tend to co-evolve into specific patterns. Therefore, policies need to be specifically designed for the national/regional context to ensure that the various components of the research and innovation system work at a reasonable level of efficiency and effectiveness.

3. Current Research and Innovation Ecosystem Challenges

While formulating policies, it is essential to understand the challenges faced by these actors and the shortcomings of interlinking mechanisms that may impede the whole system's innovation capacity. The fundamental challenge is a seamless end-to-end synergy, focus and target orientation of the involved entities and individuals. A brief description of the key challenges is listed below:

- **Segmented governance structure:** Segmented governance structures lack integration or coordination and strategic orientation to evolve into a robust, interconnected research and innovation ecosystem.
- **Untapped potential of universities/HEIs:** The majority of the R&D work in universities and HEIs ends up in labs or as journal articles and reports without creating any social or economic impact. The mechanism needed to orient and connect academic research to end users is missing.
- **Access to the R&D ecosystem:** Small/medium scale industry/start-ups cannot easily gain access to R&D done in HEIs.



- **Affordability of R&D:** Even though universities, MNCs and high-end R&D centres are available, their cost of engagement is high.
- **Disconnect of actors:** Academic researchers, mentors, public and private R&D centres and R&D beneficiaries are disconnected from each other because of the lack of a unified forum/platform for interactions and a lack of a value proposition for such interactions.
- **Need of incentive/recognition:** Measurement of outcome needs to be structured and incentive is to be provisioned to motivate actors to orient huge demand and supply systematically.
- **Strengthening of innovation management:** Knowledge about how to systematically develop, commercialise and diffuse innovations needs to be strengthened.
- **Integration of social science research to the overall R&D ecosystem:** There is no systematic research framework that binds social science research to R&D in science and technology.
- **Regional imbalance:** There is innovation divide with regions away from major cities significantly lagging in robust research and innovation ecosystems, widening the regional disparities in economic growth.
- **Estimating the size of science and technology activities:** For proper policy formulation, estimating the size of science and technology activities, such as the digital economy, is important. There is a lack of rigorous estimation of such activities where social sciences can play a role.

4. Way Forward

The Karnataka Research, Development and Innovation Policy will take a systemic view of the research and innovation ecosystem to build a robust and enabling environment to grow the state's competitiveness and leadership in a knowledge-based economy. The policy seeks to strengthen research and innovation capabilities across institutions and sectors and promote structures that nurture new enterprises (start-ups) and enhance the fluidity of knowledge flow among enterprises, universities and research institutions.

As the policy aims for research and innovation-led economic growth and social welfare, it might overlap with several other existing sector-specific policies (or components of policies) that have been developed by different departments of the state to serve their mandates and aspirations. Prevailing policies such as the Karnataka Startup Policy, Karnataka Industrial Policy and Karnataka Engineering R&D Policy have programmes/schemes, incentives and instruments to promote research and innovation-led growth. Over time, efforts would be made for the confluence of overlapping policy components to ensure all policy instruments synergistically achieve the desired goals envisioned by the state. However, the prevalent successful sector-specific programmes/schemes can be carried forward and mapped to the present policy recommendations.

2. Strengthening the Capacity for Research and Innovation





1. Purpose and Intent

The strength and vitality of universities remain essential for growth in a knowledge-based economy. The modern higher education institution (HEI) in India is an organisation in transition. The traditional roles of research and teaching are increasingly complemented by the ability to transfer knowledge and technology into other realms, benefiting industry and broader society. However, the capacity of HEIs to integrate research results and innovative practices into education and translate them into valuable applications with socio-economic impacts remains weak.

Further, the complex challenges faced by society often demand a combination of knowledge and technology spread across different fields. The complexity of real-world problems mirrors an increased complexity in research projects, many of which (both basic and applied) have become transdisciplinary. Consequently, an HEI's ability to solve complex and meaningful problems depends on how well research collaborations are organised inside and across institutional borders.

Developing *entrepreneurial and intrapreneurial competencies* in our education system is becoming increasingly important. Academic entrepreneurship and university spin-offs are promising ways to improve technology transfer and increase the impact of universities in the entrepreneurial economy of their states and regions. Strong and well-established HEIs can anchor innovation clusters at a regional level to bring together world-class researchers, business expertise and entrepreneurial drive to boost the innovation ecosystem.

To make the State economy more research-intensive and prepare the ground for the industries of tomorrow, there is a need for more high-quality researchers. A robust training system for research students, the next generation of Indian researchers, is an essential element of the research system.

The National Education Policy 2020 (NEP2020) emphasises the focus of HEIs on research and innovation by setting up start-up incubation centres, technology development centres, centres in frontier areas of research, greater industry-academic linkages and interdisciplinary research including humanities and social sciences.



2. Way Forward

i. Strengthening of the research support system in the state's HEIs.

In the new economy, the research and innovation capacities of universities and HEIs are central to the future competitiveness of regions and the state. There is a need to ensure that they continually strengthen their capability and excellence across disciplines and create an exceptional training ground for research students and young researchers. There is also a need to invest in people and ensure that researchers have access to the best possible facilities and infrastructure to pursue their research work. **At present, the state budget does not reflect R&D spending directly. It is beneficial to have a separate accounting head for R&D in the state and enhanced specific allocation for HEIs to grow and maintain research and innovation capabilities.**

Specific Objective

- Enhance the state support for high-quality research in universities/HEIs across the spectrum, from basic to applied research.

Instruments

- The financial outlay will be enhanced to support and grow research initiatives in HEIs of Karnataka, and a specific portion of the state R&D budget will be set aside for this purpose.
- Various funding programmes will be evolved to support research infrastructure and develop a research base to undertake high-quality, innovative research. Expanding the research and innovation ecosystem in HEIs will be done by focusing on (1) priority areas in which the state should emerge as a world leader, (2) addressing local problems and (3) engagement and participation of industry to ensure R&D also aligns with industry needs.
- Alignment and interlinkages will be strengthened between the central and state government programmes and research support schemes in terms of resource mobilisation and budget sharing to support research in HEIs.
- **Research Karnataka programme:** Various modes of extramural research funding schemes (long-term and short-term schemes) will be evolved to enhance the research base, capacity and infrastructure of HEIs in Karnataka to undertake high-quality, innovative research. The programme aims to fund curiosity-driven foundational research and build capacity in frontier research areas. This research will be the foundation for strategic and applied work supported by other programmes.

ii. Promotion of interdisciplinary research.

Because of the complex dynamics of societal problems and the multifaceted nature of cutting-edge products and services, translational research must draw on multiple fields of science, technology, engineering and math, and increasingly, arts, humanities and social sciences. More support, increased engagement and interventions should be designed to grow, nurture and embed interdisciplinary research in HEIs in Karnataka. **These initiatives should help create institutional structures in which researchers**



from different disciplines tackle innovative, challenging, complex and long-term research undertakings through the coordination and concentration of individuals and resources within the institution. These HEIs can engage other institutions and industries.

Specific Objective

- Foster interdisciplinary research collaborations within and across institutional boundaries to undertake high-impact research projects that lead to leaps in scientific and technological progress and greater economic and societal benefits.

Instruments

- **Interdisciplinary research centres (IRCs):** IRCs will be established to encourage and facilitate interdisciplinary research environments in HEIs. These are long-term HEI-based research centres where researchers work together within a multidisciplinary research programme. They will allow researchers to tackle innovative, challenging, complex and long-term research undertakings through the coordination and concentration of individuals and resources within the institution. IRCs enable institutional priority area development and structural development. The centres must pursue strategic and application-oriented research and expertise, bringing together complementary resources for technical/industrial application and bridging the gap between researchers and users.
- **Regional research consortium (RRC):** The RRC programme will fund research collaborations between regional HEIs to synergise their research strengths to solve regional industrial or societal problems. It seeks to inspire collaborative research projects that bring institutions and disciplines together, engaging inter- and intra-institutional research teams with the capacity to undertake interdisciplinary research, leading to a positive social, economic, environmental or health impact in the region or state.
- **Innovation/entrepreneurship management research centres (IEMRC):** The IEMRC programme will fund research projects seeking to understand and resolve unique challenges individuals, organisations and partnerships face in undertaking systematic innovation in the Indian context. This would involve research that addresses organisational and managerial challenges involved in seeding and nurturing innovations, mobilising resources and developing and scaling them, and managing their diffusion or dissemination. These centres may be created within management schools and social science research institutions.

iii. Promotion of translational research and industry collaboration.

