

INDIA





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CTIER CENTRE FOR
TECHNOLOGY, INNOVATION
AND ECONOMIC RESEARCH

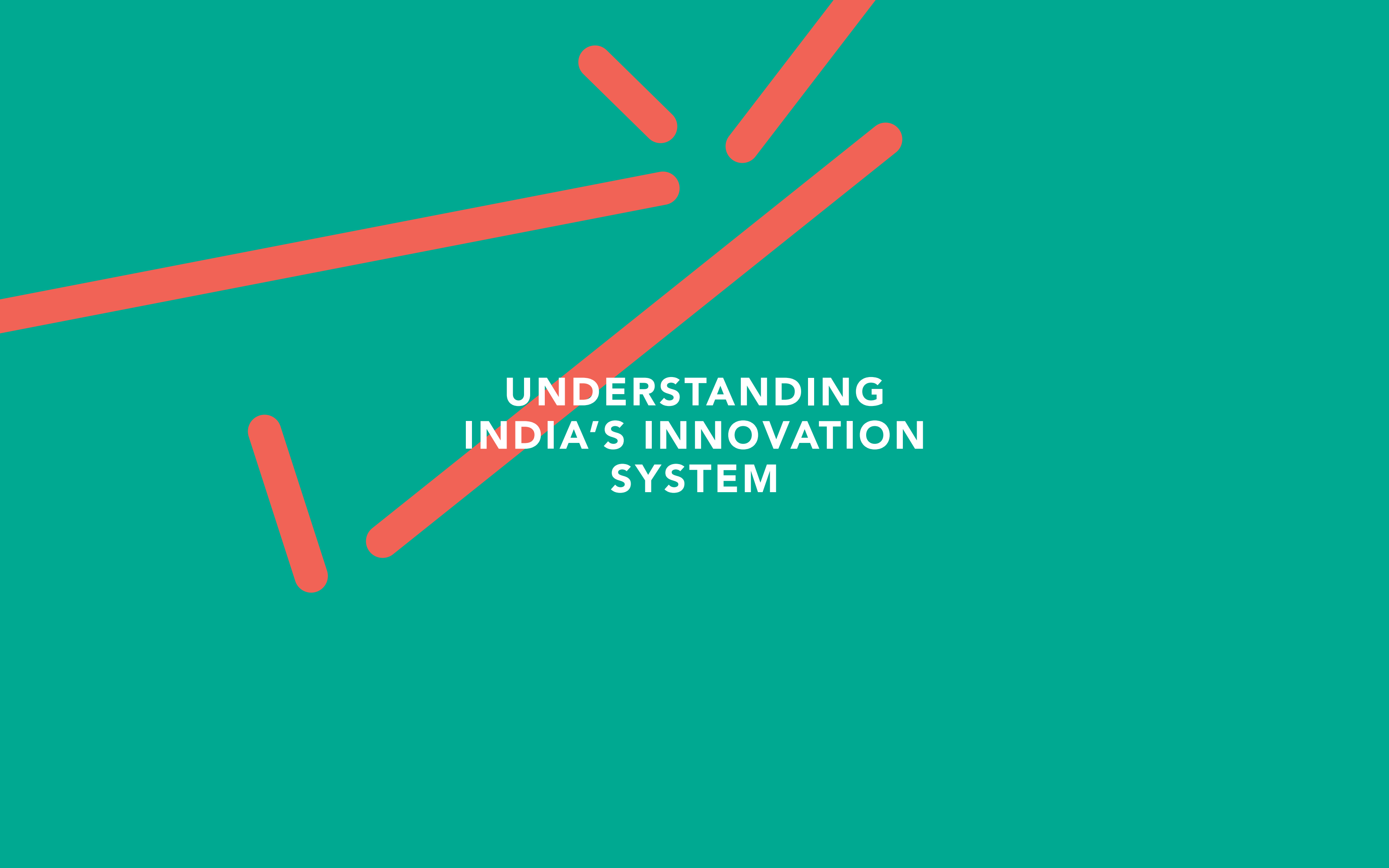
ABOUT THE REPORT

This report is a compilation of qualitative and quantitative information to give the reader a broad overview of the Indian innovation system. Effort has been made to present the reader with a framework that can serve as a comprehensive starting point to explore the multiple layers of the Indian innovation system.

The report benefits from conversations and interviews with many actors in the Indian innovation system conducted over a year. These discussions included policymakers from the state governments of Maharashtra, Telangana, Kerala, Punjab, Tamil Nadu, Andhra Pradesh and policymakers from the various departments of the Government of India, in particular the Department of Industrial Policy and Promotion, the Department of Science and Technology, the Ministry of Electronics and Information Technology and NITI Aayog.

Inputs from interactions with private sector firms, members of industry associations like the Confederation of Indian Industry, academicians and former (retired) policymakers have been included.

The latest available data as of January 2019 has been used, wherever possible. Readers should be aware that some of the data will be subject to change.

The image features a solid teal background. Several thick, rounded red lines are scattered across the frame, some parallel and some intersecting, creating a dynamic, abstract pattern. The text is centered in the middle of the image.

**UNDERSTANDING
INDIA'S INNOVATION
SYSTEM**

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* This report should be referenced as follows: CTIER and Nesta (2019) Understanding India's innovation system.

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1. COUNTRY PROFILE

COUNTRY PROFILE

1.1 INTRODUCTION

India: Summary of Innovation System

1 RBI, 1USD= 64.46

2 State of the World
Population, UNFPA (2014)

3 World Bank

4 Report, World Economic Forum (2017-18)

5 NIC, Decade of Innovations Roadmap (2013)

6 Rio Country Report (2015)

7 Forbes (2017)

8 UNESCO report (2015)

9 Report, IBEF(2017)

10 MNC R&D in India, CII -DST (2016)

11 Report, MHRD (2015)

12 Sharma et al. (2017)

13 Startup India

14 Website: SRISTI

India's gross domestic product (GDP) in current prices for 2017-2018 was USD2652 billion.¹ With a population of 1.3 billion, India has the world's largest young population but faces the danger of not realising this demographic dividend.²

India is the world's seventh largest economy and has a GDP per capita of USD1942.³

India is currently one of the fastest growing economies globally but several factors like demonetisation, ongoing implementation of a national Goods and Services Tax (GST), rising non-performing assets (NPA) with banks, etc., have affected the growth of the Indian economy in the recent past.⁴ Innovation is a political priority, with former Prime Minister Singh having declared 2010-2020 as the "decade of innovation"⁵ and flagship programs like "Startup India", "Make in India", "Digital India", "Skill India" being implemented by current Prime Minister Modi.

The Indian STI system follows a top-down model of research prioritisation wherein publicly funded-research and development (R&D) has a lion's share.⁶ India's investment in R&D has been stuck in a range between 0.6% of GDP and 0.9% of GDP for over 30 years,⁷

despite both the 2003 and 2013 STI policy specifically stating the objective of increasing GERD to 2% of GDP. Historically, the STI system has tended to place more importance on science rather than technology, resulting in Indian companies having less success in manufacturing products that require engineering skills, compared to the success seen in industries like pharmaceuticals that are science based.⁸ An interesting dynamic that has emerged is the growing number of R&D centres set up by multinational corporations (MNCs) like Intel, GE or Microsoft, making India a hub for global R&D and innovation, though little data on R&D output and positive spillovers from these centres is available.^{9,10} R&D in the university system is largely lacking. Indian universities rank poorly on global university rankings and do not reach their research potential - shortcomings recognised by the Government of India (GoI) which has taken steps towards formulating a new education policy.¹¹ The recent emphasis on patent policy has had a positive influence on R&D intensity¹² and has the potential to positively influence the Indian startup ecosystem, one of the largest ecosystems in the world.¹³

Innovation in India is also characterised by the emergence of frugal innovation (for example, the Mangalyaan spacecraft or Mitticool fridge), but increasingly, through demand for smart innovation by companies and consumers. The Honey Bee Network, supported by GoI, is a one-of-a-kind platform for uncovering grassroots innovations and inventions and bringing them to the global space.¹⁴

1.2 INNOVATION IN INDIA IN COMPARISON WITH OTHER COUNTRIES

INDICATORS	YEAR	INDIA	CHINA	SOUTH KOREA	BRAZIL	UK	EU	SOURCE
GLOBAL INNOVATION INDEX	2018	57/126	17/126	12/126	64/126	4/126	9/126	Global Innovation Index 2018
GLOBAL COMPETITIVENESS INDEX	2018	58/140	28/140	15/140	72/140	8/140	3/140	World Economic Forum
R&D GROSS DOMESTIC EXPENDITURE AS % OF GDP	2015	0.7	2.1	4.2	1.2	1.7	2	UIS, World Bank for Brazil, DST for India
HIGH-TECH EXPORTS, IN % OF MANUFACTURED EXPORTS	2017	7	23.8	14.2	12.3	21.1	14.2	World Bank
PATENTS FILED PER MILLION PEOPLE	2016	20	912	4562	35	807	—	World Bank, WIPO
% GROWTH IN TOTAL PATENT APPLICATIONS BETWEEN 2006 AND 2016	2016	174	873	35	45	11	—	WIPO
TIME IN DAYS REQUIRED TO START A BUSINESS	2018	17	9	4	21	5	13	World Bank
% OF 18-64 POPULATION WHO BELIEVE THEY HAVE THE SKILL/ KNOWLEDGE TO START BUSINESS	2017	42.1	27.2	45.7	55.9	48.2	—	Global Entrepreneurship Monitor

1.3 STATISTICAL HIGHLIGHTS

- Much of the R&D in India is being carried out in the public sector, which accounts for around 52% of India's expenditure on R&D, while the private sector accounts for around 44%. The higher education sector accounts for around just 4% of total expenditure on R&D.¹
- Innovation in India is largely concentrated in a few states (6 out of 29) and industrial sectors that include pharmaceuticals and biotechnology, automotive, information technology, defence, agriculture and related machinery, industrial machinery, chemicals, and electronics and electrical equipment.²
- India's total annual publications were 439,834 for the years 2012-2016, led by 67,581 publications in electrical and electronic engineering and 30,881 in multidisciplinary materials science. India's contribution to the world publication output was 3.5% in the five years from 2012.³
- Researchers per million population was 216 in 2015, lower than countries like China at 1,177. The indicator for developed countries like USA and Sweden stood at 4,232 and 7,022, respectively.⁴
- The number of applications for patents filed with the Indian Patent Office declined marginally to 45,444 in 2016-2017 from 46,904 in 2015-2016. 10,213 applications were filed for registration of designs while the number of applications for trademarks filed during 2016-17 was 278,170.⁵
- High technology exports in India were only 7% of manufactured exports in 2017.⁶
- India is the third largest startup ecosystem globally with startup exits totalling up to \$ 2.55 billion in 2017.⁷

¹ Research and Development Statistics, DST (2017-18)

² UNESCO Science report (2015)

³ InCites, CTIER

⁴ UNESCO Institute of Statistics (2015)

⁵ Indian Patent Office (IPO) (2017)

⁶ World Development Indicators, World Bank, (2017)

⁷ Economic Times (Dec 2017)

1.4 HIGHLIGHTS OF KEY INNOVATION PROGRAMMES

- **DIGITAL INDIA:** Launched in July 2015, this is one of the flagship programmes to transform India into a digitally empowered society and knowledge economy. India jumped 11 positions in the United Nations eGovernance index. The number of internet users doubled to 500 million in 2017 in three years. 1140 million Indians have registered under AADHAR. digitalindia.gov.in/
- **MAKE IN INDIA:** Launched in 2014 to push for greater investment, improve overall manufacturing infrastructure, increase innovation, protect intellectual property and promote skill development. India has jumped 30 places to rank 100 in the Ease of Doing Business 2018, largest increase recorded by a country. FDI inflows increased by 37% since its launch. makeinindia.com/home
- **STARTUP INDIA:** Startup India intends to create a strong innovation and startup ecosystem to create sustainable economic growth and promote large-scale employment opportunities. It was launched in January 2016 with 4,536 applications being recognised by DIPP and 74 startups have been approved for tax benefits of IMB. startupindia.gov.in/
- **ATAL INNOVATION MISSION:** The mission has two main constituents: promotion of entrepreneurship through Self-Employment and Talent Utilization (SETU program), where innovators are supported and mentored to become successful entrepreneurs. Second is promotion of innovation through the provision of a platform where innovative ideas are generated. NITI Aayog has selected 941 schools for establishing Tinkering Labs. Of the 457 selected in FY 2016-2017, 374 Tinkering Labs have received a Grant-in-Aid of INR1.2 million each. niti.gov.in/content/atal-innovation-mission-aim
- **GLOBAL INNOVATION & TECHNOLOGY ALLIANCE (GITA):** DST and Confederation of Indian Industry established GITA in 2011 as a joint venture company to work towards promoting collaborative industrial R&D programmes between India and other innovative countries. Links have been established with UK, Japan, Israel, EU etc. gita.org.in/OnlineRfp/ProgramInfo.

1.4 HIGHLIGHTS OF KEY INNOVATION PROGRAMMES

- **VISITING ADVANCED JOINT RESEARCH (VAJRA) FACULTY SCHEME:** SERB at DST has created a VAJRA Faculty Scheme in January 2017 for overseas scientists and academicians especially for Non-resident Indians (NRI) and Overseas Citizen of India (OCI) to undertake research on a nationally relevant area and help grow research and development in the country.

dst.gov.in/vajra

- **UCHCHATAR AVISHKAR YOJANA (UAY):** SERB is partnering with MHRD for UAY projects with an emphasis on industry-university collaboration wherein the share of SERB funding will be 25%, while MHRD will contribute 50% and Industry the remaining 25%. For the year 2016-2017, 92 projects for INR2.85 billion have been approved in the IITs.

mhrd.gov.in/rusa

- **INDUSTRY RELEVANT R&D (IRRD):** This scheme, implemented by SERB is to encourage collaborative R&D between academic institutions and industry on industry specific problems. Industry is expected to fund at least 50% of the project.

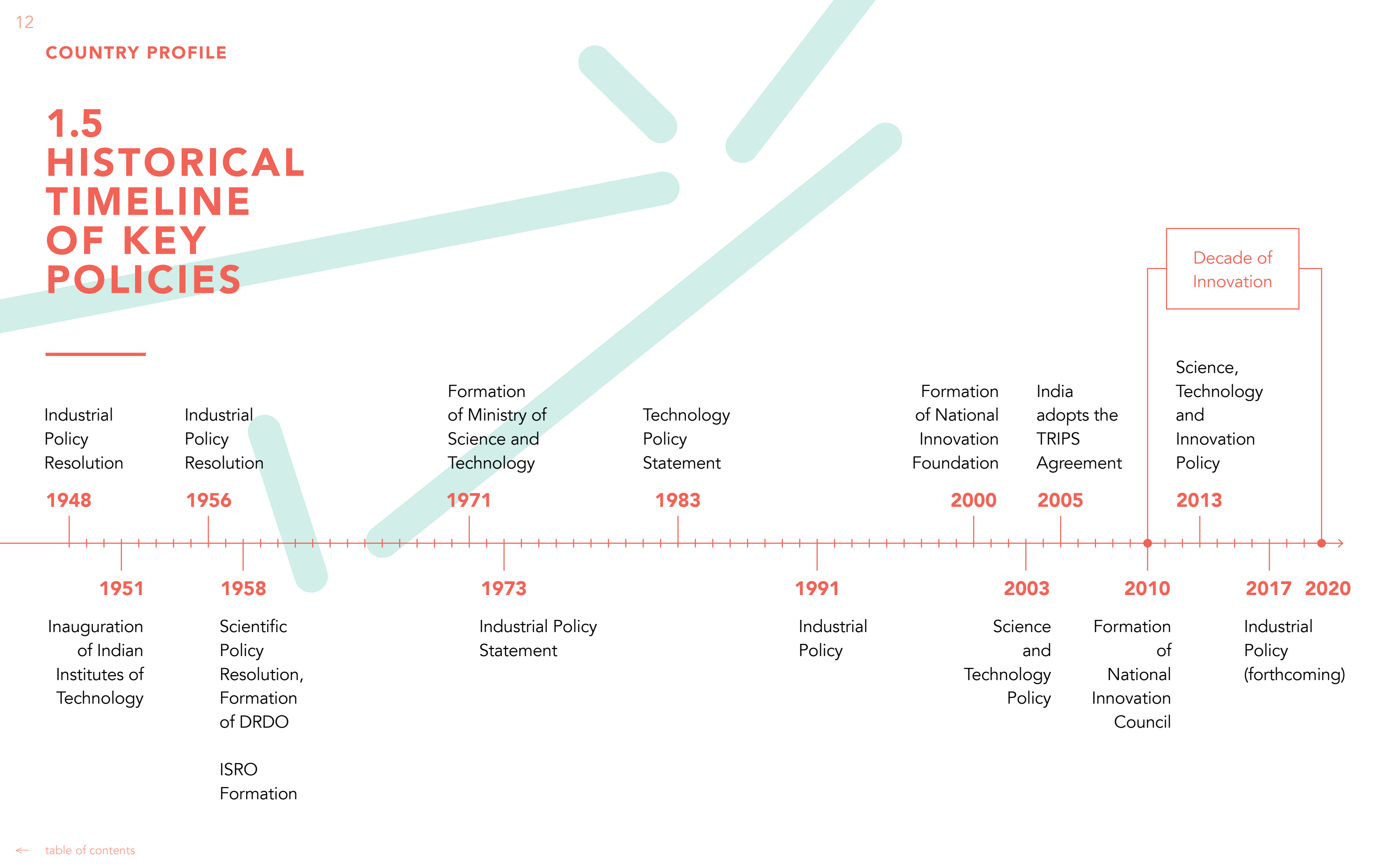
serb.gov.in/irrd.php

- **SKILL INDIA:** Launched in July 2015, the Skill Certification Scheme is intended to help young people develop industry-relevant skill training. In 2016-2017, around 1,018,572 candidates were provided with skills training.