Though basic and applied forms of research go hand in hand, HEIs appear to remain engaged only in teaching, learning and basic research. They remain focused on publications and citation indexes as opposed to the economic and social impact of research outcomes. **HEIs should be encouraged to undertake not only fundamental research but also applied and translational research and mission- and challenge-driven research.** The structures, pathways and incentives are to be evolved to enable



HEIs to improve the continuum between basic and applied research; deliver new solutions, products and services for a better future; and forge partnerships with industry and other institutions in creating, transforming and applying knowledge. **It is necessary to encourage partnership and cooperation with businesses as a core activity of higher education institutions through reward structures, incentives for multidisciplinary and cross-organisational collaboration, and the reduction of regulatory and administrative barriers to partnerships between institutions and other public and private actors.**

Specific Objectives

- Encourage partnership and cooperation with businesses/industries as a core activity of HEIs.
- Support faculty and institutions to undertake applied and translational research and enhance their capacity to engage with start-ups and spin-offs.
- Reduce the regulatory and administrative barriers to partnerships between institutions and other public and private actors.
- Create opportunities for wealth creation through monetisation of intellectual properties.

Instruments

- **Collaborative research centres (CRC):** CRCs will be established in HEIs to enable them to connect and work with industries, MSMEs and start-ups in the region. CRCs will provide an ongoing long-term platform for collaboration between different STI stakeholders to improve industrial research, innovation and the ability to compete and produce. The programme will have two modes of support:
 - CRC grants: For establishing centres and research facilities for long-term industry collaborative research in frontier areas that are critical to the growth of industries in the region
 - CRC projects: To support short-term collaborative projects to solve industry-identified problems

The proposal for seeking CRC grants/projects must include at least one partner organisation for funding under the CRC scheme. The partner organisation must contribute in cash and/or in kind and/or other material resources to the project.

- **Small business technology enabling centres (SBTECs):** SBTECs will be established at select HEIs to meet the R&D needs of small and medium enterprises (SMEs). The collaborative projects funded under the programme will serve as engines of innovation, resulting in a step change in companies' technological capability, leading to new/improved products or enhanced productivity and efficiencies in processes. They also help the engaged HEI faculty improve knowledge regarding their field's practical aspects, develop networks and share experiences.



- The CRCs and SBTECs will closely connect with the network of **Global Capability Centres** and enable their transformation from cost arbitration centres to drivers of technological transformation and product innovation through the engagement.
- **Translational funding schemes:** These schemes will be evolved to enable academic researchers to set early-stage innovations and discoveries on the path to commercialisation. Funding will fill a critical gap in the innovation chain by supporting very early-stage research translation and all-important proof-of-concept studies that are essential first steps in the technology transfer process.
- **Faculty enterprise scheme:** This scheme will be formulated in line with the scheme approved by the Union Cabinet, Government of India (vide OM No. 3/3/2009-TU/V/Knowledge-to-equity dated May 25, 2009), permitting faculty / scientific staff to own equity stakes in scientific enterprises/spin-offs while in professional employment with their research and academic organisations. Appropriate guidelines will be developed to permit and enable the faculty and researchers to get involved with science- and engineering-driven scientific enterprises while in professional employment with the institute.
- **Seed fund enabling entrepreneurship development (SEED):** The SEED scheme will be implemented to assist universities (as a grant) and HEIs that are successfully running in-campus incubation centres to support potential innovative ideas/projects that would emanate from students/researchers and others. This initial funding would greatly boost the translation of entrepreneurial ideas and reach a stage where investors would gain confidence and feel comfortable to commit investments.
- **Flexi IP:** Intellectual property (IP) arising from joint industry-academia research will be unlocked for wealth creation under the Flexi IP scheme. HEIs will lower the barriers to sharing joint IP and liberalise IP licensing models. HEIs will create various well-defined models of IP sharing and licensing upfront. The availability of templates will facilitate easy identification of the best model for a particular interaction and efficient negotiation with a focus on the specifics of the particular interaction. This will reduce the negotiation time, lower the barriers to interaction and increase the number of industry-academia engagements, thereby facilitating more wealth creation opportunities. Additionally, under the FlexiIP scheme, HEIs will also allow faculty to engage with sponsoring industries in a consultancy mode for up to a certain number of days in a month. Any IP created during such interactions will be wholly owned by the sponsoring industry if no other HEI resources are used in the engagement. Suitable compensation will be provided by the sponsoring industry to the HEI and the consulting faculty member to incentivise such IP creations.

iv. **Positioning HEIs as drivers of regional growth.**

Strengthening and enhancing the regional innovation ecosystem around HEIs in a strategic and targeted way can address the significant regional disparities in economic performance across the state. **HEIs must be increasingly seen as anchors of the regional innovation system, and geographically targeted research and innovation**



investments are essential in the seeding and emergence of regional research clusters. The participation of consortia of HEIs, companies, SMEs and other regional actors will enhance the value proposition of these clusters. HEIs should emphasise strengthening the knowledge transfer infrastructure and improving their capacity to engage in start-ups and spin-offs through incubators and accelerators at their campuses.

Specific Objective

- Promote systematic involvement of higher education institutions in integrated local and regional development by creating regional hubs of excellence and specialisation.

Instruments

- Well-established, leading universities/HEIs or a consortium of regional HEIs will be equipped and enabled to act as the locus of the region's economic activity by establishing research parks, incubators and accelerators.

v. Grow the research talent pipeline.

Research capacity development and a growing talent pool of future researchers are of high priority and are to be achieved through master's and doctoral programmes, postdoctoral support and internship programmes. **To develop and create an internationally competitive research training environment, there is a need to increase investment in research training, number of researchers supported, models of delivery and stipend levels. This will help graduates transition successfully into the next stage of their career, either in academia or industry.** Doable actions will be identified to increase support for early career researchers and empower them with the skills, knowledge and experience needed to advance their careers inside or outside academia. Supporting greater mobility of the research and innovation workforce between business and academia is essential in the new context.

Specific Objectives

- Prepare the next generation of researchers in cutting-edge disciplines with a broad skill set and the ability to work in an interdisciplinary environment.
- Support bilateral flow of researchers between academia and industry by introducing fellowships/internship programmes and enhancing career opportunities for research candidates and postdoctoral fellows.

Instruments

- To drive **research culture** across the student community of HEIs, the inclusion of undergraduate research experience and creative inquiry projects as required components of the curriculum in all degree programmes will be promoted. They will aim to contribute to the development of students' critical thinking, information literacy, problem solving, creativity, quantitative reasoning, scientific reasoning and effective communication skills throughout their academic careers.
- **Engage initiative:** This initiative will be undertaken by HEIs, and it mandates the engagement of undergraduate/postgraduate students, research fellows (doctoral and



postdoctoral) and young faculty in all the research centres and projects sanctioned by the state government. For each research scheme approved for an HEI, a definitive outcome is to be defined regarding the number of students, fellows and young faculty engaged. The main objective of the initiative is to develop a research culture and interest among undergraduate and postgraduate students, scholars and young faculty to pursue careers and undertake high-quality research in challenging fields that augment and expand their research capacity.

- **The industrial PhD programmes:** These programmes will be initiated in universities that aim at the systematic build-up and further qualification of research and innovation staff in the industry sector and non-university research institutions. They will offer doctoral training in cooperation with the industry sector. A student is enrolled in a university but works as a fully integrated professional in the industry for the programme duration. The programme can enable the swift transfer of scientific results to the industry while strengthening the industry and academia relationship.

vi. Creation of opportunities for improved researcher mobility.