skilldevelopment.gov.in/pmkvy.html

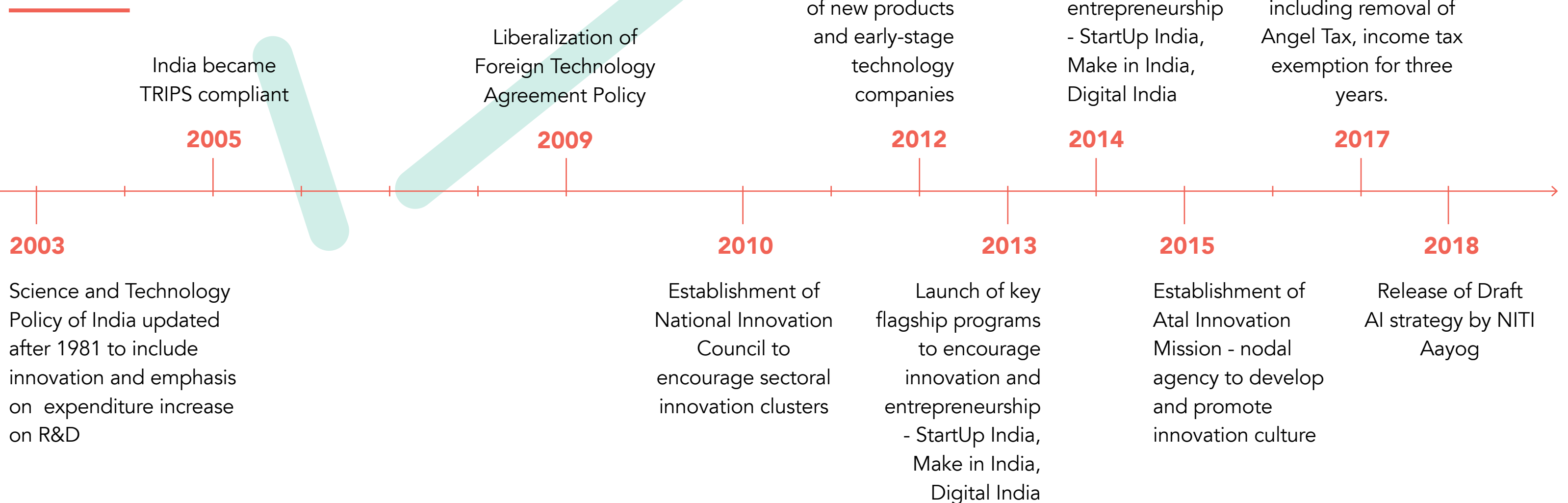
COUNTRY PROFILE

1.5 HISTORICAL TIMELINE OF KEY POLICIES



COUNTRY PROFILE

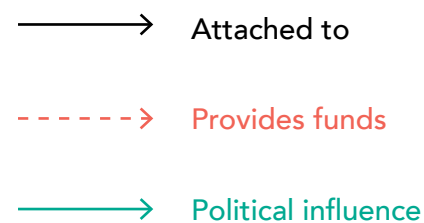
1.5 HISTORICAL TIMELINE OF MAJOR EVENTS IN INNOVATION



COUNTRY PROFILE

1.6.1 INSTITUTIONAL MAP OF THE INDIAN INNOVATION SYSTEM

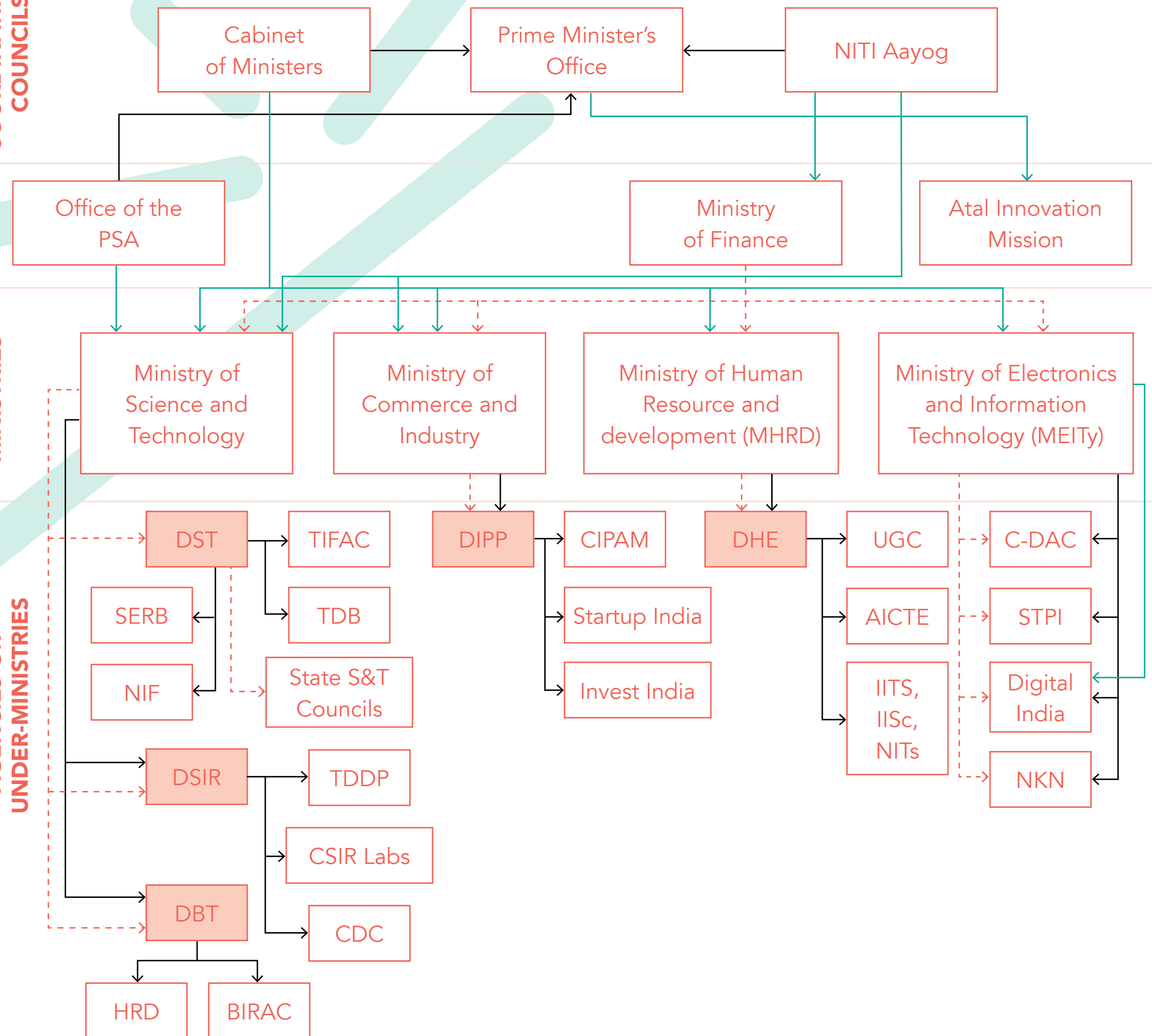
- The National System of Innovation represented here is meant to provide the reader a broad outline of the major government organizations involved
- The Cabinet, which is the highest body, take help of outside experts as well as representation from all states, often through the mechanism of steering committees and task forces, for specific issues
- Industry organizations, private sector firms, private universities are also major actors, though not represented in this institutional map



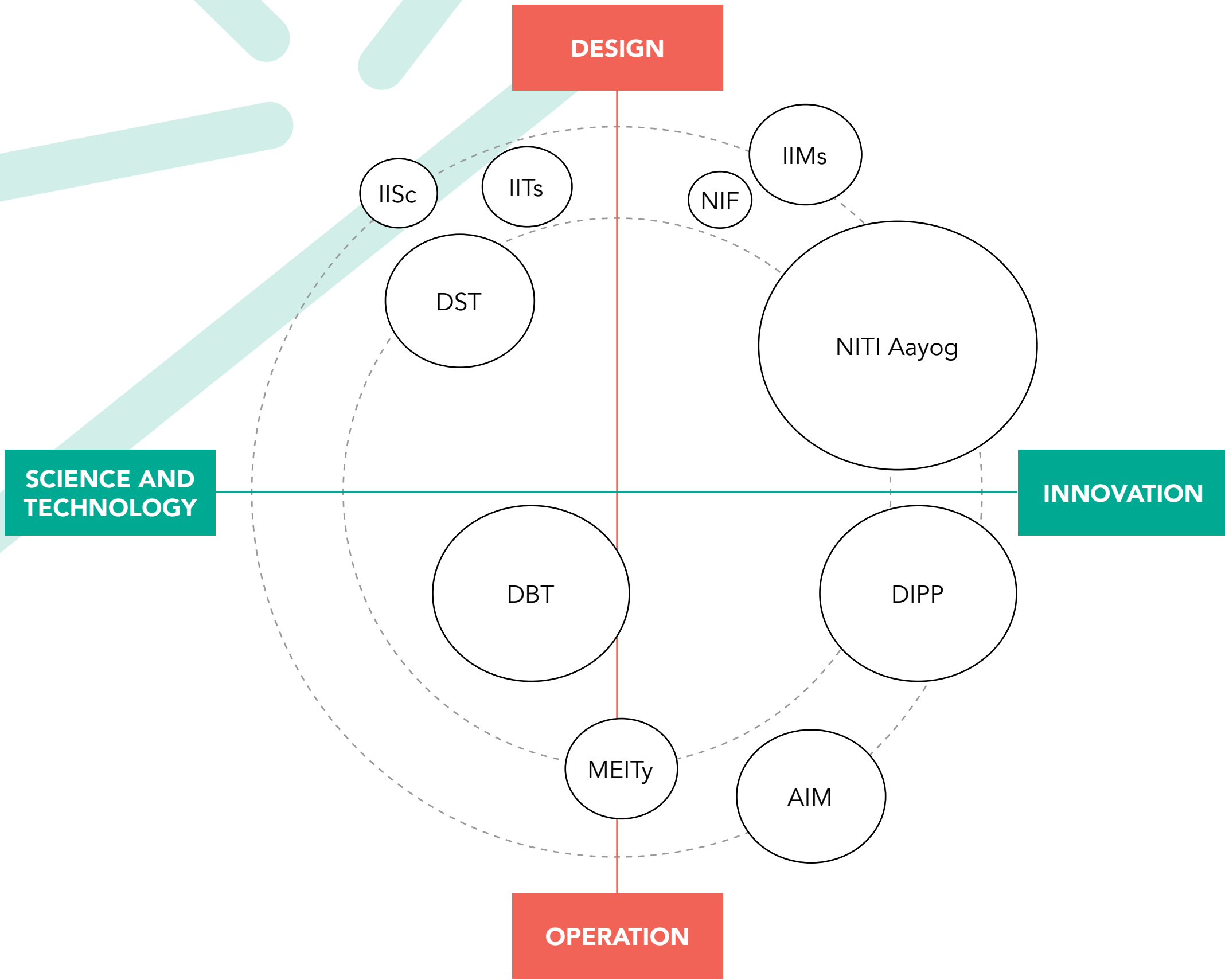
COORDINATING COUNCILS

MINISTRIES

AGENCIES OR UNDER-MINISTRIES



1.6.2 ROLE AND INFLUENCE DIAGRAM OF KEY MINISTRIES AND AGENCIES



Level of influence: the bigger the size of the bubble, the more influence in the innovation system.

This influence map is indicative and reflects the insights of the project team rather than a formal statement of roles and structures.

COUNTRY PROFILE

1.7 GLOSSARY OF INSTITUTIONAL ABBREVIATIONS AND ACRONYMS

- **AICTE:** All India Council for Technical Education
- **ASSOCHAM:** Associated Chambers of Commerce and Industry of India
- **BIRAC:** Biotechnology Industry Research Assistance Council
- **CAGR:** Compound Annual Growth Rate
- **C-DAC:** Centre for Development of Advanced Computing
- **CDC:** Consultancy Development Centre
- **COE:** Centres of Excellence
- **CII:** Confederation of Indian Industries
- **CIPAM:** Cell for IPR Promotion and Management
- **CSIR:** Council of Scientific and Industrial Research
- **DBT:** Department of Biotechnology
- **DHE:** Department of Higher Education
- **DIPP:** Department of Industrial Policy and Promotion
- **DSIR:** Department of Scientific and Industrial Research
- **DST:** Department of Science & Technology
- **EODB:** Ease of Doing Business
- **FDI:** Foreign Direct Investment
- **FICCI:** Federation of Indian Chambers of Commerce and Industry
- **FTE:** Full Time Equivalent
- **GE:** General Electric
- **GERD:** Gross Domestic Expenditure on R&D
- **GDP:** Gross Domestic Product
- **GITA:** Global Innovation & Technology Alliance
- **GOI:** Government of India
- **GST:** Goods and Services Tax
- **HRD:** Human Resource Development
- **IBEF:** India Brand Equity Foundation
- **IIM:** Indian Institute of Management
- **IITS:** Indian Institutes of Technology
- **IISC:** Indian Institute of Science
- **IMB:** Inter-ministerial Board
- **IPR:** Intellectual Property India
- **IRRD:** Industry Relevant R&D
- **MEITY:** Ministry of Electronics and Information Technology
- **MHRD:** Ministry of Human Resource Development
- **MNC:** Multinational Corporation
- **NASSCOM:** National Association of Software and Services Companies
- **NIC:** National Innovation Council
- **NIF:** National Innovation Foundation
- **NIT:** National Institute of Technology
- **NITI:** National Institution for Transforming India
- **NKN:** National Knowledge Network
- **NPA:** Non-performing assets
- **NRI:** Non-resident Indian
- **OCI:** Overseas Citizen of India
- **PIO:** Persons of Indian Origin
- **PSA:** Principal Scientific Advisor
- **PSU:** Public Sector Unit
- **R&D:** Research and Development
- **RBI:** Reserve Bank of India
- **S&T:** Science and Technology
- **SERB:** Science and Engineering Research Board
- **SETU:** Self-Employment and Talent Utilization
- **SME:** Small and Medium-sized Enterprises
- **SRISTI:** Society for Research and Initiatives for Sustainable Technologies and Institutions
- **STEM:** Science, Technology, Engineering and Mathematics
- **STI:** Science, Technology and Innovation
- **STPI:** Science and Technology Parks of India
- **TDB:** Technology Development Board
- **TDDP:** Technology Development and Demonstration Programme
- **TIFAC:** Technology Information Forecasting and Assessment Council
- **UGC:** University Grants Commission
- **UNESCO:** United Nations Educational, Scientific and Cultural Organisation
- **UNFPA:** United Nations Population Fund
- **UAY:** Uchchar Avishkar Yojana
- **VAJRA:** Visiting Advanced Joint Research (VAJRA) Faculty Scheme

1.8 STRENGTHS AND WEAKNESSES ANALYSIS

1 DIPP

2 The India State Innovation Report (2016)

3 DST

4 AIM

5 Website: BIRAC

6 NIC

7 Forbes (2017)

INSTITUTIONAL FRAMEWORK

STRENGTHS

Most government departments recognise innovation as a necessary policy priority for economic and social growth

- Innovation is a political priority and thus, a government priority that has led to several new reforms like GST, the Insolvency and Bankruptcy code, digital payments, etc.
- DIPP has taken a keen interest in encouraging innovation initiatives - it headlines flagship programmes like Startup India and Make in India.¹
- DST runs a number of programmes for incubators, scientists, budding entrepreneurs, students² to promote inclusive innovation and also funds a grassroots innovation initiative, the National Innovation Foundation.³
- The Atal Innovation Mission⁴ under the NITI Aayog targets school and college students to promote the culture of innovation through different initiatives like tinkering labs and hackathons.
- Several departments have implemented successful public-private partnership models, for example, BIRAC⁵ that aims to strengthen biotech enterprises and promote research and innovation to address India's development needs.
- Several initiatives to foster innovation have been kickstarted by various ministries like smart cities, linking of industrial corridors, skilling initiatives, digital literacy initiatives, etc.