The bilateral mobility between researchers from institutions of higher learning and the industry is a vital element for growing a research ecosystem. Intra- and inter-sectoral researchers' mobility forge critical linkages between research and innovation performers, leading to a competitive advantage for both entities. Inter-sectoral mobility allows researchers to gain first-hand experience in a commercial research environment while providing the industry access to highly specialised trained researchers from academic institutions. Further, the mobility of researchers from institutions of higher learning to other regions benefits the research ecosystem in the area.

Specific Objectives

- Support the mobility of researchers from research-intensive institutions of higher learning or universities to other regions of the state (beyond Bengaluru).
- Encourage the bilateral flow of researchers between academia and industry by instituting fellowships and internships.
- Encourage the bilateral flow of researchers between academia and industry by creating flexible models of academia–industry interactions.
- Engage industry and philanthropists to establish research chairs and fellowships.

Instruments

- The framework of PROMAGS, or “PROfessors as MAGnetS”, will be created to leverage the expertise of faculty researchers (both in-service and retired but active senior faculty) to attract and train talented student researchers across Karnataka. Industry researchers and academic faculty members can come together and propose PhD research projects for a specific duration. Funding can cover infrastructure expenses, scholarships for PhD students and domestic and international travel of students and faculty to interact with global players and present their work at reputed and high-impact conferences. At least one of the faculty members will be from an institution





outside Bengaluru, and partnership with institutions in Bengaluru will be encouraged. The partner industry will commit 50% of the resources, which the PROMAGS programme for selected projects will match. Each science and technology cluster will administer programmes within its locality.

- The industry will be encouraged to set up TALENTBANKS, a verification and validation labs framework for enabling long-term student internships and project associateships, at HEIs in the vicinity of science and technology parks outside Bengaluru. Beyond infrastructure support, experts from the sponsoring industry will be encouraged to visit the labs; configure them for experiments; deliver lectures; supply problem statements; provide guidance; enable data gathering, storage, organisation and analysis; and train talent. The focus will be on R&D training. The contributions in kind from industry researchers will be through a “time-to-give” framework that accounts for the time spent. Targets will be set on the number of interns to train and the number of hours needed, and these targets will be tracked and monitored continuously. Through this endeavour, the hidden potential of talented young individuals will be unleashed while creating a resource pool of well-trained and talented individuals who will make a greater impact on technology development.
- HEIs will encourage faculty members to consult with the industry for up to a certain number of days a month (e.g., one day a week or five days a month) under the Flexi IP scheme. The IP created during such interactions will be owned by the sponsoring industry if no other HEI resources are utilised in the engagement. This will create better opportunities for wealth creation. The HEI and the consulting faculty will be suitably compensated by the sponsoring industry in lieu of full ownership to incentivise the engagement and IP creation.
- HEIs will encourage faculty members to engage with the industry during the summer vacation without let or hindrance. This is particularly important in fields where the industry has access to cutting-edge technology and/or data, as in the fields of computer science and electrical engineering (e.g., AI/ML, VLSI).
- HEIs will encourage exchange in the reverse direction by enabling industry experts to offer courses, interact with students and conduct research in an academic environment as adjunct faculty.
- Industry sponsors and philanthropists will be invited to set up Distinguished Visiting Chair Professorships at higher educational institutes outside Bengaluru. Reputed researchers will be invited to visit HEIs for specified time periods. The visiting professor will conduct world-class collaborative research on a topic of mutual interest (leading to high impact), give seminars / compact courses and mentor one or more faculty at the local institution.



vii. Assess and incentivise industry/society engagement and the impact of HEIs.

Although academic research and applied research are not mutually exclusive, research performance evaluation of HEIs or faculty performance evaluation today excessively leans towards peer-reviewed research publications and their venues⁶. Relatively low or nil priority is assigned to technology development, industry-related applied research or influence on policy and practice. Many rankings, awards, rewards and recognition are also based on research publications and their citation counts. There is a need to rigorously assess research engagement and the impact of HEIs and faculty/researchers. This initiative will incentivise universities to collaborate with industry and other end users and carry out research that directly benefits the economy, industry and society. Further, there is also a need to revisit faculties'/researchers' performance evaluation in HEIs to incorporate industry engagement and a broader range of impact measures as the performance metric.

Specific Objectives

- Encourage and recognise researchers and HEIs for engagement with industry and society through an assessment framework.
- Encourage international reviews of departments and institutions.

Instruments

- In consultation with HEIs, industry and stakeholders, an assessment framework titled “EI Karnataka” will be developed and implemented through a suitable body to assess how successfully HEIs are translating their research into economic, social and environmental impacts. This assessment will be an essential parameter while evaluating the research performance of HEIs.
- Faculty/researcher performance evaluation will be revisited and will consider the value and impact of all research outputs in addition to research publications. It will consider a broad range of impact measures such as the ability to create and sustain high impact collaborations with peer groups and the level of industry/society engagement generated and qualitative indicators of research impact such as influence on policy and practice.
- HEIs will conduct periodic reviews of their departments and institutions with the help of international academic review boards comprising world-renowned scientists. These boards will provide strategic analysis and advice to HEIs on institutional leadership, management, research and innovation in a global knowledge economy and reform and governance.

viii. Adoption of “Open Science and Research” initiative.

The “Open Science and Research” outlook shifts the research paradigm from the “publish or perish” mantra to a knowledge-sharing ideal. It guarantees open access to publicly-funded research results, facilities and research data and re-use outside academia. For

⁶ (San Francisco Declaration on Research Assessment)



example, companies, particularly small and medium-sized enterprises (SMEs), can access and re-use data and infrastructures (instruments, tools, library, learning resources, spaces, etc.) easily and at a nominal cost, thus accelerating the implementation of ideas for innovative products and services. All HEIs of Karnataka will adopt and apply the open science and research principles in their policies, operations and practices.

Specific Objective

- Enable and adopt an “Open Science and Research” policy to make scientific research, data and dissemination available to any member of an inquiring society, from professionals to citizens as per prevailing rules and regulations.

Instruments

- All research manuscripts that are the result of public funding or performed in publicly funded HEIs or were performed using infrastructure built with the support of public funds will be deposited immediately upon acceptance to an institutional or central repository.
- HEIs will set up language translation cells and disseminate knowledge accumulated in the repository in multiple languages.
- All public-funded scientific resources will be made shareable and accessible using digital platforms. These scientific resources include, but are not limited to, research infrastructures, laboratory facilities and instruments, high-performance computing facilities and libraries.

ix. Enable and equip schools to build a culture of discovery and innovation.

The younger generation must be encouraged to become 21st-century thinkers and learners. As also envisaged in NEP 2020, schools must increasingly focus on building creative confidence, design thinking, collaboration skills and communication skills to bring a new idea into the world. Unfortunately, schools are not well prepared to accomplish these tasks in terms of curriculum or infrastructure. Therefore, it is critical to equip schools and empower teachers of primary and secondary schools to inspire students towards a culture of discovery and innovation.

Specific Objective

- Enable primary and secondary schools to bring about transformational, hands-on learning experiences to inspire and nurture the culture of discovery and innovation and create science galleries and museums that will work with various schools and colleges to improve the R&D culture among the youth.



Instruments

- “Innovation Labs” will be established (on the lines of Atal Tinkering Labs) in primary and secondary schools of Karnataka to provide students with the necessary facilities and tools to create, discover, design, engineer and build. These facilities will enable students to work independently and collaboratively to translate a new idea into reality. At least one lab per taluk will be set up in the next 5 years. CSR funds and philanthropic contributions will be mobilised to expand the reach of the programme.