WEAKNESSES

In practice, there is no single leader for driving innovation in the country nor has R&D thus far been related to development and commercialisation of innovation

- The National Innovation Council formed in 2009-2010 to set the innovation roadmap for 2010-2020 is defunct since the new government was elected in 2014.⁶
- Government investment in R&D remains less than 1% of the nation's GDP.⁷
- There is a lack of a coordination mechanism/ collaborative umbrella between ministries as they implement similar programmes on setting up incubators and funds.
- Most innovation initiatives are relatively new and it is too early to comment on the effectiveness of the monitoring and implementation mechanisms.
- Decision-making is slow because of a cautious approach and risk averse culture. As a direct result, very little R&D has commercial potential/ market readiness, and most of the funds are invested in infrastructure building rather than capacity building.

COUNTRY PROFILE

1.8 STRENGTHS AND WEAKNESSES ANALYSIS

- 1 Census (2011)
 2 AISHE (2011-12 and 2017-18)
 3 Measuring Human Capital, World Economic Forum (2016)
 4 Economic Survey, India (2018)
 5 OECD (2017)
 6 Forbes (2017)
 7 AISHE (2017-18)
 8 Parliament Standing Committee Report (2018)
 9 Times Higher Education World University Rankings (2017,2018)
 10 Unesco Institute of Statistics (2016)
 11 MSDE annual report (2017)
 12 ibid

HUMAN CAPITAL

STRENGTHS

India has a large, young aspirational population

- More than 60% of India's population is between the ages of 14-59, with over 45% below the age of 24¹, with many displaying an entrepreneurial bent.
- There has been increase in the number of PhD enrolments from 77,000 in 2011-2012 to 161,412 in 2017-2018.²
- There is an increasing number of scholarships and loan schemes to encourage STEM education in public and private institutes in urban and rural settings.
- India has the second largest number of STEM graduates globally.³

WEAKNESSES

Reach and quality of education is highly fragmented

- 30% of India's youth are not in education, employment or training.^{4,5}
- India's technical institutions are teaching universities, not research universities resulting in a stagnation of graduate technical education and an acute shortage of qualified faculty who do research.⁶
- Gross enrolment ratio in higher education is just 25.86. The pupil teacher ratio of 29 for higher education is on the higher side as well and is a signal of an acute shortage of qualified faculty.^{7,8}
- Very few Indian institutes appear in the top 300 institutes globally.⁹
- India has just around 216 Full time Equivalent (FTE) researchers per million compared to China (over 1,100) and the UK which has nearly 4,500 researchers per million.¹⁰
- India has a low percentage of skilled workforce, with just 4.7% of the workforce having formal vocational skills in comparison to developed countries that have a skilled workforce between 60% and 90% of the total workforce.¹¹
- There is an acute shortage of well qualified faculty in the country, including premier educational institutions.¹²

1.8 STRENGTHS AND WEAKNESSES ANALYSIS

1 India Innovation Report, Thomson Reuters (2015)

2 Innovations and Patents, India Brand Equity Foundation (2017)

3 UNESCO science report (2016)

4 Forbes (2017)

5 Economic Survey of India (Chap 8) 2017-18

6 InCites (2012-16), CTIER

7 InCites (2012-16), CTIER

8 EU Industrial R&D Investment Scoreboard (2016)

9 ibid

10 Indian Startup Ecosystem: Traversing the Maturity Cycle, NASSCOM-Zinnov (2017)

STRENGTHS

Stable support system to enhance knowledge building

- The CSIR is the top Indian patentee with the USPTO, and is a globally recognised public research institution. They account for a large share of patents in India's academic and government sector.¹
- Positive reforms to make filing for IPRs simple through patent facilitation centres, incentives, subsidies have made the process more accessible, with an increase in IPR applications at a compound annual growth rate of 26.9%, with the number increasing from 262,638 to 340,000 in 2015-2016.²
- Through GITA, multiple knowledge sharing partnerships have been built globally and Centres of Excellence (CoEs) have been established. India runs several programmes in partnership with innovation leaders like Israel, Finland, Germany, Japan, etc.
- More and more Indian companies are acquiring knowledge assets from abroad through a wave of cross-border mergers and acquisitions across varied sectors like steel, automotive, aerospace, computer software development, etc.³
- India's rising technology imports could be viewed as positive for innovation in products and services.⁴

WEAKNESSES

Very little integration between industry and academia and unequal growth amongst states

- There is severe backlog and a high rate of pendency for domestic patent application. Reports indicate a backlog of 200,000 patents.⁵
- India's publication output (3.5%) is still quite low as compared to China and America which contribute 13.9% and 26.3%, respectively to world publication output.⁶
- There is a distinct gap in concurrent knowledge sharing between industry and the education sector, industry-academia publications count for only 0.8% of India's total publication output.⁷
- Not all sectors are investing in R&D in the long term, India has a presence only in three of the top 10 R&D sectors globally.⁸
- Although India's technology imports are rising resulting in a negative technology trade balance, it is unclear whether the rise can be attributed to industrial licensing of technology or towards payments for trademarks and copyrights.⁹
- The concentration of startups and incubators is skewed with just three Tier I cities serving as base for 80% of the country's startups.¹⁰

1.8 STRENGTHS AND WEAKNESSES ANALYSIS

FUNDING

STRENGTHS

Public and private funding for innovation and entrepreneurship has been increasing

- The government uses several tax incentives (such as the 150% weighted tax deduction) to encourage domestic enterprises to commit more resources to R&D. It is one of the most generous incentive regimes for R&D in the world.¹
- The establishment of the Science and Engineering Research Board in DST in 2010 has helped fluidify the availability of research grants in the public science system to encourage technical universities to embrace research.²
- Strong policy support is available for startups in the forms of funds, loan subsidies, tax incentives, IPR registration facilities, incubator set-ups, etc.³
- Venture funding into India has been on the increase, with a reported USD12.7 billion in equity funding in 2018, making India among the top destinations for venture capital funding.⁴
- FDI inflows increased by 37% since the launch of Make in India between the period October 2014-February 2016.⁵

WEAKNESSES

Fund disbursement mechanisms are restricted by a risk-averse culture

- Government funding mechanisms often require a good track record or recognition by DSIR, making it difficult for smaller firms to compete for funding.⁶
- Moreover, the government support in terms of schemes for R&D tend to be small in amount and spread across a large number of projects. Most projects are small-scale or focused on basic technologies.⁶
- There is a mismatch in public priority and private funding leading to a skewed startup ecosystem that focuses more on services than innovation. The total potential of the large underserved domestic market remains untapped.³
- More than 50% public investments in R&D account for strategic sectors like defence, atomic energy and space whereas, the share of state investments in other sectors like biotechnology, agriculture, medical research has been going down.⁷
- Private investment in R&D is severely lacking, aptly demonstrated by the low number of Indian companies in the Global R&D spenders list.⁸
- Innovation in SMEs is restricted by lack of funding and financing options.⁹
- The rate of underutilization of public funds, especially for flagship schemes, is a cause of concern.

1 Mani, S. (2014)

2 UNESCO Science report (2015)

3 Indian Startup Ecosystem: Traversing the Maturity Cycle, NASSCOM-Zinnov (2017)

4 Ramachandran (2019)

5 Website: investindia.com

6 Krishnan R, From Jugaad to Systematic Innovation (2010)

7 CTIER calculation, various years annual budgets

8 Economic Survey, GoI (2017-18)

9 Barriers to Innovation, Asian Development Bank (2016)

1.8 STRENGTHS AND WEAKNESSES ANALYSIS

BROADER ENVIRONMENT

STRENGTHS

Stable economy, with low inflation creates a conducive environment for business.

- India is one of the world's fastest growing economies with a steadily rising GDP and a stable political system.¹
- In the Global Competitiveness Index, India's ranking improved 5 places, to the 58th rank in 2017-18.² while its ranking in the Global Innovation Index improved from 60 in 2017, to 57 in 2018.³
- Policy resolve is demonstrated in India's 23 place jump in the Ease of Doing Business rankings to 77 in 2018-19.⁴
- India has a large untapped domestic market, ripe for good quality products and innovations with increasing teledensity and rising spending power.

WEAKNESSES

Innovation is focused in a few industries and places

- Innovation in India is largely concentrated in a few states (6 out of 29) and industrial sectors that include pharmaceuticals and biotechnology, automotive, information technology, defence, agriculture and related machinery, industrial machinery, chemicals, and electronics and electrical equipment.⁵
- India ranks 57th on the Global Innovation Index with not much change in education parameters.³
- India's high tech manufacturing as a percentage of total manufacturing is low. (7% in 2017).⁶
- The ecosystem for startups and SMEs is different with little evidence of diffusion.⁷
- Growth is unequal across states. There are 125 incubators across India, however nearly 70% of them are located in just six states.⁸

1 Rio Country Report (2015)

2 Global Competitiveness Index (2018)

3 Global Innovation Index (2017)

4 Ease of Doing Business, World Bank (2017)

5 Unesco Science Report (2015)

6 World Development Indicators, World Bank (2016)

7 Rajan, FICCI, (2017)

8 Startup India Hub (2017)

1.8 STRENGTHS AND WEAKNESSES ANALYSIS

ECOSYSTEM CONNECTIONS

STRENGTHS

Strong regional and international relations for knowledge creation backed by policy support

- India has strong bilateral relations with regional players and also with major innovation economies like Israel, Finland, Japan, the USA, etc.
- Strong chambers of commerce and business associations like CII, FICCI, ASSOCHAM, even though hampered by high levels of bureaucracy, recognise, support and promote innovation and entrepreneurship.
- Indian diaspora often lead and help establish high-tech businesses contributing to local diffusion and are increasingly, playing an influential role as quasi-ambassadors for India in the international arena.¹

WEAKNESSES

There is a long way to go for the greater integration of public and private efforts, education and businesses to promote innovation as a growth-driver

- Duplication of programmes, lack of information and coordination across departments and lack of a platform for peers to share implementation experiences, is a major impediment for innovation culture to spread across government.
- Lack of a strong mentorship culture for researchers and entrepreneurs and very few mechanisms to encourage mentorship are a major cause of failure.²
- Despite having one of the most generous R&D tax regimes worldwide, the spread of innovation culture has been largely limited to a few sectors.³

¹ Report, Observer Research Foundation (2017)

² Entrepreneurial India, IBM Business Value-Oxford (2016)

³ Unesco Science Report (2015)

2.
SPOTLIGHT ON THE STATE
OF MAHARASHTRA

SPOTLIGHT ON THE STATE OF MAHARASHTRA

2.1 INTRODUCTION

Maharashtra is located in the western region of India and is the second most populous state in the country with a population of 112 million. It is the third largest state by area and home to the country's financial capital - Mumbai.¹ The GSDP for Maharashtra in current prices was USD387 billion in 2017-18 and USD337 billion in 2016-17, with a real growth rate of 7.3% during 2017-2018.²

The state of Maharashtra is one of the largest state economies in India, accounting for around 19% of India's gross domestic product in 2017-18.³ It is highly industrialised and accounted for 16.3% of India's industrial output.⁴ The state is a key destination for foreign investment, attracting USD13.4 billion over the year ending April 2018. The state had FDI inflows of USD20 billion for the year ending April 2017 as compared to USD9.5 billion in the previous year.⁵

Some of the key industrial sectors present in Maharashtra include automobiles, engineering, petrochemicals, chemicals, pharmaceuticals, electronics, and food processing.⁶ Maharashtra also accounts for more than 20% of the country's total IT exports.⁷ It is also home to one of the largest creative ecosystems in the country, the Hindi film industry and its allied interests.

There is an increasing focus on promoting entrepreneurship in Maharashtra through incentives for startups and venture capital investments. The Government aims to attract investments of around USD776 million⁸ to boost the ecosystem by 2022.⁹

Some of the prominent and emerging hubs include SINE, IIT Bombay, Venture Centre, NCL campus and Gennext funded by Reliance and Microsoft Ventures. In 2016, the Maharashtra government signed MoUs with an investment intention of over USD6.7 billion¹⁰ in automobiles, steel, fertilisers, realty, IT and ITES, ports and skill development with various companies like the Vedanta Group, Uber, Raymond, Mahindra & Mahindra, etc.¹¹ This investment decision was followed by another global investment summit, Magnetic Maharashtra, in 2018 wherein a of total 4,108 proposals with an investment of USD187 billion¹² and proposed employment of 3.6 million were signed.¹³

Major cities in the state like Mumbai, Pune and Nagpur are leading knowledge hubs for the country with a high concentration of premier technical institutions and high tech government research organisations like Bhabha Atomic Research Centre (barc.gov.in), Tata Institute of Fundamental Research (tifr.res.in), Indian Rare Earths Limited (irel.co.in), National Chemical Laboratory (ncl-india.org), etc. The state also has two CSIR (csir.res.in/csir-labs) labs and a strong presence of defence training and research organisations. The Gol's nodal Intellectual Property Management and Training Institute is located in Nagpur.¹⁴

1 Economic Survey of Maharashtra (2017-18)

2 RBI; 1USD=64.46INR, FRED 2017-18, 1USD=67.03INR, FRED 2016-17

3 Maharashtra State Report, India Brand Equity Foundation (2018)

4 ibid

5 DIPP-FDI Factsheet (2018)

6 Maharashtra 2025: Leapfrogging to a 1\$Trillion Economy, Report FICCI (2018)

7 MIDC presentation, Magnetic Maharashtra Conclave (2018)

8 1USD=64.46INR, FRED 2017-18

9 Article, Yourstory (2018)

10 1USD=67.16INR, FRED 2016

11 Article, Business Standard (2016)

12 1USD=64.46INR, FRED 2017-18

13 ibid

14 Website: RGNIPM

2.2 STATISTICAL HIGHLIGHTS

- Maharashtra is one of the top destinations for MNC R&D Centres.¹
- Maharashtra ranks 13 among 36 states and Union Territories in the ease of doing business (EODB) rankings released by DIPP for the year 2018.²
- Maharashtra had an above all-India average internet (414 per 1,000 households) and computer penetration (249 per 1,000 households) in 2014.³
- The state is an educational hub with over 1,064 engineering colleges and 846 industrial training institutes.⁴
- Maharashtra has 93 industrial clusters⁵ with 117 High and Medium Tech and ten Knowledge Intensive Industrial R&D centres belonging to the top 218 private spenders on R&D in India.⁶
- The state accounts for nearly 25% of the country's total exports at USD67.4 billion in 2016-2017.⁷
- Maharashtra had 3,513 patent applications in 2016-2017, maintaining its number one ranking among the states, as the previous year, although the total number of applications has decreased by 4% since 2015-2016.⁸
- 30 Geographical Indicators were filed in 2016-2017 in this state up from 17 in the previous year.⁹
- The state has five institutes of national importance.¹⁰

¹ Euro Industrial R&D Scoreboard, CTIER

² DIPP (2018)

³ NSS 71.25.2 (2014)

⁴ Website: investIndia.com

⁵ Foundation for MSME Clusters (2010)

⁶ DSIR (2016), CTIER Handbook

⁷ Economic Survey of Maharashtra (2017-18);

1USD=67.03INR, FRED 2016-17

⁸ IPO (2016-17)

⁹ ibid

¹⁰ MHRD (2017)

2.3 HIGHLIGHTS OF KEY INNOVATION PROGRAMMES

• IT/ITES POLICY 2015:

The policy aims to make Maharashtra a preferred investment destination and retain its leadership position in the IT and ITES sector. It aims to attract investments of around USD7.8 billion and create one million jobs by 2020 while making Maharashtra a hub for the gaming, animation and IT industry.

bit.ly/1buAsV7

• INDUSTRIAL POLICY 2013:

Focuses on developing key areas such as Information Technology, Biotech, grape processing, renewable energy, textiles and power generation.

foodprocessingindia.co.in/state_pdf/Maharashtra/IndustrialPolicyofMaharashtra2013.pdf

• INNOVATION AND STARTUP POLICY 2017:

Prepared by the Skill Development and Entrepreneurship Department of Maharashtra, the policy aims at fostering a startup environment that will provide mentorship and guidance to aspiring entrepreneurs, and transform novel ideas into practical solutions for industry and other key stakeholders including government. It aims to set up an incubator in each district through a public-private partnership model for each of their 12 high priority areas. The policy also aims to garner the interest of children early in school by starting an optional

course called 'Entrepreneurial Development', with a gap year to allow young people to work on their projects.

aaplesarkar.maharashtra.gov.in/file/Innovation-Startup-Policy-2017-English.pdf

• WOMEN ENTREPRENEUR POLICY 2017:

First state in the country to have an exclusive policy for women entrepreneurs, the Maharashtra government has set aside USD100 million in the state budget. This policy will enable a woman entrepreneur to get financial assistance of USD20,000 up to USD150,000 based on the proportion of capital investment of the project at the subsidised interest rate of up to 5%.²

maitri.mahaonline.gov.in/PDF/Special_Policy_for_Women_Entrepreneur_14.12.2017.pdf

• AEROSPACE AND DEFENCE MANUFACTURING POLICY 2018:

The policy aims to make Maharashtra a top destination for Defence and Aerospace manufacturing, with the intention of also benefiting MSMEs to become globally competitive in this sector.

maitri.mahaonline.gov.in/PDF/Aerospace.pdf

¹ 1USD = 64.1INR, FRED 2015

² 1USD = 65.1INR, FRED 2017

2.3 HIGHLIGHTS OF KEY INNOVATION PROGRAMMES

• **FINTECH POLICY:**

This policy approves the establishment of the 'Global Fintech Hub' in Mumbai. To implement the policy, the state will create a Fintech corpus fund of USD40 million over the next three years. It will provide various financial incentives to FinTech startups and operational expenses of Industry Sandbox and the Global FinTech hub. Government institutions like CIDCO and MMRDA are expected to contribute an amount of USD4 million each to set up this fund.³

maitri.mahaonline.gov.in/PDF/Fintech.pdf

• **ELECTRIC VEHICLE POLICY:**

Aims to develop Maharashtra as the leader in Electric Vehicle (EV) manufacturing and use. The policy lays down several incentives to EV buyers, manufacturers and related industries with the purpose of attracting investment in the sector and to increase registration of electric vehicles in Maharashtra to 500,000.

maitri.mahaonline.gov.in/PDF/Electric_Vehicle.pdf

• **MAITRI/SINGLE WINDOW POLICY:**

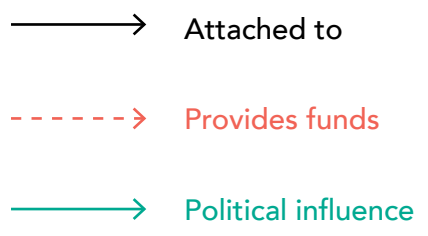
The single window scheme is a one-stop-shop for granting approvals to industries at Maharashtra Industry, Trade and Investor Facilitation Cell (MAITRI). The policy enhances the existing role of MAITRI as an information provider and a grievance redressal mechanism and to provide a holistic mechanism for industry related services to various departments of the state.

maitri.mahaonline.gov.in/PDF/Single_Window_Policy_2016.pdf

SPOTLIGHT ON THE STATE OF MAHARASHTRA

2.4.1 INSTITUTIONAL MAP OF THE MAHARASHTRIAN INNOVATION SYSTEM

- The Cabinet is the highest decision-making body and the Assembly is the highest decision approval authority.
- Innovations take place at every level starting from the District Collectorate, Local Bodies, various Directorates, Universities etc.
- In order for the innovation to come into operation, it has to be approved first by Planning Department and then by General Administration, if it involves changes in govt. processes and finally by the Finance Department if it involves any financial outlay.
- General Administration Department is also constantly working in innovation and reform in the administrative procedures and structure.
- The CMO at the apex coordinates as well as promotes new policy options.

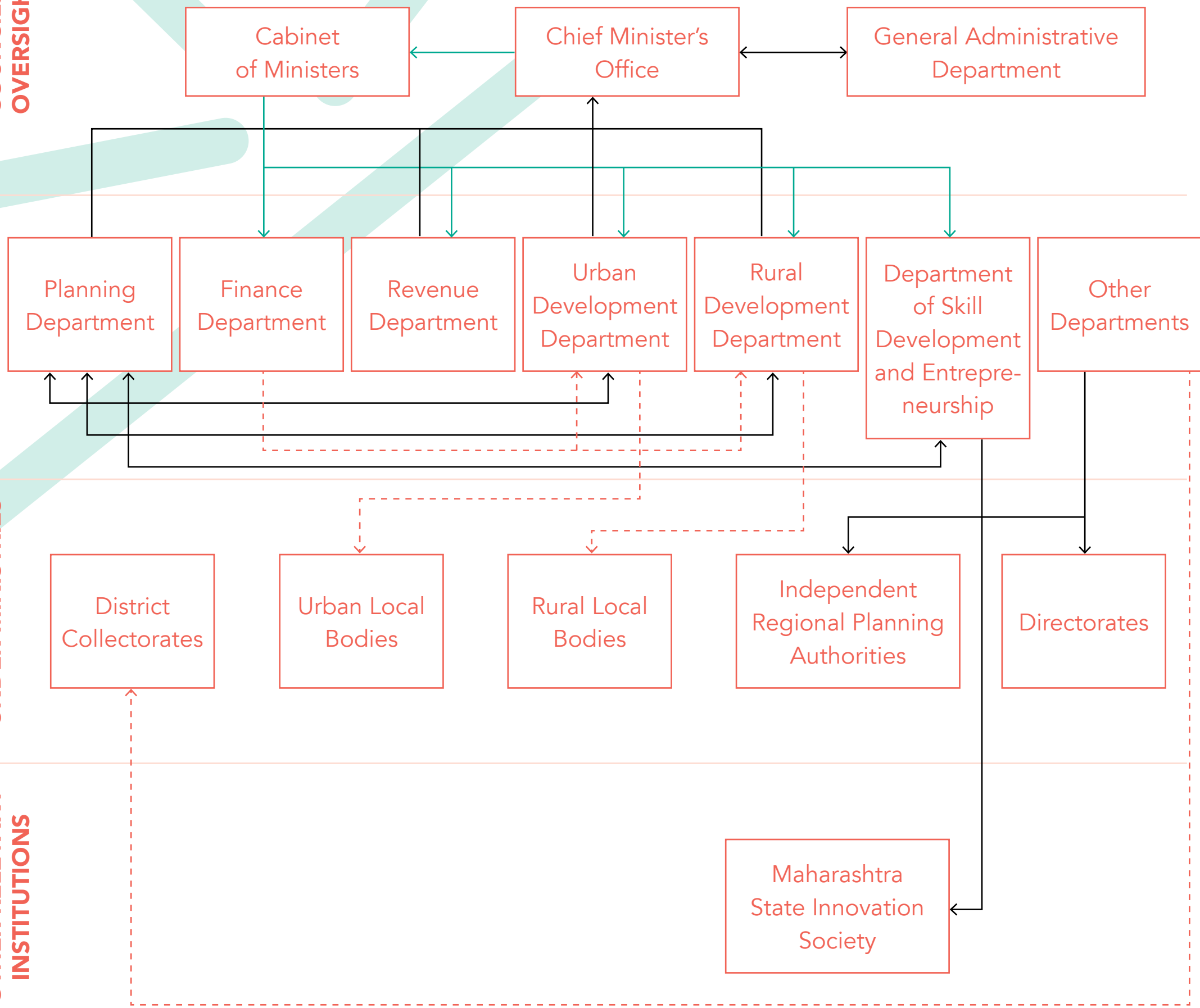


COORDINATING COUNCILS / OVERSIGHT

MINISTRIES

AGENCIES OR UNDER-MINISTRIES

BENEFICIARIES OR OTHER RELEVANT INSTITUTIONS

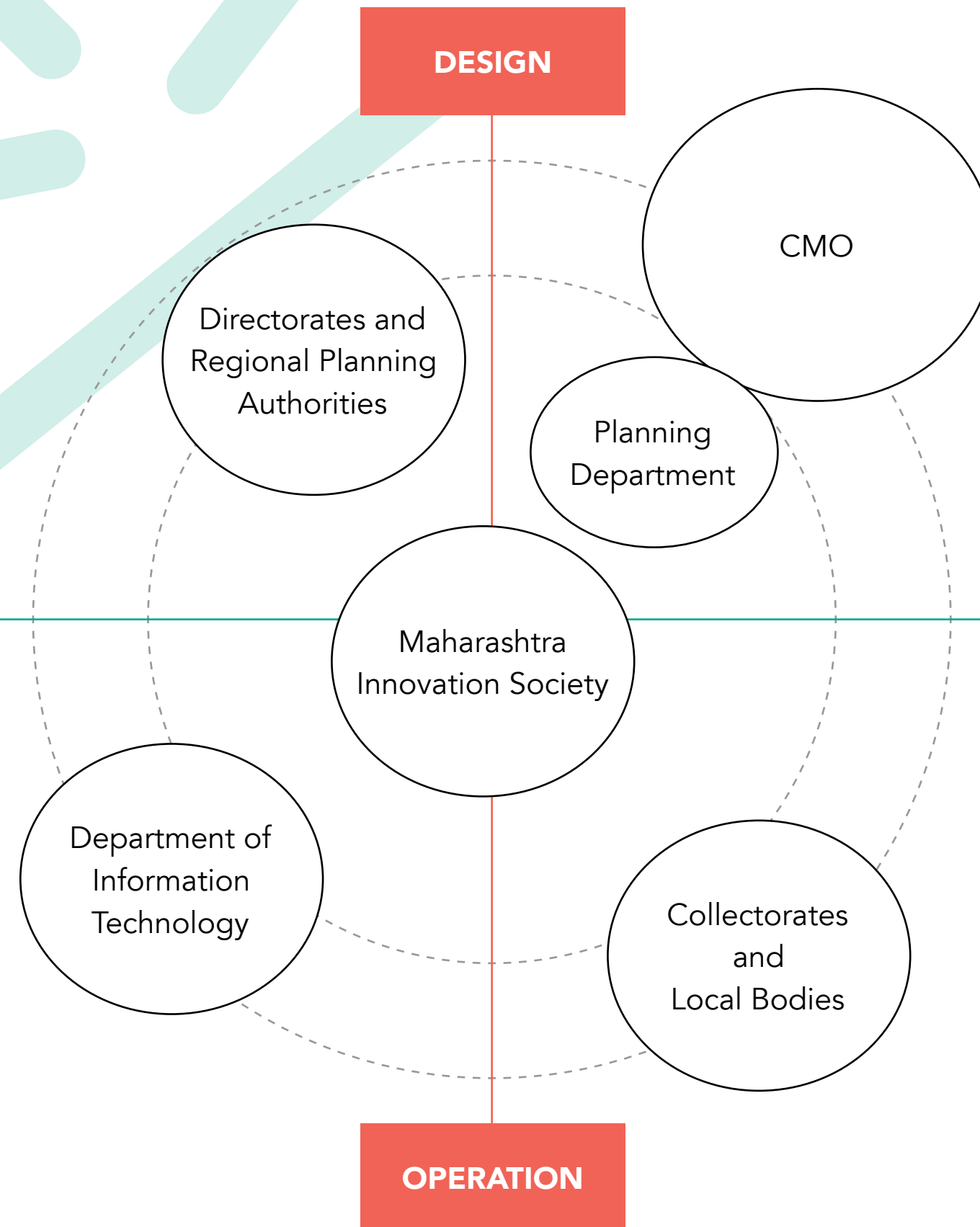


2.4.2 ROLE AND INFLUENCE DIAGRAM OF KEY MINISTRIES AND AGENCIES

SCIENCE AND
TECHNOLOGY

DESIGN

INNOVATION



Level of influence: the bigger the size of the bubble, the more influence in the innovation system.

This influence map is indicative and reflects the insights of the project team rather than a formal statement of roles and structures.

2.5 GLOSSARY OF INSTITUTIONAL ABBREVIATIONS AND ACRONYMS

- **CII:** Confederation of Indian Industries
- **CSIR:** Council of Scientific and Industrial Research
- **DIPP:** Department of Industrial Policy and Promotion
- **DST:** Department of Science and Technology
- **EODB:** Ease of Doing Business
- **EV:** Electric Vehicles
- **FD:** Fiscal Deficit
- **FDI:** Foreign Direct Investment
- **FICCI:** Federation of Indian Chambers of Commerce and Industry
- **GDP:** Gross Domestic Product
- **GITA:** Global Innovation and Technology Alliance
- **GOI:** Government of India
- **GSDP:** Gross State Domestic Product
- **HNI:** High Net Worth Individual
- **ICT:** Information and Communications Technology
- **IPO:** Indian Patent Office
- **IISER:** Indian Institute of Science Education and Research
- **IT:** Information Technology
- **IT & ITES:** Information Technology & Information Technology Enabled Services
- **IIT:** Indian Institute of Technology
- **MAITRI:** Maharashtra Industry, Trade & Investment Facilitation Cell
- **MOU:** Memorandum of Understanding
- **MMRDA:** Mumbai Metropolitan Region Development Authority
- **MNC:** Multinational Corporation
- **MSME:** Medium and Small Enterprises
- **NASSCOM:** National Association of Software and Services Companies
- **NIC:** National Informatics Centre
- **NCAER:** National Council of Applied Economic Research
- **NCL:** National Chemical Laboratory
- **R&D:** Research and Development
- **STI:** Science Technology and Innovation
- **RGSTC:** Rajiv Gandhi Science and Technology Commission
- **SIDBI:** Small Industries Development Bank of India
- **SINE:** Society for Innovation and Entrepreneurship
- **SEBI:** Securities and Exchange Board of India
- **VNIT:** Vishveshwaraya National Institute of Technology

2.6 STRENGTHS AND WEAKNESSES ANALYSIS

INSTITUTIONAL FRAMEWORK

STRENGTHS

The state government is taking efforts to promote innovation in the state

- The Maharashtra State Innovation Society (MSInS) has been established to fast track innovation programmes and assist with policy decisions.
- The state has introduced a number of initiatives to encourage and promote innovation and entrepreneurship.¹
- The state is proactive in its use of ICT for governance and is the first state in India to have a dedicated e-governance policy.^{2,3}

WEAKNESSES

Innovation is a relatively new concept and is looked at from the lens of attracting more FDI

- The previous State Innovation Council that had been set up under the NIC did not make any inroads into the innovation ecosystem.
- Although the MSInS has made significant progress, it is still early days for the organisation.
- Systemic capacity to absorb and adapt to innovation can be improved.

1 Article, Yourstory (2018)

2 Article, Centre for Communication and Development Studies (2013)

3 Article, Economicstimes (2018)

2.6 STRENGTHS AND WEAKNESSES ANALYSIS

HUMAN CAPITAL

STRENGTHS

Maharashtra has a young, urbanised population

- More than 60% of state population is aged between 14-59.¹
- The state is highly urbanised, with 45.2% of the population living in towns, and has a high literacy rate of 82.3%.²
- There has been a sharp increase in PhD enrollments over a six year period from 5,385 in 2011-2012 to 9,206 (6% of total PhDs enrolled in India) in 2017-2018.³

WEAKNESSES

Quality of education is reflected in the poor employability in the state

- Expenditure on school education as a share of GSDP has decreased over the past ten years from 2.96% in 2005-2006 to 2.16% in 2014-2015.⁴
- The pupil-teacher ratio in higher education is 27, higher than the national average.⁵
- Basic skills for mathematics and reading comprehension remain low despite high attendance.⁶
- Employability in Maharashtra falls below the bottom 25th percentile when compared to other Indian states.⁷
- The labour force participation rate decreased to 527 per 1,000 in 2015-2016 from 569 per 1,000 population in 2011-2012, but was above the national average in both years.⁸

1 Census (2011)

2 Economic Survey of Maharashtra (2017-18)

3 AISHE (2011-12, 2017-18)

4 MHRD

5 ibid

6 Annual Survey of Education Report, Pratham (2016)

7 National Employability report (2016)

8 Ministry of Labour and Employment

2.6 STRENGTHS AND WEAKNESSES ANALYSIS

KNOWLEDGE ASSETS

STRENGTHS

There is a consistent collective endeavour from the public and private sector to increase knowledge creation

- Nationally recognised institutes of note in various technology sectors are based in the state.¹
- International centres of excellence in partnership with other countries and MNCs in focus sectors like IT, agriculture, biotech are being established, particularly at universities and colleges to positively influence R&D and skilling, including a state-run Foreign Employment and Skill Development Centre.^{2, 3, 4, 5}
- Maharashtra had 3,513 patents, the highest number of patents filed in 2016-2017 by any Indian state.⁶

WEAKNESSES

There are structural problems with the knowledge creation capacity in the state

- Despite a large number of universities and educational institutes publishing research, there is a big gap in translating that research into patents and patent publications.⁷
- There is no incentive in the higher education system for faculty to pursue research nor is there a collective platform for promoting IP linkages between different stakeholders within the system.