3. Research and Innovation to Drive the Regional Ecosystem





1. Purpose and Intent

A well-connected network of educational and research institutions, industry R&D enterprises, government agencies, business incubators and technology/business mentors is essential to drive cutting-edge research and development in the regional ecosystem. Industry and government R&D enterprises are closest to real-world applications and bring problems of high societal relevance and scale. Education and research institutions bring the depth of knowledge and the intellectual potential required to generate high-quality and lasting solutions to these problems. However, there is a need to attract talented people from across the state to think about these real-world problems and harness their intellectual potential.

The linear model of research on abstract problems followed by an effort to translate research outcomes into practical solutions often falls short of attaining viable and high-quality solutions. The issues of societal relevance, the complexity of challenges in the real world, and the requirement that the research outcome be robust and scalable are questions that come into focus only during translation and are often left unaddressed. Attempts to bridge the gap will often raise new research questions at the interface of research disciplines. Ideas and questions should flow from need-driven inventions to basic research and from basic research to inventions, highlighting the need for a more dynamic model of impactful research.

There is also a need to swiftly translate newly generated ideas into prototype solutions, test them at scale and efficiently identify and focus attention on more promising approaches and solutions. This requires a well-connected regional ecosystem where researchers engaged at various readiness levels are brought together. Such an ecosystem can enable a virtuous cycle of need-driven invention feeding basic research and vice versa, thereby enabling innovations at an accelerated pace.

Even among academic and research institutions, there is a need for institutions to come together—in science and engineering and natural and social sciences—to work at the interface of new disciplines. The pandemic has taught us that experts from biology, medicine, epidemiology, logistics, ICT technologies, economics, behavioural sciences and sociology have to come together to combat the crisis. The existing barriers to exchanging ideas and talent across specialised institutions and industries should be lowered, and the bidirectional flow of talent should be encouraged.

While Bengaluru, with its unique science and technology ecosystem, will continue to be a significant technology innovation hub, leveraging the talent pool available across Karnataka can be a force multiplier for driving innovation.

2. Way Forward

i. To create a well-connected regional ecosystem where need-driven inventions feed basic research and vice versa.

Such a regional ecosystem can be enabled by the coexistence of educational and research institutions, industry R&D enterprises, government labs, business incubators and technology/business mentors in one place: **science and technology parks**. The benefits



of science and technology parks in fostering innovation are well understood. The coexistence of these entities in one place, with a research institution hosting the ecosystem, can facilitate the availability of knowledge and talent resources and reduce the time taken to translate research into prototypes and eventually into viable products. Successful examples include Stanford University Science Park, Sophia Antipolis in Southern France, Chalmers University's three parks, Melbourne Connect and IIT Madras Research Park.

Specific Objective

- Create a well-connected regional ecosystem where need-driven inventions feed basic research and vice versa.

Instruments

- Karnataka will nucleate such regional ecosystems by creating multiple science and technology parks and significantly increasing investments in R&D. The state will set up five interdisciplinary science and technology parks. The public sector, government R&D institutions and interdisciplinary centres of excellence of higher educational institutions (HEIs) focused on translation will be housed in these parks. The entities in these shared spaces will be working on exciting high-impact problems such as healthcare and medicine, energy, sustainable infrastructure, automotive, transportation, ICT and smart cities and education technologies.
- To leverage the talent pool available across Karnataka, such parks will be spread across several places in Karnataka, with strong inter-park connections. The parks outside Bengaluru will choose research themes of strategic importance to those locations (e.g., energy, health and life sciences, transportation and automotive, agriculture). The Bengaluru Park will cover all these aspects and more (e.g., sustainable urban development).
- The Bengaluru Park will have close connections with the other parks and mentor the activities in those parks, facilitated by memoranda of understanding. The collaborations will be structured to help leverage the Bengaluru advantage, create a network of science and technology parks and spread benefits from the R&D hub to the broader Karnataka ecosystem.
- The parks will be set up in a phased manner and operate as Section 8 companies. The park housed in Bengaluru and other locations will attract large and mid sized companies and experienced professionals to be part of the park working on need driven innovations.
- The state will invite competitive proposals from stakeholders (led by HEIs or companies), set up monitoring and evaluation mechanisms to identify the locations and the themes of the parks and facilitate and commit sufficient resources for the creation of the parks and direct their activities. The parks will be set up close to an HEI to leverage the talent pool available in the vicinity in a PPP mode.



ii. R&D innovation framework will be created to incentivise companies to work closely with HEIs.

Significant investment in R&D is essential to provide the incentive for organisations to come together and create such an ecosystem. Targets have to be set well beyond token investments, so as to leverage the benefits of an analogue of Metcalfe's law for telecommunications networks. The government machinery, being one of the biggest consumers of technology, should not only be an early adopter of new technologies but also trigger their innovation and development. The state will significantly increase R&D investment by establishing mission mode programmes with deliverables for technology and innovation in the priority sectors.

Specific Objective

- Create an R&D innovation framework to incentivise companies to work closely with HEIs.

Instruments

- Karnataka will create a market for new technology by being an early adopter of innovative technological solutions. For early adoption, the state will build the necessary intellectual capacity to anticipate needs, articulate requirements and drive innovation in its service delivery. This will, in turn, feed the R&D ecosystem with exciting problems of appropriate scale and societal relevance. The state will interact with entities in these parks to create innovative solutions in its delivery of citizen services and its march towards smart cities and sustainable development.
- The state will promote a culture of bringing R&D and innovation in its delivery by encouraging its personnel to be actively and continuously retrained on the latest technologies by working closely with HEIs.
- The science and engineering academies, the science and technology clusters and the research park expertise will identify grand challenges every year and advertise calls for solutions. The state will provide adequate funding for supporting such challenge-related research. Members of research parks will mentor shortlisted teams and closely monitor activities.

iii. The state will create research clusters for reducing barriers to sharing of ideas, knowledge and talent.

As highlighted earlier, the pandemic has taught us that multidisciplinary experts across science, technology, engineering and social sciences need to coherently address the complex societal challenges. Administrative and operational hurdles which are too well entrenched in the culture of our institutions pose significant challenges in our coming together. The science and technology parks are designed to align the normally perceived to be divergent agendas of industry and academic research institutions. But there is also a need among academic institutions to come together, share expertise, create infrastructure, break boundaries and engage in cutting-edge research related to grand challenges. Barriers to exchanging ideas and talent across specialised institutions should be lowered, and the flow of talent should be encouraged.



Specific Objective

- Create research clusters for reducing barriers to sharing of ideas, knowledge and talent and act as a regional growth engine.

Instruments

- Karnataka will support the Bengaluru science and technology cluster for sharing talent and ideas across institutions and fostering closer collaboration between the various R&D institutes and HEIs. The cluster, following the vision outlined in the report of the high-level committee on developing science and technology clusters in India (April 2020), will be a “shared ecosystem” to leverage pre-existing strengths and benefit from stronger linkages between existing academic institutions, national laboratories, state laboratories, applied research institutions (C-DAC, C-DoT, IIITs, CSIR labs, etc.) and other stakeholders. Islands of excellence spread across academia, research labs, industry and the government will come together, leverage complementary strengths and create a collaborative and flexible environment that accelerates technological innovation and entrepreneurship. Institutions will be encouraged to sign memoranda of understanding to cross-list courses for credit for students and facilitate greater collaboration and travel of researchers across institutes.
- The state will support the scaling up of infrastructure for such cross-connections and the development of shared objectives for solving grand challenges.
- The state will encourage institutions to create mechanisms to increase the ease of doing research. Institutions will be encouraged to simplify processes, provide standard operating procedures, IP policy processes, track service completion times and enable timely decisions so that researchers and teachers are not burdened with unnecessary administrative overheads.

iv. The state will bring science into the culture by fostering the engagement of scientists with the public and community.

The state will also bring science into the culture, empower young minds and foster the engagement of scientists with the public and the community. Additionally, state will engage with the public in outreach activities to attract the best talent to R&D.

State will also connect globally through an international centre for science interaction, a place where promising ideas develop and unrelated lines of thought converge. The sources of inspiration should come from many fields (the sciences and the social sciences and the sciences and engineering) and have different motivations (intellectually driven or industrially motivated). People interested in similar problems will converge and pool their potential and blend their efforts to work on joint research projects.



Specific Objective

- Bring science into our culture by fostering the engagement of scientists with the public and community.

Instruments

- To improve the R&D culture among the youth, the state will support the creation of science galleries and museums where engineering, natural science, social science and arts will meet. These galleries and museums will work with various schools and colleges across the state of Karnataka and create innovation labs within these institutions where students are encouraged to build exhibits at the interface of natural sciences, social sciences, engineering and art. The labs will facilitate open-ended experiments to catalyse cross-disciplinary thinking.
- To build global connections, the state will create an international centre for scientific interaction at a suitable, attractive and easily accessible location. The state will adopt a model similar to Oberwolfach, Banff International Research Station or ICTS and run programmes of various lengths (two-day, three-day, week-long, two-week long, etc.) throughout the year.

4. Supporting Entrepreneurs and MSMEs through Research and Innovation





1. Purpose and Intent

Micro, small and medium enterprises (MSMEs) and start-ups are the prime drivers behind India's growth story, and they play a crucial role in the country's socio-economic development. While start-ups in India have been at the forefront of driving innovation through technology, MSMEs are playing an essential role in ensuring balanced economic growth, considering that many of them operate in Tier 2 cities and smaller towns.

There are around 6.3 crore MSMEs in India, contributing approximately 29% to the country's GDP through national and international trade⁷. This sector generates about 11.10 crore jobs and accounts for nearly 50% of the country's exports. Despite having substantial potential for growth, the Indian MSME sector is struggling to follow the innovation route. Given the importance of the MSME sector, it is critical to ensure that MSMEs in India remain competitive both nationally and globally. Currently, the sector faces several challenges such as the lack of financial resources and qualified manpower for R&D, innovation-enabling support in key areas of technology transfer and innovation management. In addition, there is a disconnect among the actors (industry and, specifically, small enterprises, research institutions, buyers, technology suppliers, etc.). Given this, MSMEs need better networks to commercialise their innovations. MSMEs can overcome the problem of limited resources by leveraging these networks consisting of firms in the value chain and academic research institutions.

India has emerged as the **third-largest start-up ecosystem in the world** and is expected to witness a consistent annual growth of 12%–15%. India had about 50,000 start-ups in 2018, and 8900–9300 of these were technology-led. Recognising the need and potential of the start-ups, the Government of India and the Government of Karnataka have initiated several programmes to encourage entrepreneurship in the form of supportive policies, collaborative platforms and institutions. Through "Startup India", an ambitious programme, the Government of India approved INR 10,000 crore "Fund of Funds" to support start-ups. However, start-ups require more than just funds to scale up to become enterprises. They need training, connections and capacity building, usually provided by business incubators. The central government has initiated several schemes to establish technology business incubators (TBI). In line with the schemes, the Government of Karnataka has implemented the "New Age Innovation Network – NAIN" programme to encourage entrepreneurship and innovation. Incubation centres in the ICT sector, in association with selected engineering colleges at district headquarters, will be established. Even with all these programmes, India still lacks adequate incubation facilities that can catalyse the growth of the start-ups at the scale that the country requires. These TBIs need to be further strengthened to provide cost-effective and value-added services to start-ups such as mentoring, legal, financial, technical and intellectual property-related services.

Further, it is to be kept in mind that the growth of the MSME sector and new-age start-ups is critical for developing all the regions in the state. There is a need to ensure that the initiatives in this direction go beyond Bengaluru and support the industrial ecosystem in

⁷ MSME Ministry data released on 16 May 2021.



all the districts of Karnataka, impacting people's lives in smaller towns and cities. Funding agencies, venture capitalists (VCs), mentors/advisors and industries who could benefit from partnering with academic institutions and businesses in Tier 2 or 3 cities do not find opportunities to do so because of a lack of visibility and awareness. This needs to be addressed on a priority basis. One positive impact of the COVID pandemic is that it has expedited the migration of a large percentage of the population to the digital way of life—this needs to be leveraged. This digital advantage must be used to enable the benefits of R&D to reach all sections and geographies of Karnataka.

2. Way Forward

i. Strengthen the research and innovation support system for MSMEs.

The main barriers to research and innovation in MSMEs are a lack of internal financial resources, partners for innovation cooperation and qualified employees for innovation activities. Further, the inability to access and absorb technological developments hampers the capacity of Indian MSMEs to make good use of external knowledge from an innovation perspective. It is critical to evolve good institutional support to drive MSME innovation. Institutional support primarily refers to entities engaged in extending assistance to MSMEs such as government bodies, universities/HEIs and R&D institutions.

Supporting and growing existing and new industrial clusters are critical for regional economic growth. In the present clusters infrastructure for R&D needs to be strengthened to make MSMEs more productive, stimulate innovation and present opportunities for entrepreneurial activity. There is a need to further strengthen and modernise the cluster support system in line with the new imperatives that MSMEs are facing.

Specific Objective

- Strengthen the research and innovation support system for MSMEs.

Instruments

- **Karnataka-Technology Acceleration Programme (K-TAP)** will be initiated to establish K-TAP centres across different regions of Karnataka. These centres will fulfil the following objectives.
 - Assess technology needs of MSMEs, especially in the context of local strengths and requirements with respect to becoming "Atmanirbhar."
 - Act as an mediator to connect SMEs with appropriate R&D or knowledge partners to carry out collaborative developmental work.
 - Handhold and mentor MSMEs on absorption and adoption of technology, acquisition of capital goods needed to drive product innovation and protection and utilisation of IPR.
 - Connect MSMEs with other government schemes to fund collaborative research and innovation projects.

These centres will be established in collaboration with industry associations or HEIs.



- Establish **cluster innovation centres (CICs)** to drive the competitiveness of our SMEs at the national and global levels. These CICs will have state-of-the-art design/product/prototype development and validation facilities and expertise to provide services to the MSMEs in the region.
- A **Karnataka UchhatarAvishkar Yojana** will be created following the National UchhatarAvishkar Yojana model, focusing on supporting MSMEs. Industry and academic partners will come together to propose projects to enable and enhance the MSMEs. Successful proposals will be funded 75% by the State and 25% by the industry.

ii. Set up a digital e-platform to ensure that the benefits of R&D reach all people and regions of Karnataka.

A research and innovation system is a complex set of relationships among actors, including enterprises, universities, HEIs, research institutes, intermediaries and governments. In such a complex system, knowledge and ideas must flow seamlessly between these entities and individuals. Particularly, MSMEs and start-ups depend on external sources of information, knowledge, know-how, technologies and research partnerships to build their innovative capability and reach their markets. A digital platform will connect all the actors in the system so that the benefits of R&D reach all sections and geographies of Karnataka.

Specific Objectives

- Bring together critical stakeholders such as the government, academia, industries, MSMEs, start-ups, mentors, funding agencies and schools.
- Help in the translation of innovation and R&D into useful technologies and products, which should benefit people in all parts of the state.
- Create synergies between academia, industry, MSMEs and start-ups and enable R&D to help in the local development and growth of businesses and the economy.
- Operationalise and regulate funding mechanisms.
- Monitor effectiveness of R&D programmes across departments, ensure compliance, measure outcomes, and facilitate the entire process of coordination.

Instruments

- To ensure that the benefits of R&D reach all people and regions of Karnataka, a digital e-platform called the Karnataka R&D Innovation Platform (e-KRDIP) will be set up. Setting up e-KRDIP will bring together all important stakeholders involved in R&D, business and entrepreneurial initiatives and play an important role in taking the results of R&D and innovation to the people at large.
- Karnataka Research, Development and Innovation Advisory (KRDIA) (a directorate formed by the Karnataka State Research Foundation) will facilitate the membership and participation of industry, VCs, MSMEs, start-ups and academia through e-KRDIP, thus ensuring positive synergies between all key stakeholders (with no geographical



constraints). They will be supported by the Karnataka Research, Development and Innovation Office (KRDIO).