1 MHRD

2 GITA

3 Website: IBM initiatives

4 Article: The Indian Express (August 2015)

5 PRS Maharashtra Budget Analysis (2018-19)

6 IPO (2016-17)

7 DST- Centre for Policy Research, Chandigarh (2018)

2.6 STRENGTHS AND WEAKNESSES ANALYSIS

FUNDING

STRENGTHS

WEAKNESSES

Public sector finance for innovation and startups is on the increase

- The government has pledged a USD776 million investment to boost the innovation ecosystem.¹
- The state has a partnership with SEBI accredited venture funds, providing funding upto 25%² while SIDBI ventures has set up a USD16.3 million venture fund for Maharashtra.³
- The state microfinance gross loan portfolio increased 31% year-over-year (from USD2.5 billion to USD3.4 billion in 2017-18).⁴

Public sector finance is not directed at research institutes or research activities tied to state priority

- Fiscal deficit as a percentage has increased in this state, in 2016-2017.⁵
- There is no dedicated state budget for R&D at universities, which fall under the purview of the state government.⁶

1 Article: Yourstory (2018);1USD=64.46INR, FRED 2017-18
 2 Website: Technology Development Board
 3 Article: Business Line (2016);1USD=65.42INR, FRED 2015-16
 4 MUDRA (2016-17;2017-18);1USD=67.03INR, FRED 2016-17; 1 USD =64.46, FRED 2017-18
 5 Economic Survey of Maharashtra (2017-18)
 6 ibid

2.6 STRENGTHS AND WEAKNESSES ANALYSIS

1 Economic Survey of Maharashtra (2017-18)

2 Article : The Indian Express (2018)

3 Article: Indiaspend (2017)

4 FICCI (2016)

5 State Competitiveness Report (2017)

6 Ministry of Corporate Affairs (2016-17)

7 DIPP (2018)

8 ibid

9 NCAER (2017)

10 Article: The Financial Express (2016)

BROADER ENVIRONMENT

STRENGTHS

Maharashtra is a highly industrialised progressive state with well developed infrastructure and a growing economy

- Maharashtra was the highest contributor amongst all states to India's GDP in 2017-2018. It also has one of the highest per capita incomes in the country.¹
- There is strong political and bureaucratic will to transform the state into a trillion dollar economy through global investments and sectoral growth.²
- The state is forward looking in its policies, it recently became the first state in India to rate industries by emissions³, is focused on smart cities⁴ and has the highest number of operational Special Economic Zones in India.
- Maharashtra is ranked third on competitiveness and recognised as an innovation driven economy among all Indian states.⁵
- Maharashtra recorded the highest number of companies registered in 2016-2017 in India at 17,507, 17% of all companies registered in the country.⁶

WEAKNESSES

Maharashtra is perceived to be bureaucratic and lacking in implementation of good governance

- Maharashtra has fallen three places back on the Ease of Doing Business ranking in 2018, ranked 13th of 36 states and union territories, compared to the previous year.⁷
- Recent survey results show that even though Maharashtra ranks highly on innovation parameters in comparison to other states, it pales when compared regionally⁸ and there is poor perception of the state at ground level due to corruption, stalled projects and governance issues.⁹
- Awareness about need for a mentorship culture, need for more research centres and shortcomings within the system to support innovation does not translate into action.
- Innovation within the system is vertical - there is no platform for different agencies within the government to work together or share learnings.
- The state has not been able to harness its potential in the maritime industries - only 12 of its 48 ports are currently in use.¹⁰

2.6 STRENGTHS AND WEAKNESSES ANALYSIS

1 Article: The Times of India (2016)

2 Startup India

3 IBEF (2018)

4 Creative Economy of Indian States (2013)

5 Aggarwal et al (2017)

6 ibid

7 Article: Yourstory (2016)

ECOSYSTEM CONNECTIONS

STRENGTHS

Public and private sectors are conducive to the development of innovation as a growth drive

- The state has strong chambers of commerce and business associations such as the Maharashtra Chamber of Commerce, Industry and Agriculture, the regional chapters of CII, NASSCOM actively promoting startup-led innovation.
- Mumbai has the second largest concentration of angel investors including HNIs like Mukesh Ambani, Ratan Tata, Kishore Biyani, Adi Godrej etc.¹
- Many of the incubators and accelerators are located in educational institutes and colleges, encouraging entrepreneurship and innovation in students.²
- The state's capital, Mumbai, is the commercial capital of India and has evolved into a global financial hub - the city is home to several global banking and financial service firms.³
- Creative industries are heavily concentrated in the state.^{4, 5}

WEAKNESSES

The boom in government activity is restricted to a few regions

- Maharashtra is a top destination for startups, but the concentration of startups is in cities like Mumbai and Pune, with little spillover into other urban and semi-urban areas.
- Despite being one of the most populous states with a high number of startups in India, the state has only seven incubators.⁶
- Maharashtra was one of the pioneering states in setting up startup funds but unable to capitalise on that.⁷

**3.
EXAMPLES OF OTHER INDIAN
REGIONAL INNOVATION SYSTEMS**

3.1 INTRODUCTION

Different rates of economic growth, varying levels of investment in infrastructure, tackling societal challenges like access to healthcare and education, and changing political priorities have all resulted in diverse and differently developed regional innovation systems. Innovation has become central to economic development dialogue in states and increasingly, a matter of political priority.

Our study indicates that regional innovation systems have a few things in common. There is a strong drive to improve existing regional innovation systems. States are increasing their investments and encouraging private investments in respective regional innovation systems. States are using a wide variety of policy interventions to experiment with approaches to deepen regional innovation. States are coming up with policies to integrate new emerging technologies to address regional needs.

The drivers for innovation in the public ecosystem are mostly highly motivated bureaucrats though the delivery models vary. In a few cases, innovation is driven by a motivated political leader or unit. For example, the model for implementation of many innovation policies in Maharashtra is through an autonomous society, which allows the drivers (bureaucrats) to work outside the hierarchical and sometimes confining rules of government but at the same time, be attached to the public ecosystem and retain government influence.

The state of Telangana is a case-study in how a young state (formed in 2014) in using the startup ecosystem

to attract investors and promote growth. The Industries and IT department is the main driving force in promoting the innovation ecosystem and the state is forward looking in adoption of newer technologies, formulating policies to address disruptive emerging technologies like AI much before the Centre.

The state of Kerala has a dual model - the first wherein innovation and entrepreneurship is encouraged through a mission setup under the Department of Information Technology and the second through an autonomous society that has a long term aim of changing the mindsets of young children through specific interventions.

The state of Punjab is an interesting case-study in how strong centre-state linkages can influence regional innovation ecosystems. Innovation is largely driven by the state science council (a centre-state body) in coordination with other relevant departments. The country's first Technology Innovation Support Centre (TISC) was set up there.

In the following section, we have outlined the innovation systems for four states (Telangana, Tamil Nadu, Kerala, Punjab) to showcase the diversity of regional innovation systems and some of the common challenges they face. The section begins with an overview of each state, followed by key state policies. This is followed by examples of institutional maps and a SWOT to give the reader a flavour of the common challenges and diverse strengths of the states.

EXAMPLES OF OTHER INDIAN
REGIONAL INNOVATION SYSTEMS

3.2 INNOVATION INDICATORS ACROSS INDIAN STATES

INDICATORS	YEAR	INDIA	MAHARASHTRA	TELANGANA	KERALA	TAMIL NADU	PUNJAB	SOURCE
REAL GROWTH RATE	2016-17	7.1	10	10.1	7.4	4.3	6.8	RBI
G(S)DP (CURRENT PRICES, USD BILLION)	2016-17	2292	337	98	93	190	64	RBI
POPULATION (MILLIONS)	2011	1210	113	35	33	72	28	Census, State Websites
EASE OF DOING BUSINESS RANKING	2018	77/190	13/34	2/34	21/34	15/34	20/34	World Bank, DIPP
NUMBER OF HMT R&D CENTERS	2016	334	117	32	4	21	8	DSIR, CTIER
NUMBER OF KI R&D CENTERS	2016	28	10	2	0	5	0	DSIR, CTIER
NO. OF INCUBATION CENTERS	2018	125	7	8	9	30	2	Startup India
FDI SHARE (%)	2017-18	100	30	3	.5	8	.2	DIPP Factsheet
NO. OF COMPANIES REGISTERED IN LAST 1 YEAR	2016-17	97840	17507	6568	3067	6647	1037	MCA
ORDINARY PATENTS FILED	2016-17	12997	3513	798	276	2003	207	IP India
GEOGRAPHICAL INDICATIONS	2016-17	294	30	11	26	27	1	IP India

TELANGANA

3.3.1 INTRODUCTION

Telangana*, located in South India, is the youngest Indian state (29th, formed as per the Andhra Pradesh (AP) Reorganization Act, 2014 (No. 6 of 2014). The estimated population of Telangana is 35 million, around 39% is urbanised.¹

In terms of both area and population, Telangana is the twelfth largest State in India. As part of the AP reorganization act, it currently shares Hyderabad as joint capital with Andhra Pradesh.

The GSDP at current prices was USD117 billion for the year 2017-18 and USD98 billion for 2016-17.² Real GSDP grew 10.3% in 2017-2018 over the previous year.³

The cities of Warangal and Karimnagar are part of the Prime Minister's Smart City programme.⁴

The government of Telangana is proactively taking steps to make Telangana a preferred investment destination. It has attracted several billion since 2015. The state also hosted the Global Entrepreneurship Summit in November 2017.⁵

Hyderabad, the capital city, is a major IT hub. In 2014-2015 the total value of software and IT products exports in the state accounted for USD11 billion i.e. about 11% of national IT exports. The YoY growth of the IT sector in 2014-2015 was 16%, which was 3 percentage points higher than that for the national average.⁶

The state contributes to nearly one-third of India's pharmaceutical production and one-fifth of pharmaceutical exports.⁷

* While conducting our analysis, we have used statistics for Telangana wherever available and used the statistics for combined Andhra Pradesh where such data was not available.

1 Telangana Statistical Yearbook (2017)

2 RBI; 1USD=64.46INR, FRED 2017-18, 1USD=67.03INR, FRED 2016-17

3 ibid, 1USD= 67.03INR, FRED 2016-17

4 Telangana Today (2018)

5 Website: Global Entrepreneurship Summit

6 Telangana ICT Policy Framework (2016); 1USD= 61.13INR, FRED 2014-15

7 Website: Invest India

TELANGANA

3.3.2 HIGHLIGHTS OF KEY INNOVATION PROGRAMMES

- **TELANGANA ICT POLICY:** the priority areas identified in the Telangana ICT Policy Framework document from 2016 are Expansion of IT/ITES units; electronics, where Hyderabad would be a global hub for electronics and have an extensive use of TS-iPASS; entrepreneurship, where the government will support by providing access to critical capital and state-of-the-art physical infrastructure through the T-hub; and procurement of IT services and products by the government.

it.telangana.gov.in/wp-content/uploads/2016/04/Telangana-ICT-Policy-Framework-2016.pdf

- **INNOVATION POLICY (2016):** the policy has a key focus on areas which includes fields like IoT, healthtech, sustainability, fintech, etc. for the medium term. The policy also aims to identify areas that are important from the government's perspective, namely skilling, agritech, rural commerce and payment related opportunities where existing government infrastructure and access can play a critical role. [telangana.gov.in/PDFDocuments/Telangana Innovation Policy 2016.pdf](http://telangana.gov.in/PDFDocuments/Telangana%20Innovation%20Policy%202016.pdf)

- **TASK:** this academy was conceptualised by the government to equip graduates with the required skills to reach their goals. The government will establish a separate fund to support the infrastructure and development of incubation facilities that will be based on a PPP model. task.telangana.gov.in/

- **INDUSTRIAL POLICY FRAMEWORK 2014:** focuses on core manufacturing sectors, employment for youth in urban and rural areas and skills development. All departments related to

industrialisation would follow a policy of minimum inspection and maximum facilitation. ipass.telangana.gov.in/docs/IndustrialPolicyTelangana.pdf

- **ELECTRONICS POLICY 2016:** formulates the incentives laid out by the Telangana state government to make the electronics industry a major contributor to the state's employment and growth. These incentives include exemption from stamp duty, assistance in patent filing, and capability building. Additionally, the policy also gives specific incentives for mega projects, and other areas of strategic importance. it.telangana.gov.in/wp-content/uploads/2016/04/Telangana-Electronics-Policy-2016.pdf

- **LIFE SCIENCES POLICY (2015-2020):** is designed to cover the entire range of Life Sciences including biotechnology, pharma, nutraceuticals and medical devices. To increase growth and employment in this sector, the state plans to simplify regulations, set apart 3,000 acres of land for a "Pharma City", a life sciences park and also to set up a "Life Sciences Knowledge Centre" for nurturing existing talent. industries.telangana.gov.in/Library/FinalBookLS%20Policy.pdf

- **FOOD PROCESSING AND PRESERVATION POLICY:** recognises that food processing is a link between agriculture and industry since it contributes to both. This policy aims to modernise production units and develop processing clusters in the state. The state provides various incentives in the form of subsidies, capability development and infrastructure towards the development of this sector. industries.telangana.gov.in/Library/TS%20FOOD%20POLICY%202017.pdf

TAMIL NADU

3.4.1 INTRODUCTION

Tamil Nadu is the second largest economy among Indian States and saw a real growth rate of 8% in 2017-2018. The GSDP in current prices was USD221 billion in 2017-2018 and USD190 billion in 2016-17.¹ It is the one of most urbanised states among the major states (48.4%)² and ranks 6th in terms of population (72 million).³

The State has attracted several global multinational corporations given the presence of a skilled labour force, strong infrastructure with four major ports and four international airports as well as well connected road and rail network. The sectors that the global players are present vary from agro-engineering to aerospace engineering.⁴

It has a well developed automobile industry, with Chennai being nicknamed the Detroit of India. Major automobile companies like BMW, Ford, Hyundai Motors, Michelin, Royal Enfield, TVS, Apollo Tyres, MRF, TAFE tractors have a strong manufacturing presence.⁵

Industrial sectors in Tamil Nadu like auto and auto-components, leather, textiles, software and ITES, etc., are contributors to the country's exports. Tamil Nadu's exports were valued at USD36 billion during 2013-2014.