- All research and innovation programmes and schemes of the Government of Karnataka (cutting across ministries/departments) will be shared and monitored through the platform.

iii. *Unlock the entrepreneurial potential of young entrepreneurs across all regions of Karnataka through a robust support system.*

As torchbearers of innovation in the country, start-ups have seen a phenomenal rise in the last decade. Karnataka has earned the tag of being the country's start-up hub, with Bengaluru often dubbed as the "Silicon Valley of India". Proactive initiatives from the Government of India and Government of Karnataka are spurring growth in the entrepreneurial ecosystem. A large number of incubators set up by central and state governments in universities and HEIs have played a vital role in the growth and success of tech start-ups in India.

The Government of Karnataka has initiated several programmes for establishing incubators across the state. Under the "New Age Innovation Network – NAIN" programme, 30 incubator centres have been set up at selected engineering colleges in the district headquarters. Under the TBI scheme, the state has set up five incubators with larger funding support. But four out of the five are located in Bengaluru. Even though Karnataka is the country's start-up hub, most entrepreneurial ecosystem support is centred around Bengaluru. There is a need to strengthen incubator, accelerator and technology support programmes across all regions of the state to unleash the entrepreneurial potential of young entrepreneurs in Karnataka.

Specific Objectives

- Foster and zealously establish a vibrant entrepreneurship ecosystem that inspires budding entrepreneurs and supports existing ones.
- Provide a platform for speedy commercialisation of technologies developed by any academic/technical/R&D institution or entrepreneurs.
- Provide holistic incubation support to start-ups, including co-working space, mentoring and value-added services such as mentoring legal, financial, technical and intellectual property-related services

Instruments

- A new incubation programme, "Karnataka-Technology Innovation and Entrepreneurship (K-TIE)", which is in line with the "Technology Incubation and Development of Entrepreneurs (TIDE) 2.0" programme of the Government of India, will be initiated to strengthen the entrepreneurial ecosystem beyond Bengaluru.



The K-TIE programme will have two schemes:

K-TIE Group 1 Centres (G1C):

These centres will be set up at mature incubators that have existed for at least 5 years. They will provide deep support for start-ups, including mentoring, research and innovation, capacity building and collaborations, investing and post-investment advisory. To further augment and scale up existing incubation activities in TBIs, the government will provide enhanced support (of INR 25 crore in 5 years). The support would include design/product/prototype development and validation centres (TALENTBANKS set up with the help of the industry) along with patent facilitation centres, state-of-the-art technology-based TBI facilities to accommodate a minimum of 100 start-ups and an accelerator for ten high-potential start-ups. The support would encourage innovation, entrepreneurship, successful business development and community revitalisation and ensure the development of the local economy. Karnataka will have five such centres, and the locations will be chosen to ensure pan-Karnataka reach.

K-TIE Group 2 Centres (G2C):

These centres will enable a large number of aspiring entrepreneurs and students to build high-quality start-ups. Typically, G2Cs will either be new incubators or academic/student-focused incubators with deep networks in the local ecosystem. Fifteen such centres, distributed across all the regions of Karnataka, will be established.

iv. Integration of grassroots innovations with the research and development ecosystem to transform ideas and innovations of individuals and communities into feasible means of acquiring income and addressing the needs of the society.

Grassroots innovations are solutions created by people to solve local issues. In developing countries such as India, solutions to these persistent issues are not available or affordable to a large section of the consumer population. These grassroots innovations will fulfil the needs of a huge segment of the population. Developing a value chain around these innovations and bringing them to market have wealth creation potential in a truly equitable and sustainable manner.

Members of the informal sector such as farmers, artisans, workers, mechanics and children develop grassroots innovations at the community level to address unresolved issues without help from outside. These innovations can be the forerunners of MSMEs. However, to nurture the innovations, inventors need excellent support systems. Proactive public policies that support the emergence and diffusion of grassroots innovations are needed.

Specific Objectives

- Identify and promote grassroots innovations.
- Build linkages between grassroots innovators, civil society organisations, public institutions, firms and academia.
- Integrate grassroots innovations with the mainstream research and innovation ecosystem.



- Support the incubation of grassroots innovations to validate, refine and add value to inventions, leading to commercialisation.

Instruments

- To scout for prevailing grassroots innovators and inspire new grassroots innovations, state-wide innovation challenges, idea competitions and exhibitions will be conducted to provide the opportunity for common citizens to identify problems, innovate to solve them and exhibit solutions to their fellow citizens and the wider ecosystem. The outstanding solutions will be taken up for further support.
- A Grassroots Innovation Cell will be created under the Karnataka Research Development Advisory (KRDA), which will assist in the coordination and support of grassroots innovators across the entire R&D ecosystem. A 'Grassroots Innovation Enabling Network' (GIEN) will be established to assist linking between grassroots innovators, civil society organisations, industry, academia and the public administration. This network is crucial for the identification, development, validation, recognition and diffusion of grassroots innovations.
- To support grassroots innovations in prototyping, value addition and validation, a separate funding scheme will be implemented for formal science, technology and innovation (STI) institutions/centres.
- The incubation centres funded by the Government will be incentivised to incubate grassroots innovators and provide services such as value addition, mentoring or IP support.
- A mentoring platform for grassroots innovators will be created as part of the proposed digital e-platform "Karnataka R&D Innovation Platform" to provide resources, knowledge and guidance for grassroots innovators to develop their initial ideas into products.

5. Promoting R&D in Priority Sectors for Societal Transformation





1. Purpose and Intent

The 21st century is being increasingly defined by the need to respond to significant social, environmental, and economic challenges. Sometimes referred to as "grand challenges", these include ecological degradation, climate change, health and well-being concerns, food and nutrition, poverty alleviation, addressing regional inequalities and the difficulties of generating sustainable and inclusive growth.

The agricultural sector in India is closely connected to several of these challenges such as food and nutrition and the quality and availability of natural resources (soil and water, poverty alleviation, etc.). The sector's importance in India's economic and social fabric is significant, and a productive, competitive, diversified and sustainable agricultural sector will need to emerge at an accelerated pace. Making agriculture more productive, sustainable, remunerative and climate-resilient while conserving water and soil is the present challenge faced by India.

Given the contemporary challenges to be addressed by our society, priority sectors considered by the policy are agriculture, conservation of natural resources (water and soil), food and nutrition, health and well-being, energy efficiency and climate change. The unique characteristics of priority sectors are that they involve a large number of stakeholders and entrepreneurs with limited capability to exploit knowledge and skills (such as small and marginal farmers). The research and innovation ecosystems must be wellconnected to these stakeholders or end users.

The issues that are to be addressed in priority sectors are complex, systemic, interconnected and urgent, requiring insights from many perspectives, including science, technology and social sciences. Engaging the researchers and innovation actors across disciplines (science and social sciences) and multiple sectors (public and private) to find viable solutions is the need of the hour.

Leveraging ground-breaking technologies such as the Internet of Things (IoT), artificial intelligence (AI) and data-driven decision science can help us use natural resources more efficiently, advance agricultural practices and conserve the environment. Developing public-private partnerships is crucial to undertake such endeavours. However, there is a gap between innovators and users, often created by socio-economic, historical and cultural parameters. Social science research can help identify such gaps and facilitate the adoption of new technology.

2. Way Forward

i. Strengthen the interdisciplinary research and innovation ecosystem to create impactful solutions in priority sectors.

The research and development activities in priority sectors such as agriculture, animal husbandry and veterinary are currently carried out at the six state agriculture and allied universities. Though they are well funded through various schemes and programmes of the central and state governments, dissemination of knowledge and translation of research must be strengthened to benefit stakeholders. As these universities are not truly multidisciplinary, integration of other disparate scientific and technological advances



into their research and innovation activities is difficult. The same is true for other priority areas. Further, the socio-economic considerations of innovations in various priority sectors also require studies to be carried out by experts in social sciences.

The majority of large-scale problems in priority sectors will require close collaboration between researchers from different disciplines. The UK's Research Excellence Framework⁸ defines interdisciplinary research as follows: "Interdisciplinary research is understood to achieve outcomes (including new approaches) that could not be achieved within the framework of a single discipline. Interdisciplinary research features significant interaction between two or more disciplines and/or moves beyond established disciplinary foundations in applying or integrating research approaches from other disciplines."

Specific Objective

- Foster multidisciplinary research collaborations within and across institutional boundaries to undertake complex, high-impact research projects in priority sectors to transform society.

Instruments

- Establishment of **Priority Area Research Consortiums (PARC)** primarily in agricultural and allied universities and other capable research-intensive HEIs. These centres will engage institutions and researchers of different disciplines, leverage connections in science and technology clusters and synergise their research strengths to serve the needs of societies, deliver solutions and impact lives. Every PARC centre will focus on specific regional priority areas and develop facilities, structures and expertise to conduct innovative and transformative research that addresses contemporary problems. The state will create a long-term funding mechanism to sustain these centres.
- Establishment of the social science and humanities advanced research platform (SHARP) for priority areas where various disciplines of humanities and social sciences will work together, taking an integrated view of different sectors. This will involve research on the economic impacts of technological innovations, cultural barriers and other relevant societal issues. A prominent social science research centre may coordinate these activities by bringing together relevant stakeholders, with the state providing long-term funding.
- Thematic project funding schemes will be created to support the interdisciplinary research teams working in priority areas. These schemes will be tied to a particular application area that addresses a real-life problem.

⁸ <https://www.ref.ac.uk/about/interdisciplinary-research/>



ii. Mission-oriented / challenge-based programmes will be established to drive innovation across priority sectors.

A mission-oriented innovation programme approach is designed to mobilise science, technology and innovation to address important societal challenges. This approach is used to stimulate innovation across sectors through well-defined missions focused on challenges related to agriculture, climate, environment, health and well-being, poverty and so forth. Missions are great drivers of positive change as they set concrete directions. The concentration of talent and effort often leads to paradigm shifts and positive changes in practice. A great amount of coordination and deliberation is required from different ministries/departments to strategically choose appropriate missions with long-term impacts.

Specific Objectives

- Address critical societal challenges by stimulating researchers, innovators and entrepreneurs across sectors through mission-driven research projects.

Instruments

- Mission mode programmes with deliverables for technology and innovation will be introduced in priority sectors (e.g., agriculture, water, health, energy and environment). Based on current and future needs, interdepartmental consultations will identify challenges and opportunities in these sectors. Pathways to leverage resources to achieve the goals will also be identified.
- Mission-oriented efforts will be incentivised for tackling various local and/or region-specific issues of societal relevance. Cross-learning across regions will be encouraged. This will address developmental challenges and help in realising Sustainable Development Goals.

iii. Promotion of digital technology as the enabler for driving priority-sector innovations.

The rise of digital and intelligent technologies such as the IoT, AI and data-driven decision science are reshaping industries and lifting businesses to a new level. Now it is time to think of ways they can contribute to the development of priority sectors. Leveraging such groundbreaking technologies can help us use natural resources more efficiently, reduce carbon footprint and advance agricultural practices. With the increased availability of connectivity and data, predictive tools and precision machinery will revolutionise agriculture productivity and enhance farmers' income. However, agriculture remains less digitised or automated compared to many other industries globally. Therefore, there is a need to support and incentivise research and innovation to transform priority sectors.



Specific Objectives

- Leverage the advances in digital technologies to enhance the productivity and efficiency of priority sectors.
- Engage and support new-age entrepreneurs to evolve state-of-the-art solutions to the challenges of priority sectors.
- Establish a digital platform in the local language to connect farmers with valuable information and innovators.

Instruments

- Through challenge-led schemes/programmes (on the lines of "Agriculture Grand Challenge", Government of India), researchers, technologists and start-ups will be engaged to undertake research, innovation and product developmental activities—laying the ground for the digitisation of agriculture and allied fields. Typical examples of the themes are advanced analytics that allows farmers to make smart decisions, livestock and farm management (cloud-edge systems), crop and soil health monitoring, agri autonomous vehicles and drones, automation for small farmers and so forth.
- **Smart-agri technology hubs (SATH)** will be established on the lines of TBIs to support entrepreneurs working in the area of digital technology innovations and applications in agriculture and allied priority sectors. Apart from providing working space and support services, these hubs will have design, development, prototyping, verification, and validation facilities. These hubs will have incubation and acceleration programmes.
- **Agriculture seed fund scheme (ASFS)** will be initiated to provide financial assistance to start-ups in the agriculture technology area for proof of concept, prototype development, product trials and market entry and commercialisation. This would enable these start-ups to graduate to a level where they will be able to raise investments from angel investors or venture capitalists or seek loans from commercial banks or financial institutions.
- A mission mode collaborative programme will be undertaken to address the problem of the information gap between the innovator and potential user. A "digital information dissemination platform" in the local language will be developed and implemented to disseminate knowledge from researchers and innovators.

6. R&D Financing





1. Purpose and Intent

The purpose and intent of this chapter is to develop a framework to adequately support R&D initiatives in the state of Karnataka. The framework should have adequate administrative and financial independence to enable concerted action towards long-term objectives. The framework should ensure that resources come from multiple sources and are distributed to a number of beneficiaries (Departments, universities, research institutes, start-ups, MSMEs, large corporations). The framework should also audit the resources to ensure that expenditures are as per policies and meet objectives.

2. Way Forward

- All R&D initiatives require financial support. There are three key considerations when it comes to R&D financing: (1) how much funding is to be allocated, (2) who in the ecosystem should be funding R&D and (3) how the R&D budget should be disbursed.
- At the national level (and by extension at the state level), the current spend on R&D is 0.65% of the GDP. Countries that have a strong R&D backbone spend at least 3% of their GDP on R&D. Moving forward, the R&D budget of Karnataka needs to be gradually increased to globally competitive levels.
- At the national level (and by extension at the state level), the government has been doing the majority of R&D spending. The private sector investment in R&D accounts for only 37% of the R&D spending at the national level. Moving forward, there needs to be a concerted effort to increase the private sector investment in R&D. Such an effort could also draw on philanthropic individuals/entities that provide support for different types of research.
- Traditionally, the government has supported fundamental research that is undertaken in state-affiliated universities and research labs. Industry, on the other hand, has typically undertaken applied research that it can commercialise in a short window of time. However, the investments do not necessarily feed off one another. For instance, the fundamental research that is undertaken in universities and research institutes is often not (or takes a long time to be) commercialised, and the research undertaken by the industry may not draw on the fundamental research undertaken within the ecosystem. Moving forward, there is a need to encourage and create spaces where government and industry funding can be aligned to achieve technological breakthroughs that benefit society at large. Additionally, government investment in R&D should expand beyond intramural financing that is focused on funding government entities to extramural financing that supports a larger set of ecosystem actors. Further, beyond financial grants, government spending on R&D should include in-kind endowments such as land or other physical infrastructure and equipment.
- To ensure a sustained focus on long-term objectives, the state envision the administration of the same by a largely autonomous entity that is funded by the government and other local private and philanthropic contributions.



Specific Objectives

- Allocate adequate funding for basic and applied research.
- Support a number of research institutions, centres, universities and private sector actors for the conduct of research and enhance the research and innovation ecosystem of the state.
- Create incentives to align government, industry and philanthropic funding.
- Unlock new sources of R&D capital.