The state's share in the total export of the country was 11.5% in 2013-2014, and was ranked third among Indian states in terms of exports.⁶ Tamil Nadu is one of the top ranked Indian states in terms of operational SEZs.⁷

To attract foreign direct investment, to promote exports and to generate more employment opportunities, SIPCOT has promoted six 'Sector Specific Special Economic Zones' in its Industrial Parks. Many of the top global companies like DELL India Pvt. Limited, Nokia Network Solutions, and, WIPRO have made large investments in these Special Economic Zones.⁸

Several projects have been fast-tracked recently, especially those that are expected to contribute to the development of the Southern Districts. Many of the projects signed under an MoU during TNGIM 2015 were largely in the southern districts.⁹

¹ RBI; 1USD=64.46INR, FRED 2017-18,1USD=67.03INR, FRED 2016-17

² Ministry of Housing and Urban Affairs

³ Census (2011)

⁴ Industries Department Policy Note 2016-17

⁵ Website: TIDCO

⁶ ibid

⁷ Article, The Hindu

⁸ Website: SIPCOT

⁹ ibid

TAMIL NADU

3.4.2
HIGHLIGHTS
OF KEY
INNOVATION
PROGRAMMES

- **NEW INDUSTRIAL POLICY (2014):** the Tamil Nadu government in its New Industrial Policy of 2014, includes incentives to promote investments in southern districts of the state. The policy focuses on infrastructure development, and lays emphasis on advanced technology and skill development. It also includes a modified 'Structured Package of Assistance' and encourages balanced regional development.
www.indiaenvironmentportal.org.in/files/file/TN_Industrial_Policy_2014.pdf

- **AUTOMOBILE AND AUTO COMPONENTS POLICY (2014):** the policy envisages the set up of institutions like the Department of Biotechnology and a State Biotechnology Board for further development of the biotech sector. The policy focuses on infrastructure development projects like biotech parks and biotech incubators, along with various fiscal incentives for improvement in this sector. The state would also invest in human capital development.
www.indiaenvironmentportal.org.in/files/file/TN_Automobile_Policy_2014.pdf

- **BIOTECHNOLOGY POLICY (2014):** the policy envisages the set up of institutions like the Department of Biotechnology and a State Biotechnology Board for further development of the biotech sector. The policy focuses on infrastructure development projects like biotech parks and biotech incubators, along with various fiscal incentives for improvement in this sector. The state would also invest in human capital development. www.indiaenvironmentportal.org.in/files/file/Biotechnology%20Policy%202014%20-%20Tamil%20Nadu.pdf

- **MSME POLICY (2016-17):** the policy outlines the restructuring of the Commissionerate of industries and commerce, the development of a single window portal, the set up of a state industries centre and provides other special incentives for tea value-added products. The policy supports MSMEs in the state by providing them with various fiscal and infrastructure-related incentives.
www.cms.tn.gov.in/sites/default/files/documents/msme_e_pn_2016_17.pdf

KERALA

3.5.1 INTRODUCTION

Kerala is the southernmost state of India on the West coast. The population of the state is 33 million. 48% of Kerala's people live in urban areas.¹ Kerala's GSDP in current prices was USD93 billion for the year 2016-17. The real GSDP grew 7.4% in 2016-17 over the previous year.²

Kerala is called "God's own country" due to its scenic beauty, and is famous for its tourism and exotic spices. The tertiary sector contributes more than 63% to state GSDP, of which the trade and tourism services sector are prominent. 30% of the state's finances come from remittances.³

Income from tourism amounts to 10% of GSDP. The employment in this sector grew by 2.6% in 2015 creating 7.2 million jobs. The state has been given several awards for excelling in this sector.⁴

Kerala's location and with ports like Vallarpadam and the one under construction at Vizhinjam, as well as three international airports, provides a unique opportunity for export-oriented industries in the state.⁵

Kerala has traditionally been known for its spices, fish and other agricultural products. The industrial policy identifies agro and food processing, electronics, biotechnology and nanotechnology as some of the key sectors. There are plans to set up various industrial parks across the state to support these sectors.⁶

The state of Kerala is called a "consumer state" and is often seen as a 'ready market' for industry. Per capita consumer expenditure in rural areas is double that of rural India, while in urban areas it is estimated to be 1.3 times that of urban India.⁷

¹ Kerala Economic Review

² RBI, 1USD=67.03INR, FRED 2016-17

³ ibid

⁴ ibid

⁵ Kerala Industrial and Commercial Policy (2018)

⁶ ibid

⁷ ibid

KERALA

3.5.2 HIGHLIGHTS OF KEY INNOVATION PROGRAMMES

- **KERALA INDUSTRIAL & COMMERCIAL POLICY 2018:** The industrial policy aims to speed up the development of industrial clusters in the Kerala. Some of the key areas of focus for the state include electronics, garments and textiles, biotechnology and nanotechnology, wood processing, mining, petrochemicals in Kochi as well as export-oriented production.
www.keralaindustry.org/images/pdf/ipeng.pdf
- **IT POLICY 2017:** this policy aims to digitise various public services through an enhanced e-governance system to cater to the technology-savvy demands of citizens as well as of commerce and industry. It plans to reform the state IT infrastructure through the creation of Fab Labs, encouraging cloud-based and other internet-based technology, and to invest in human capital development.
www.kerala.gov.in/documents/10180/2b4ad075-0f50-4eb9-912d-026bd589877c
- **KERALA TECHNOLOGY STARTUP POLICY 2014:** the policy aims to attract USD820 million in investments in the incubation and startup ecosystem of the state by the year 2020. It plans to achieve this by establishing at least ten technology business incubators or accelerators in each of the different sectors of the state, developing at least 1000 sq feet of incubation space and facilitating venture capital funding of a minimum USD328 million.¹
www.kerala.gov.in/documents/10180/46696/Kerala%20Technology%20%20Startup%20Policy%202014
- **KSUM:** The Kerala Startup Mission is the nodal agency for the government on promoting and developing the startup ecosystem.
www.startupmission.kerala.gov.in
- **AGRICULTURAL DEVELOPMENT POLICY 2015:** this policy document lays down 323 different policies in 46 major areas for agriculture including land use, water, distressed farmers and international trade. It recognises the need for technological adaptation and improvement in the sector and has policies on ICT use, GM technology, information and communication and high tech farming.
www.kerala.gov.in/documents/10180/46696/AGRICULTURAL%20DEVELOPMENT%20POLICY%202015
- **YEDP:** a scheme by the Kerala government to improve entrepreneurial talent in the state through incubation of startups. The scheme intends to promote innovation and cross-sector startups.
www.itmission.kerala.gov.in/it-policy/comment/view/97/s/EN
- **KERALA IT MISSION:** is the IT implementation agency for the Department of Information Technology, and assists the Department in various initiatives by providing managerial support. The agency is autonomous.
www.itmission.kerala.gov.in

¹ 1 USD = 61.01INR, FRED 2014

PUNJAB

3.6.1 INTRODUCTION

Punjab is a state in the North of India, with a population of 27 million. The GSDP of the State was USD64 billion at current prices for 2016-2017 and saw real growth of 6.8% in 2016-17.¹

Punjab is called the “Food Basket and Granary of India” due to its fertile soils and rivers. The mainstay of Punjab’s economy is agriculture and it is also the main source of livelihood for the rural population which includes about two-thirds of the total population of Punjab. Punjab’s inland fish production ranks first in India, with a fish production per hectare of 6,560 kg.² Punjab’s industrial sector contributes 25% to its GSDP.³

The state’s farm sector is highly mechanised, unlike most other states in India. Despite this, the agricultural sector is showing signs of a serious slow down over the past few years declining by 6.7% in 2014-2015.⁴

A major proportion of Punjab’s industrial sector is directly dependent upon agriculture. Examples of such large scale industrial units include Sonalika Tractors, National Fertilizer limited, Swaraj Tractors, NFL, Nestle, Preet Tractors & Markfed.

Punjab has several top management and scientific institutions in its capital city of Chandigarh and neighbouring Mohali such as the Indian School of Business (ISB) in Mohali, the Indian Institute of Technology, Ropar (IIT-R), the Indian Institute of Science Education & Research (IISER), the Institute of Nano Science and Technology, both in Mohali, and the Postgraduate Institute of Medical Education and Research (PGIMER) in Chandigarh. Mohali and surrounding areas have been emerging as a preferred investment destination in Northern India for IT/ITES and knowledge industries.

The state government is developing a Knowledge City in Mohali and has already identified about 1,700 acres for setting up knowledge clusters for the electronics industry. Due to very active IPR dissemination activities, the state Patent Information Centre recently got selected for setting up WIPO’s first Technology Innovation Support Centre (TISC) in India.⁵

¹ 1 RBI, 1USD=67.03INR, FRED 2016-17

² Fiscal Incentives for Industrial Promotion-2013

³ Economic Survey of Punjab-2016-17

⁴ Economic Survey of Punjab-2016-17

⁵ Sharma, G. M (2017)

PUNJAB

3.6.2
HIGHLIGHTS
OF KEY
INNOVATION
PROGRAMMES

- **SPIRE PUNJAB (STARTUP PROGRAM FOR INNOVATION, RESEARCH AND ENTREPRENEURSHIP):** under this mission, a special purpose vehicle, the Pollinator will be established Punjab Infotech (under the Department of Industries and Commerce, Government of Punjab), the Indian School of Business, Mohali and EDC Chandigarh, and shall connect the ecosystem with government and new startups. The focus areas for the Pollinator will include among others, Agriculture and Food Processing, Digital Manufacturing, Aerospace and Defence, Low Carbon Economy, Lifesciences, Healthcare.

investpunjab.gov.in/Content/documents/Startup_Policy_Punjab_v4.pdf

- **INDUSTRIAL AND BUSINESS DEVELOPMENT POLICY (2017):** among other incentives for industry, a fund of funds for Startups worth USD15 million¹ has also been planned under this programme to support incubators and capacity building programmes. Ten technology centres, ten common facility centres and ten clusters have been proposed under this policy. It is also noteworthy that MSMEs appear to have been provided with more incentives than the larger industries, with respect to finance, infrastructure etc.

investpunjab.gov.in/Content/documents/Notifications/Industrial_and_Business_Development_Policy_2017.pdf

- **AGRICULTURAL POLICY FOR PUNJAB (DRAFT 2013):** the policy details various incentive mechanisms for improving farm productivity through technology. The policy also aims to encourage optimal use of natural resources for long-term sustainability of agriculture, strengthening research in the farming sector, especially in terms of high-value crops.

punjab.gov.in/documents/10191/20775/Agriculture+policy+of+punjab.pdf/9db4456f-55c5-4b55-882a-adf5811b2a53

- **STATE YOUTH POLICY (2017):** the policy aims to address challenges like education and training, youth unemployment, health and population, drug abuse and sports. The policy lists a number of schemes involving training and various forms of incentivisation to be introduced in the state to alleviate these issues.

punjab.gov.in/documents/10191/20775/youthpolicy.pdf/cd5196a1-ac4c-47f5-b71b-6b1b652a9230

¹ 1USD=67.03INR, FRED 2016-17

EXAMPLES OF OTHER INDIAN REGIONAL INNOVATION SYSTEMS

3.7 GLOSSARY OF INSTITUTIONAL ABBREVIATIONS AND ACRONYMS

- **AISHE:** All India Survey on Higher Education
- **BSIR:**
- **BTIC:** Biotechnology Incubation Centre
- **CRIKC:** Chandigarh Region Innovation and Knowledge Cluster
- **CTIER:** Centre for Technology, Innovation and Economic Research
- **DIPP:** Department of Industrial Policy and Promotion
- **DSIR:** Department of Scientific and Industrial Research
- **EDC:** Entrepreneur Development Centre
- **EDII:** Entrepreneurship Development and Innovation Institute
- **GARC:** Global Automotive Research Center
- **ICT:** Information and Communication Technology
- **IEDP:** Innovation and Entrepreneurship Development Program
- **IFMR:** Institute for Financial Management and Research
- **IISER:** Indian Institute of Science Education & Research
- **IIT-H:** Indian Institute Technology, Hyderabad
- **IIT-R:** Indian Institute of Technology, Ropar
- **IP INDIA:** Intellectual Property India
- **IPR:** Intellectual Property Rights
- **ISB:** Indian School of Business
- **ITE&C:** Information Technology, Electronics and Communications
- **ITES:** Information Technology enabled Services
- **K-DISC:** Kerala Development and Innovation Strategic Council
- **KINFRA:** Kerala Industrial Infrastructure Development Corporation
- **KSCSTE:** Kerala State Council for Science, Technology & Environment
- **KSINC:** Kerala State Innovation Council
- **KSUM:** Kerala Startup Mission
- **MCA:** Ministry of Corporate Affairs
- **MHRD:** Ministry of Human Resource Development
- **MSE-CDP:** Micro and Small Enterprises- Cluster Development Programme
- **MSME:** Micro, Small and Medium Enterprises
- **MUDRA:** Micro Units Development and Refinance Agency
- **NALSAR:** National Academy of Legal Studies and Research
- **NATRIP:** National Automotive Testing and R&D Infrastructure Project
- **NIRF:** National Institutional Ranking Framework
- **NITI AAYOG:** National Institute for Transforming India
- **NSSO:** National Sample Survey Office
- **PGIMER:** Postgraduate Institute of Medical Education and Research
- **PSU:** Public Sector Undertaking
- **RBI:** Reserve Bank of India
- **SEZS:** Special Economic Zones
- **SPIRE:** Startup Programme for Innovation Research and Enterprise
- **TANI:** Tamil Nadu Innovation Initiatives
- **TASK:** Telangana Academy for Skill and Knowledge
- **T-HUB:** Technology Hub
- **TISC:** Technology Innovation Support Centre
- **TNGIM:** Tamil Nadu Global Investors Meet
- **TSCHE:** Telangana State Council of Higher Education
- **UNWTO:** United Nations World Tourism Organisation
- **YEDP:** Youth Entrepreneurship Development Programme

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

1 IT,E&C (2017)

2 T-Hub

3 StatrupIndia Report, Tamil Nadu (2018)

4 ibid

5 Rajan A, Thillai (2017)

INSTITUTIONAL FRAMEWORK

STRENGTHS

Telangana has a strong institutional focus on innovation for growth

- The state Innovation Cell is a 'single window' facility for state incentives for startups. Established in May 2017, it is meant to help develop the early stage startup ecosystem.¹
- T-Hub (Technology-hub), a unique public-private partnership between the government, leaders from the private sector and three top academic institutes (IIIT-H, ISB and NALSAR) is actively associated with 835 startups and 117 mentors across sectors.²

Tamil Nadu has policies and schemes to support innovation

- Tamil Nadu Innovation Initiatives (TANII) in the State Planning Commission has been established to promote innovation in Government and its agencies in the State.³
- The Entrepreneurship Development and Innovation Institute (EDII) conducts a programme to promote entrepreneurship and innovation in colleges, polytechnics, etc.⁴

WEAKNESSES

In Telangana, focus on innovation is not uniform across sectors

- The incubator model is focused largely on technology and healthcare sectors and traditional sectors like agriculture, textiles and materials have limited support.⁵

There is no separate department to cater to innovation-related functions in Tamil Nadu

- The state does not have a specific startup policy.
- There is an existing structure for the State Innovation Council but it is inactive and does not play any leadership role.
- Unlike the other states, Tamil Nadu does not have a separate department for Science and Technology, the functions of which are under the jurisdiction of the Directorate of Technical Education.

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

INSTITUTIONAL FRAMEWORK

Kerala also has policies and schemes to support innovation

- Kerala was one of the first states to have a startup policy outlining fiscal and non-fiscal incentives for startups and it also has an active IPR policy under KSCSTE.⁶
- Innovation is also supported by a strategic thinktank set up by the government, the Kerala Development and Innovation Strategic Council.⁷

An active Innovation Council in Punjab spearheads innovation-related activities

- The State Innovation Council and State Council for Science and Technology was recently awarded for setting up WIPO's first Technology Innovation Support Centre (TISC) in India.⁸

The most important institutional body for innovation in Kerala remains inactive

- The Kerala State Innovation Council is inactive, one of the reasons being that the personnel at the top keep changing, lacking a sense of ownership.

The policy framework to support startups in Punjab is fairly new and not fully formed

- The state came out with its Startup Policy in 2017.⁹
- It is still in the process of developing mechanisms for tracking progress of implementation of policy.¹⁰

⁶ StartupIndia Report, Kerala (2018)

⁷ Website: K-DISC

⁸ Sharma, Manraj G (2017)

⁹ Punjab Startup Policy (2017)

¹⁰ StartupIndia Report, Punjab (2018)

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

1 Telangana Statistical Yearbook (2017)

2 AISHE 2017-18

3 Website: Invest India

4 Labour Bureau (2015-16)

5 AISHE 2011-12 & 2017-18

6 MHRD

7 ibid

8 ibid

9 Srinivasan (2016)

10 Census 2011

11 Labour Bureau (2011-12 and 2015-16)

HUMAN CAPITAL

STRENGTHS

Telangana has a young population

- 63% of the population is in the 15-59 age group.¹
- Telangana has a good pupil to teacher ratio (19) in higher education in 2016-2017.²
- The state has 23 polytechnic institutes. It hosts three central and 16 state universities.³
- In combined Andhra Pradesh, labour force participation rates were the highest among the states chosen for analysis at 625 per 1,000 households in 2015-2016.⁴

Government investment in education is decreasing yet Tamil Nadu is talent rich

- The state has a good pupil to teacher ratio (18) in higher education for the year 2017-2018. Between 2011-2012 and 2017-2018, PhD enrollment more than tripled to 29,778, the highest among all states in India.⁵
- However, expenditure on school education as a percent of GDP has decreased over ten years to 2% in 2014-2015⁶

WEAKNESSES

The Telangana education system needs to be more connected to the innovation system

- The literacy rate in the state is currently around 66%.⁷
- Enrollment of PhDs increased in the last six years from 7,239 in 2011-2012 to 11,173 in 2017-2018, for Telangana and Andhra Pradesh taken together.⁸
- There is a considerable mismatch between job seekers and their employability which poses a big challenge for policymakers in terms of job creation.⁹

Tamil Nadu has seen a decline in the labour force participation rate

- While more than 65% of the state population is aged between 15-59, which is the highest amongst the states analysed in this report¹⁰, the state has seen a decline in the labour force participation.
- Labour force participation decreased to 572 per 1,000 people according to the employment-unemployment survey conducted by the Labour Bureau in 2015-2016. It was 596 per 1,000 people in the same survey in 2011-2012.¹¹