Instruments and strategies

- Fund Allocation of 0.1% of state GDP towards R&D and Innovation expenditure is proposed to begin with. This percentage or enhancement of the amount will be provisioned based on availability of funds and ability to spend.
- The R&D and Innovation budget (over and above the current allocations for research through various departments) will be allocated as a block grant to the Karnataka State Research Foundation (KSRF), which will be the entity responsible for the administration of Research, Development and Innovation in the state. This budget will be subject to an annual audit.
- KSRF will enable private citizens/foundations and philanthropic entities to contribute towards R&D that addresses pressing regional problems and promotes citizens' quality of life. It would be proposed to Government of India that the contributions get tax benefits (80G) for the same (similar to the CM Relief Fund). The aim will be to ensure that funds from private and philanthropic sources form a sizable fraction of the entity's budget.
- The state will acquire and allocate land grants for R&D activities such as clusters and science parks, as per rules.
- KSRF will make specific (separate) allocations for basic and applied research. Similarly, KSRF will fix allocations for intramural and extramural research. Further, budget will be allocated to the projects and programmes recommended in this policy document.
- KSRF will assign a portion of its budget towards providing seed capital/grant for very early-stage R&D driven start-ups to evolve into a working prototype. This may be routed through Departments, HEIs, clusters, science parks or other vehicles outlined in this policy document. It may also be routed through select private VC funds. This funding should serve as risk/venture capital.
- A portion of the state R&D budget will be kept aside for matching grants. This will be used to encourage the financing of R&D projects by philanthropies, corporates and SMEs by providing appropriate matching grants from the state R&D budget.
- Accounting will be standardised across departments to keep track of R&D expenditure by the state as per State's accounting principles. The audited accounts will be published to ensure maximum transparency.

7. R&D Governance





1. Purpose and Intent

The purpose and intent of this chapter is to create a robust and transparent governance framework for the implementation of the Karnataka Research, Development and Innovation Policy articulated in this document. This chapter will also outline the governance mechanisms that will help facilitate the ongoing monitoring and evaluation of the various R&D activities in the state.

2. Way Forward

The Karnataka Research, Development and Innovation Policy is a first-of-its-kind effort to make the state a hub of R&D activity and lay the foundation for innovation-led growth. While there are several ambitious recommendations in this policy document, their success depends heavily on the collective ability of the state to drive the implementation of the policy.

There are several key aspects to the successful implementation of this policy.

- The policy requires patronage from the highest levels of the government, which will ensure the necessary support from all the ministries and departments and orient the government machinery to implement the policy directives.
- There is a need to audit the existing R&D activities spread across various line departments so that there is a clear baseline from which future steps can be chalked out. Schemes that are currently funded and fall under the ambit of this policy will be retained and counted under this policy. Steps will be taken to ensure that there will be no duplication of schemes/funding.
- Inter-departmental orchestration and coordination are key. Several initiatives outlined in this policy document require multiple government departments to work closely. Towards that end, there is a need to create support structures and processes that will help achieve interdepartmental coordination and collaboration.
- When it comes to R&D activities, R&D spending is the easiest to measure, that is, the amount of investment going into R&D. However, this will give a partial picture at best. It is equally important to track process and outcome metrics. Process metrics will ensure that there is a need to have a grasp of how the money is being spent (activities funded, technologies developed, actors involved, etc.), and outcome metrics will tell us the impact of R&D (patents, papers, prototypes, etc.). Moving ahead, there is a need to monitor, evaluate and report R&D activities on an ongoing basis.
- The state will need a relatively autonomous entity that will be fully empowered administratively and financially to set the agenda for R&D and Innovation in the state and will be accountable to the state through a duly defined process.



Specific Objectives

- Specify an administration structure that will orchestrate R&D activities/programmes of the state across various departments.
- Outline the composition, tenure and responsibilities of the administrative bodies being proposed.
- Provide guidance regarding monitoring, evaluation and reporting of R&D activities in the state.

Instruments and strategies

Figure 1 provides a representation of the governance structure of the R&D.

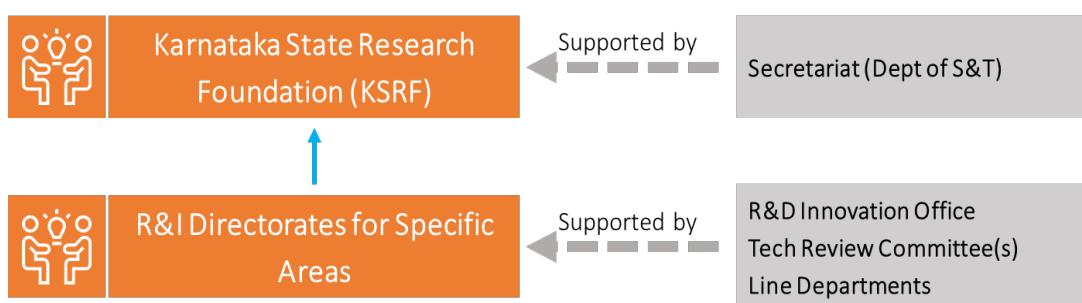


Figure 1: Administrative structure for R&D governance

Governance of R&D will be managed at *two* levels.

Level 1: KSRF (governed by a Board co-chaired by the Chief Secretary/Additional Chief Secretary/Principal Secretary/Secretary - Education/S&T and an eminent person from the scientific community to provide strategic leadership)

Level 2: Research and Innovation (R&I) Directorates to be formed under KSRF to address specific areas/needs as outlined in this policy.

Level 1: The Karnataka State Research Foundation(KSRF)

- KSRF will be governed by a Board of eminent persons. The Board will be co-chaired by the Chief Secretary/Additional Chief Secretary/Principal Secretary/Secretary - Education/S&T and an eminent person from the scientific community to provide strategic leadership.
- Members of the KSRF Board will be appointed by Government. The KSRF Board will comprise representatives from all sectors — academia, private sector (large companies, SMEs and start-ups) and civil society. KSRF will ensure adequate representation from all disciplines and sectors. The KSRF Board will meet at least four times a year to review progress and take operational decisions.
- The KSRF Board members will serve for a period of 6 years and will be constituted in a manner such that a third of the members will retire every 2 years. This is to ensure a balance between continuity and the introduction of new ideas and thinking.





- KSRF will appoint a Chief Executive Officer (CEO) who will be responsible for the oversight of administration, management, development, budgeting and short- and long-term planning of the organisation.
- KSRF will also appoint a Chief Operating Officer (COO) who will be directly involved in and responsible for the oversight of the day-to-day operational functions of the organisation.
- The CEO and COO will be ex-officio members of the KSRF Board.
- KSRF will draft specific plans/activities in line with the R&D policy and deliberate on identifying priority areas and sectors for R&D support.
- KSRF will enable interdepartmental coordination and collaboration of R&D activities. KSRF will rely on a number of Research Directorates to ensure that various sectors/areas/issues are adequately addressed and there is sufficient inter-sectoral/interdepartmental coordination.
- KSRF will be initially supported by the Karnataka Science and Technology Cell (Department of S&T), which will serve as the secretariat for matters related to R&D in the state. The Karnataka Science and Technology cell will provide technical support for the implementation and monitoring of R&D activities, for example, developing a digital platform to track the R&D activities across the state.
- Metrics collated/captured will be reviewed by the KSRF Board. These will include input, process and outcome metrics. KSRF (with the help of the secretariat and members) will develop a monitoring and evaluation framework for all R&D activities and review the frameworks developed by the respective directorates.
- KSRF will publish an annual report on the R&D activities in the state.

Level 2: Research and Innovation Directorates

- The Research and Innovation Directorates will be constituted to address specific aspects of the state R&D policy, including programmes and projects related to capacity building, cross-sectoral collaboration and others specified within this document. Special attention will be given to ensure the creation of directorates to address the R&D and innovation needs of priority sectors.
- The directorates will be the nodal points for review/evaluation and awarding of proposals. They will be supported by respective technical review committees and the various line departments (as the secretariat). The KSRF secretariat will support the directorates focussed on various aspects of the university-industry innovation ecosystem. Project technical review committees will be constituted for the projects to ensure high-quality outputs and make sure that the objectives of the projects are achieved.
- A comprehensive monitoring and evaluation framework for the R&D plans developed as part of this policy will be developed by all directorates and reviewed by the KSRF Board.