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

HUMAN CAPITAL

Kerala has high literacy rates as well as high technology penetration

- Kerala is known for its high literacy rates, ranking first among all Indian states at 93.91%.¹²
- Between 2011-2012 and 2017-2018, PhD enrolments more than doubled from 2,869 to 5,911.¹³
- Several innovation focused programs and activities have been undertaken in the State. In order to promote innovation in schools, the State Government introduced the Learn to Code: Key Strengths 6 Raspberry Pi Distribution Program and the Electronics@School Program.¹⁴
- According to the NSSO 2014 round reports, access to computer (313 per 1,000 households) and internet facilities (567 per 1,000 households) is very high, both categories being more than double the national average.¹⁵

Punjab benefits from higher than average technological penetration

- Punjab has a good pupil to teacher ratio (21) in higher education¹⁶, and enrollment of PhDs increased in the last six years from 2,484 to 6,877.¹⁷
- For every 1,000 households, 229 have access to a computer and 316 have access to the internet, which is above the national average for both categories.¹⁸

Kerala has a high literacy rate but out-migration may result in a loss of talent

- The literacy rate in the state is currently around 66%.¹⁸
- Enrollment of PhDs increased in the last six years from 7,239 in 2011-2012 to 11,173 in 2017-2018, for Telangana and Andhra Pradesh taken together.¹⁹
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- Labour force participation decreased to 572 per 1,000 people according to the employment-unemployment survey conducted by the Labour Bureau in 2015-2016. It was 596 per 1,000 people in the same survey in 2011-2012.²²

¹² Telangana Statistical Yearbook (2017)

¹³ AISHE 2017-18

¹⁴ Website: Invest India

¹⁵ Labour Bureau (2015-16)

¹⁶ AISHE 2011-12 & 2017-18

¹⁷ MHRD

¹⁸ ibid

¹⁹ ibid

²⁰ Srinivasan (2016)

²¹ Census 2011

²² Labour Bureau (2011-12 and 2015-16)

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

- 1 NIRF (2018)
2 MHRD (2017)
3 Website: Genome valley
4 Indian Patent Office Report (2017)
5 ibid
6 NIRF (2018)
7 MHRD
8 NSSO 71st Round Report (2014)
9 TSCHE
10 StartupIndia Report, Tamil Nadu (2018)
11 MCI, GOI

KNOWLEDGE ASSETS

STRENGTHS

Telangana hosts public institutions of national importance and a growing support system for knowledge creation

- Telangana hosts four institutes included in the NIRF top 100 rankings list,¹ and three institutes of national importance.²
- Genome Valley in Hyderabad is the first of its kind R&D cluster that has been 'systematically developed' for Life Sciences. It includes the National Institute of Pharmaceutical Education and Research along with six of the world's top R&D companies as well as some of India's top vaccine manufacturers.³
- 798 patents were filed in Telangana in the year 2016-2017 up from 790 patents filed the previous year.⁴

Tamil Nadu has a high number of educational institutes

- A Patent Information Centre has been set up by the State Council of S&T and 2,003 patents were filed in 2016-2017, an increase from 1,739 in 2015-2016.⁵
- Tamil Nadu has 20 institutes in the top 100 NIRF rankings⁶ and six institutes of national importance.⁷
- Internet penetration is much higher than that of computers. For every 1,000 households 197 have computers and 452 have the Internet. However, both rates are above the national average.⁸

WEAKNESSES

Lack of sufficient number of teachers and researchers at all levels of education

- Telangana faces a severe shortage of faculty and researchers at universities - resulting in loss of central government funding and a void in knowledge creation.⁹

Tamil Nadu is focussing on building incubators around traditional sectors like agriculture but implementation requires more work

- The state has issued in-principle approval to many incubators but the financial and other support is still lagging.¹⁰
- The state has the country's second TISC but it shows marginal improvement in patents filing despite this support.¹¹

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

KNOWLEDGE ASSETS

Kerala and Punjab both benefit from a substantial source of talent and research

- Kerala is home to four of the top 100 institutes ranked by NIRF¹² and three institutes of national importance.¹³
- Punjab has four institutes of national importance: IISER Mohali, Ambedkar National institute of Technology, IIT Ropar and the National Institute of Pharmaceutical Educational Research, as well as several other top management and scientific institutions.¹⁴

The diffusion of technology startups to the rest of the ecosystem is poor in Kerala

- The number of incubators in educational institutes is quite low.¹⁵
- Kerala has very few high technology DSIR recognized R&D centres¹⁶
- Patent filing has dropped in the state despite a boom in support for startups, 276 ordinary patents were filed in Kerala in the year 2016-2017.¹⁷

Punjab has a very active Patent Information Centre but low patent filings

- The Patent Information Centre has set up 13 IPR cells in various educational institutes. Despite this, patents filed in 2016-17 (242, including the union territory of Chandigarh) were the lowest amongst the chosen states.¹⁸
- The number of incubators is very low in comparison to the number of startups in the state and a successful knowledge cluster.¹⁹

12 NIRF (2018)

13 MHRD (2017)

14 ibid

15 CTIER Handbook:

16 CTIER Handbook

17 Indian Patent Office Report (2017)

18 ibid

19 StartupIndia Report, Punjab (2018)

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

1 PRS Telangana Budget Analysis (2017-18)

2 Website: Wehub

3 MUDRA (1USD =67.03INR, FRED 2016-17,
1USD=64.46INR, FRED 2017-18)

4 ibid

5 Report Inc42

6 1USD = 67.03 INR, FRED 2017-18

7 Website: Startup India

8 StartupIndia Report, Telangana (2018)

9 DIPP (2017)

10 StartupIndia Report, Tamil Nadu (2018)

FUNDING

STRENGTHS

Telangana has multiple fiscal incentives for startups and incubators

- The state offers multiple fiscal incentives like patent fee reimbursement, tax benefits, recruitment assistance¹ and also offers fiscal incentives to support idea-stage companies.
- The state also has a special infrastructure and funding setup aimed at supporting women entrepreneurs.²
- The microfinance gross loan portfolio (MUDRA) for Telangana is USD998 million in 2017-2018, up from USD564 million in 2016-2017.³

Tamil Nadu has a strong presence of private venture capital network funds

- The state microfinance gross loan portfolio increased by 41% over the previous year to USD3875 million in 2017-2018.⁴
- The state government allocated several funds to startups: a USD78 million venture fund plan and the Amma Fund of USD31 million for women entrepreneurs.^{5, 6}
- Tamil Nadu has an overall strong venture capital, incubator and accelerator network, hosting 30 incubators across the state.⁷

WEAKNESSES

Public funds are not always utilised to the fullest in Telangana

- In 2016-17, the government budget for school education was underutilised by 4.1%.¹
- Currently incentives for angel investment appear to be lacking in Telangana.⁸

Tamil Nadu lags behind in public sector financing of the startup ecosystem

- Tamil Nadu receives only 8% of total FDI coming into India.⁹
- There is no state supported venture fund or a mechanism for startups to win public procurement orders.¹⁰

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

11 MUDRA (1USD =67.03INR, FRED 2016-17,
1USD=64.46INR, FRED 2017-18)

12 Startup India Rankings

13 Website: Yourstory

14 Punjab Startup Policy

15 ibid, 1USD = 67.03 INR, FRED 2017-18

16 MUDRA (1USD =67.03INR, FRED 2016-17,
1USD=64.46INR, FRED 2017-18)

17 ibid

18 StartupIndia Report, Kerala (2018)

19 Inc42

20 ibid

21 SPIRE Punjab 2016, (1USD=67.03 INR, FRED 2016-17)

FUNDING

Kerala is increasing institutional funding in startups

- The State microfinance gross loan portfolio has increased by 51% from USD916 million in 2016-2017 to USD1440 million in 2017-2018.¹¹
- Kerala is one of the top performers in the state rankings for startups, with significant support for incubators.¹²
- The state government's support through seed funding and equity based funding has seen an increase in overall institutional funding.¹³

Public sector funding for startups is increasing in Punjab

- The state has a USD4 million venture fund for SMEs in software and IT.¹⁴
- The government has provisions to provide seed funding for startups upto USD4475¹⁵
- The state microfinance gross loan portfolio increased by 45% over the previous year to USD1012.1 million in 2017-2018.¹⁶

The focus of funding is IT startups in Kerala and disconnected from other departments

- Kerala receives only 0.5% of total FDI coming into India, even though the state has a large hardware industry presence.¹⁷
- Even though Kerala is a leading state for funding startups with multiple announcements, the actual trickle down of funds is not easily accessible.
- The focus of funding is concentrated heavily on technology startups and not necessarily connected to existing state strengths like tourism.¹⁸
- Despite being one of the most progressive states, Kerala has a poor gender ratio of women founders and no specific funding support to encourage women led startups.¹⁹

Punjab is still emerging in the startup space and not all funding mechanisms are not yet in place

- Punjab receives only .2% of total FDI coming into India, despite heavy industry presence.²⁰
- Under the SPIRE program, Punjab is yet to set up a Fund of Funds which is worth USD15 million, despite public announcements.²¹

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

1 Ministry of Corporate Affairs (2016-17)

2 Website: Invest India

3 Website: IIT Madras Research Park

4 Website: Kerala Startup Mission

5 StartupIndia Report, Telangana (2018)

6 ibid

7 DIPP (2018)

8 Census (2011)

9 ibid

10 Website: InvestIndia; USD=64.46INR, FRED 2017-18

BROADER ENVIRONMENT

STRENGTHS

There is growing support for businesses and entrepreneurship in Telangana

- Telangana had 6,568 new companies registered in 2016-2017, an increase of 14% from 5,764 companies in 2015-2016.¹
- Telangana ranks second in the number of operational Special Economic Zones in the country.²

Tamil Nadu has a good network of premier educational institutes that support startups

- The IIT Madras Research Park is one of the country's leading institutions to support biotech startups.³

Kerala is proactive in promoting startups

- A number of programmes have been introduced to provide young entrepreneurs with an exposure to global startups and their ecosystems.⁴
- Different government departments have been encouraged to benefit from the startup ecosystem by working with startups on IT projects that cost up to USD 155,000.¹⁰

WEAKNESSES

Telangana incentivizes technology startups more

- Even though the state has eased regulations for public procurement, the criteria benefits only technology based startups.⁵
- The state conducts numerous high profile events like BioAsia, GES but the diffusion effect of these outreach events is limited.⁶

Tamil Nadu fell behind in Ease of Doing Business

- Tamil Nadu fell by six places from 12 out of 32 in 2017 to 18 out of 32 in the 2018 Ease of Doing Business Ranking.⁷

Lack of job opportunities, outmigration and dwindling fertility rates has made labour a problem for Kerala

- More than 60% of the state population is aged between 15-59 but this share has been increasing at a declining rate, unlike in other Indian states.⁸
- Kerala was ranked 20 out of 32 states and Union Territories on Ease of Doing Business in 2016, going down from 18 the previous year.⁹

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

BROADER ENVIRONMENT

- The number of new companies in the state registered in the past year has increased by 40% in 2016-2017 to 3,067 companies.¹¹

Punjab, a predominantly agricultural state, has an industry thriving on its linkages with well-developed infrastructure

- Punjab improved its ranking on Ease of Doing Business from 16 in 2015 to 12 in 2016.¹²
- Punjab has the highest road density in India and is working towards being a power surplus state.¹³ It has a thriving industry, known for its apparel, tractors and autoparts.

- Labour participation rates have increased from 480 per 1,000 population in 2011-2012 to 500 per 1,000 population in 2015-2016, but the lack of job opportunities has increased outmigration, especially towards Gulf countries.¹⁴

Public debt is a serious problem for the Punjab government

- Rising public debt is a significant problem for the Punjab government. Public debt has been continuously rising since 2012-13.¹⁵

¹¹ Ministry of Corporate Affairs (2016-17)

¹² DIPP (2018)

¹³ Economic Survey of Punjab-2016-17

¹⁴ Labour Bureau (2015-16)

¹⁵ Sawhney, U. and Vats, D. (2016)

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

ECOSYSTEM CONNECTIONS

STRENGTHS

Public and Private sectors in Telangana share common goal of innovation as a growth driver

- Well-established entities outside of the government like private academic institutions, chambers of commerce and industry and private sector companies promote and support innovation and entrepreneurship.
- T-Hub, Telangana's flagship incubator model, has built foundations for a sustainable startup ecosystem and is recognised as a role model by NITI Aayog.
- The state has around 30 operational SEZs and 16 national Highways (NH).¹

Strong academic infrastructure in Tamil Nadu provides an impetus for innovation

- IIT Madras, has a high startup success rate for its Research Park.
- Tamil Nadu is also home to a finance research hub (IFMR).
- The state provides facilities for performance testing of vehicles that range from two wheelers to heavy commercial vehicles.

WEAKNESSES

Telangana's strength is restricted to Hyderabad and its surroundings

- Even though Telangana is a forward looking state, the ecosystem evolution in its smaller towns is at a much slower pace than the capital city of Hyderabad

Tamil Nadu lacks policy backing for vital sectors in the state

- Presently, a package of incentives is available only for automobile mega-projects.
- There is no integrated policy to ensure that Tamil Nadu will maintain a leadership position in the automobile and auto components sector.

¹ Website: Invest India

3.8 STRENGTHS AND WEAKNESSES ANALYSIS

ECOSYSTEM CONNECTIONS

Kerala is driven to provide infrastructure for incubators and other facilities for innovation

- Kerala was the first state to open a Technology Park (1990) with a focus on electronics and IT including software. It is one of the largest in India. It houses many of the global leading IT companies, special economic zones and the Kerala Startup Mission.²

Punjab provides an ecosystem for innovation with participation from academic institutions

- Apart from a Knowledge Park and a biotechnology incubator in Mohali, an innovation cluster called the Chandigarh Region Innovation and Knowledge Cluster (CRIKC) has been established to promote industry-university linkages for industrial research across sectors.

Although Kerala is driven to develop infrastructure, these sometimes do not become productive

- Kerala has 9 incubators, which given its size seems to be a strength. However, despite having a biotechnology incubation centre (BTIC), there has been only one startup from Kerala as of 2017 in this sector. The set up of BTIC was outsourced to KINFRA, an infrastructure company which may have been unable to cater to the particular needs of a biotechnology incubation centre.
- Only a small number of startups benefit from subsidized incubation.³

The ecosystem faces regulatory obstacles in Punjab

- There are no regulatory changes yet in place to ease public procurement to encourage startups or an established mechanism for startups working in disruptive technologies to approach government.⁴

² Website : Technopark

³ StartupIndia Report. Kerala (2018)

⁴ StartupIndia Report. Punjab (2018)

**4.
CAPACITY BUILDING FOR
INNOVATION IN INDIA**

4.1 UNDERSTANDING THE RANGE AND SPREAD OF INNOVATION POLICYMAKERS

The table on the next page shows estimates of the numbers of policymakers at four key levels of seniority in the core innovation departments at the central level and an example of the regional level. These numbers are drawn from publicly available data and interviews with experts. These numbers are intended to give an insight into the potential size of the innovation policymaker community and should be regarded as estimates as such. These numbers include permanent staff only and not lateral hires, even though they are also a part of the overall innovation policymaker community.

At the national level, the core innovation departments included are NITI Aayog, DIPP, DST, DBT, DSIR, MEITy and MHRD. Of these, the staff structure is different for the scientific departments (DST, DBT, DSIR and MEITy) where all level officers are career scientists or hold technical degrees (the only exception to this is the appointment of a career bureaucrat as head). The staff structure at NITI Aayog, DIPP and MHRD includes career bureaucrats at the top levels (L1 and L2) and supporting department staff (which may include lateral hires).

We have considered only career bureaucrats at the regional level because they exert the most policy influence over the regional innovation ecosystem, irrespective of seniority. Occasional high profile lateral hires are the only exception to this. One should also take into consideration that the number of L3 and L4 policymakers will change based on the size of the state (Biggers states like Maharashtra will have more officers), so the target audience just from the states may well run into hundreds. Moreover, the local senior staff from core innovation departments such as industries, planning, IT, etc. can also be considered as part of the L4 cohort but these numbers are variable and difficult to approximate.

4.2 MAPPING INNOVATION POLICYMAKERS

CORE INNOVATION POLICYMAKERS AT NATIONAL LEVEL

DEPARTMENT	L1	L2	L3	L4	TOTAL CORE INNOVATION POLICYMAKERS
MEITY	1	20	25	40	86
NITI AAYOG	1	2	0	6	9
DST	1	25	38	36*	129
DSIR	1	3	11	12	27
DBT	1	8	23	3	35
DIPP	3	4	9	27	43
MHRD	2	4	22	71	99

CORE INNOVATION POLICYMAKERS AT REGIONAL LEVEL

MAHARASHTRA STATE	3	22	57	36+	118
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* includes key regional heads who act as a linkage between centre-state for state S&T councils (29)

4.3 INNOVATION POLICYMAKER 'PERSONAS'



Former Secretary

DEPARTMENT OF SCIENCE AND
TECHNOLOGY, GOVERNMENT OF
INDIA (LEVEL 1)

A career scientist with DST for more than 30 years. Responsible for budget planning, managerial responsibilities of DST, creation of new programs and policies in science and technology.

"Innovation today is competition driven, the challenge for the government is to make it collaboration driven."

"Measuring innovation is not well understood across systems and policymakers."

"The top and middle management of the system need strengthening to translate research into policy."

"There should be interactions among the policymakers and the public."

"Failure is punished within the system but how can there be innovation without failure?"

KEY CHALLENGES

- The current **risk-averse culture** has a direct bearing on innovation - decision-making within the government becomes slow, government risk capital invested in new ideas is not enough, the thinking culture in researchers is affected, there is a very real fear of failure.
- There is a need to invest in and **develop** a platform for **mentorship** and sharing ideas, especially with increased policy focus on entrepreneurship.
- There is a divide between policymakers and industry, industry and researchers; a lot of good research does not translate into policy or into market ready applications, very few institutes turn out industry ready people for research - **collaboration** between industry, research and policy needs to be strengthened.
- A major organisational challenge is **human resource development** - there is a distinct gap between policy goals and their implementation.
- There is a knowledge gap in models for **scaling up successful innovation** across the country.

A DESIRE TO LEARN FROM BEST PRACTICES AROUND THE WORLD AND IMPROVE ORGANISATIONAL CAPABILITY

- Interest in learning from global best practices on innovation and apply them to current programmes.
- Ideal training programme would comprise of mix of officers from different levels within the same organisation with an emphasis on the younger rising stars.
- Creation of a space where policymakers across domains can interact without fear of backlash.



Joint Secretary

GOVERNMENT OF INDIA (LEVEL 2)

A career bureaucrat with more than 20 years of experience or a senior experienced lateral hire. Responsible for design and nationwide implementation of policy.

“In government, there is only constant evolution, there is no such thing as “done”.”

“There is no umbrella organisation for innovation in India. That is why we are focusing on ecosystem creation.”

“What we need is to be able to experiment with different models of innovation, how can one strategise if there is no experimentation. How do we create these feedback loops? How do we measure outcomes?”

KEY CHALLENGES

- The current administrative system is person-driven, a rather **individual driven way of functioning** - departmental priorities are to some extent tied to the person instead of long term institution building.
- There is a **lack of collaboration and coordination between departments** resulting in duplicate programmes and spending.
- Manpower **capacity and capability** for implementation is **limited**, there needs to be a focused effort to fill this large gap.
- A key challenge in terms of planning for innovation for India is the **scale and complexity of the country** - there are ecosystems within ecosystems, there is a large thriving informal economy, there is a very large rural population, there is an increasing young population that wants greater integration in the global economy - change is slow and takes time to show.

A DESIRE TO STUDY THE UK INNOVATION MODEL AND TO CREATE A COMMON PLATFORM ACROSS DEPARTMENTS FOR KNOWLEDGE DIFFUSION

- Wants to learn how the UK innovation system evolved and how it is relevant to the Indian context
- Wants to learn how the UK innovation system was able to roll out different programme models for piloting, how that knowledge was absorbed in the system across departments



Director, International Co-operation, e-commerce and innovation

MINISTRY OF ELECTRONICS AND INFORMATION TECHNOLOGY (LEVEL 4)

Coordination of international division activities with foreign counterparts, policy input into electronics and internet infrastructure.

“One of India’s greatest strengths is that there is no dearth of problems. There is genuine opportunity for private sector to scale up, for people to create businesses.”

“There is definitely potential for a gap analysis that looks for funding efficacy based on patents filed through the Indian system.”

“Digitisation is a huge opportunity for the country with a massive impact factor”

KEY CHALLENGES

- There is **no clear, common understanding** of what “innovation” means by different players in the system, whether it is other government departments, industry or academia.
- There should be **better dialogue between the centre-regional** innovation ecosystems, especially in programme design.
- A key challenge is how to bring educational institutes at the forefront of **translating R&D into commercial applications**, how to **incentivise a researcher** to turn into an entrepreneur, how to **reduce barriers to access**.
- Human resources capacity is a major organisational challenge, staff is typically **trained as executors and not problem solvers**, they do not get the understanding required to develop a macro perspective.
- The **knowledge network between public institutions is quite poor** - so there are many successful “models” that come with the recommendation of replication (policy and otherwise) but they do not get replicated.

INTEREST IN CREATING IMPACT THROUGH A TIME-BOUND PROJECT

- To create a project that is impactful (using emergent technologies and aligned with MEITY’s thematic areas) with measurable outputs.
- To embed learnings and best practices from the UK and other participating countries into day-to-day work.



CEO

MAHARASHTRA INNOVATION SOCIETY (LEVEL 3)

Responsible for policy formulation and implementation of all skill and innovation related programmes of the state government and of the central government in the state.

“Support staff in the system do not have all necessary capabilities needed for implementation, especially in the innovation and technology space.”

“Local training are mostly restricted to administrative processes or pan-government changes like digitisation.”

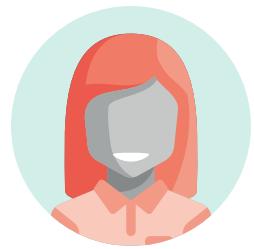
“ The Innovation Society is a fairly new organisation and we want to build it so that the youth are attracted to innovation, to building startups for the state.”

KEY CHALLENGES

- There is a **huge gap between the ideation** or the policymaking and the **implementation**.
- Institutional memory is person dependent, there is **no easily accessible repository** which can be referred to for the future; no provision to access the learnings from past failures.
- The system’s **adaptability to technology is poor**, the understanding of technology and its implications system-wide is quite low.
- There is a lot of **systemic resistance to change**.
- **Lack of collaboration and coordination between departments**, especially in terms of innovation.
- A lot of people practice innovation without realising and thus, the system does not benefit as well as it should through such individual achievements.
- Most of the staff has limited exposure, no motivation to seek specialised training and hence, their thinking is limited - one of the challenges is **change** their **mindset**.
- **The government has to play a better role of collaborator or matchmaker**, between the market and industry, between investors and innovators, between the supply side and demand side of innovation.

A DESIRE TO CREATE NETWORKS WITH GLOBAL COUNTERPARTS AND GAIN EXPOSURE THROUGH FIELD VISITS

- Gain global perspective from innovation policies.
- Develop a broader understanding of innovation policy formulation and implementation.
- To access network of global innovators in policymaking regularly.
- To create a common platform within government for supporting innovation.



Chief Innovation Officer

GOVERNMENT OF TELANGANA
(LEVEL 2)

Experienced lateral short-term hire. Responsible for developing policy frameworks, attracting new investments, promoting digital empowerment of the citizens, etc.

“There is an immense need for building interdepartmental synergies and for networking between the stakeholders in the country.”

“There is a difference between the state and centre priorities, in terms of growth and promoting innovation.”

“The challenge for me here is how to achieve that turning point or how to get that critical mass in place, for the Telangana ecosystem to flourish without external impetus.”

“There is a need to sensitise the industry and government about the importance of technology.”

KEY CHALLENGES

- There is a **disconnect between scientists and administrators**, research conducted in institutes does not respond to the needs of the state, and **stakeholders work in isolation**.
- **Lack of funding restricts innovation** - it distorts the purpose of innovation; startups come up in the IT sector because of the obvious financial gains but not as much in sectors where there are societal needs (pharmaceuticals, education, agriculture).
- A key challenge is to **improve the interaction** of the youth in the education system and the private sector, to encourage a **mentorship** culture to take root.
- We want to **make better policy** to make it easier for students to pursue entrepreneurial dreams, through accessible capital, IPR facilitation, etc.
- We need **better standards for measuring performance**, for evaluating what interventions work, what gaps need to be filled.
- We need a **better understanding** of how **technology** can be used to solve existing social issues like job generation in traditional communities.

A DESIRE TO IMPROVE COMMUNICATION WITHIN THE ORGANISATION, BUILD CREDIBILITY FOR THE NEED TO DEVELOP INNOVATION CAPACITY

- Increase personal networks and explore possibilities of future collaborations with other stakeholders.
- To come up with a programme that creates tangible/ measurable benefits for the state on a long-term basis.

**5.
ASSESSMENT OF CURRENT AVAILABLE
RANGE OF SUPPORT AND
TRAINING FOR INNOVATION POLICYMAKERS
IN INDIA**

The current available range of support and training for an innovation policymaker within the country appear limited and ad-hoc. Innovation is studied either as a component of a larger executive development programme or through study tours or visits with a specific programme or objective. Moreover, almost all innovation-focused executive development programmes offered in-country are designed for business managers.

TEACHING METHODS	Classroom teaching, workshop style lectures (may include experiential and participatory methods)
PROVIDERS	Premier Management schools, large non-Governmental bodies like the World Bank, UNDP, WIPO, etc.
SUBJECTS	Introduction to innovation, strategy models for fostering innovation, design-thinking for policy, instruments for monitoring and evaluation, good governance, etc.
REACH	Mid-senior level
OUTPUT	Short certificate course
DELIVERY	Classroom course

Typically, a senior innovation policymaker would be highly qualified (with at least a postgraduate or doctorate degree) and have access to executive development opportunities overseas and within the country. A senior policymaker would also have the influence and resources to access ad-hoc training/exposure through field visits, establishing contact with the desired institutions or experts, both within the country and abroad.

Junior innovation policymakers have little access to innovation policy training except through obligatory workshops or programmes. Junior policymakers also tend to be overburdened with administrative duties and are often unable to contribute dedicated time, effort and thought to their own professional development.

The demand for specialist innovation policy training at all levels is high because of the increasing policy focus on improving the innovation ecosystem to increase economic growth and address potential employment and other social issues through this ecosystem.

Our interactions with innovation policymakers indicate the following areas of interest for training:

- Components of a good innovation policy.
- Management of transitory phases like migrating to digital systems, technology disruptions.
- Improving technological coordination between government and industry, government and market.
- Sustainable interventions to foster innovation in universities.
- Scaling the importance and understanding of innovation within and across departments.
- Using innovation to fuel job growth, to create jobs.
- Increasing access and improving quality of access to public services.
- Strengthening innovation capacity within government.
- Developing regional IP systems within the country by promoting patenting and licensing.
- Creating strategic linkages between mid-level actors within the system to foster innovation in government.
- Using innovation policy to address societal issues like poverty, climate change, inequality, etc.
- Learning from global best practices.
- Developing implementation/execution capacity within government.
- Improving the use of data analytics and innovative methods for policy corrections.

Experts also indicated that the following factors will contribute to a sustainable innovation policy training programme in India:

- **Location:** Policymakers in the states showed willingness to participate if the programme was organised in the capital region of Delhi or within the country. Overseas travel require authorisations and even then, are subject to last minute cancellation.
- **Duration:** Shorter courses or workshops are the preferred method for training (however, most policymakers look for immediate applicability of their learnings in their day job).
- **Funding:** Preferably funded by another government agency like the Line ministry or the highest office in the state.
- **Timing:** April - September (these are the first months of the financial year with a departmental focus on implementation. Typically, September - November is a festive time with a lot of public holidays and November- March are parliament sessions and a rush to finish pending projects, so officials are more time-poor).

**6.
ASSESSMENT OF LIKELY AREAS
OF FOCUS FOR GLOBAL INNOVATION POLICY
ACCELERATOR TEAMS FROM INDIA**

CONTENT AREAS

Establishing a programme along the lines of the UK's Small Business Research Initiative (SBRI) in India, to support small businesses and the start-up ecosystem.

Embedding entrepreneurship curricula in the education system.

Developing mentorship programmes so that young innovators are able to develop "highly impactful innovations" and are able to pursue the opportunities they deserve, irrespective of their economic background.

Developing innovative/appropriate funding mechanisms for providing credit to small communities such as financing through sandbox technique, designing alternative Impact investment funds, participation of HNIs, etc.

Policy interventions for boosting the share of Hi-Tech Products in Manufacturing & Exports.

Improving translation of existing public sector R&D into commercial/market-ready products.

Building a policy framework to support technology deepening in traditional sectors like agriculture, healthcare, handlooms, etc.

Creating cluster models similar to the UK Catapult model.

PROCESS THEMES

Setting up a platform for horizontal diffusion of innovation as opposed to vertical diffusion.

Improving cross-departmental coordination and communication and building a network of like-minded partners to identify innovation priorities for economic growth.

Creating a sustainable network of mentors and corporate access for startups.

Building a collaborative knowledge platform for all national stakeholders to identify and work together on innovation priorities and have complementary programme designs across ministries.

Building a platform for sharing and archiving innovations in governance across departments.

Improving connections between government, industry and academia to establish sector-specific "innovation clusters" in major urban and rural areas by leveraging existing and potential regional economic strengths.

Creating a sustainable environment to boost innovation and entrepreneurship in rural areas (understand what conditions are required for sustainability and boosting entrepreneurial mindset).

CAPABILITY THEMES

Developing standards for measuring impact of innovative policies, measuring performance of innovation, guidelines for scaling up proven innovations.

Developing capabilities within the system to execute innovation-related policies and programmes.

Improving policy understanding of newer technologies like Artificial Intelligence and identifying how to develop policy skills needed for adoption of new technology implementation.

Identifying funding and policy innovations for enabling better private sector participation.

Developing internal repository for accessing ideas and resources related to the latest in innovation thinking.

7. DIAGNOSIS AND RECOMMENDATIONS

There is considerable awareness among policymakers about the increasingly important role of innovation across all sectors in government. There is also a growing recognition that traditional administrative/managerial knowledge and implementation setups are no longer enough to effectively support innovation programmes and build sustainable ecosystems. The following are some of the common challenges identified by stakeholders in building sustainable ecosystems:

- Departments work in 'silos', there is a lack of collaboration between departments despite official channels of communication;
- Transfers, short terms for policymakers make it difficult to implement long-term solutions;
- Not enough participation or partnership with industry;
- Lack of capacity to implement innovation programmes;
- Lack of understanding within the system about innovation;
- Outdated higher education system with few links to industry.

There have been a number of initiatives to build the innovation ecosystem like strengthening the IP rules to encourage entrepreneurship, boosting the startup ecosystem through financial and other incentives, promoting awareness in schools, etc. at the national and regional levels. However, our analysis suggests that regional stakeholders stand to benefit more from a programme like the Policy Accelerator because of the relatively greater level of dynamism and flexibility in implementation.

Already, regional stakeholders bypass national stakeholders to seek global expertise and attract investment to their particular region, irrespective of the national narrative. Currently, this is mostly done through study tours or ad-hoc engagement with institutions and experts abroad and within the country but it is a worthy opportunity for a well-structured programme like the Policy Accelerator to explore. A mix of junior/mid-level bureaucrats and influential lateral hires with a buy-in from political/senior management working on a short term (6-9 months) action project based on national/state priority would be the ideal combination for maximum impact.

Our research also suggests the following recurring themes of interest for capacity building and improving the innovation ecosystem to policymakers:

- Innovation policy formulation and challenges;
- Learning from UK system and its historical lineage;
- Continuous learning from global peer network;
- Improving university-industry links and improving private sector participation in the ecosystem;
- Improving coordination and communication across linked departments;
- Learning newer or improve existing policy interventions like funding/tax incentives, sandbox techniques, clustering interventions, R&D to commercialisation, etc.;
- Tangible, practical skills that can be applied to day-job.

Our recommendations to convert the Policy Accelerator programme into a sustainable long-term running programme are as follows:

Programme engagement:

- Develop strategy or secure buy-in at the highest level of government;
- Increase pre-Programme engagement between Nesta and potential participants;
- Build time within pre-Programme engagement to allow for potential roadblocks like sign-offs, clashing schedules, rejections, identifying potential participants, etc.;
- Modify the target participant cohort to include regular government knowledge partners like experts from academia, consultants or organisations like industry bodies - especially if the end goal is a tangible project;
- Develop a system to counter for embedding learning in institutions if participants are suddenly transferred;
- Alternately, choose participants from a pre-decided selection of institutions to build multiple cross-departmental teams;
- Focus on regional players;
- Link Programme to ongoing Newton/Innovate UK activities as a another way of continual engagement;
- Showcase Programme as an opportunity for the two ecosystems to collaborate beyond;
- Include at least one interaction with counterparts from the UK system;
- Run multiple iterations of the Programme to increase visibility.

Programme activities:

- Conduct some parts of the programme locally with UK experts travelling to India;
- Alternately, introduce more local components that can be done as a part of regular embedded learning for participants (through partnership with local training institutions);
- Increase the number of field visits/experiences especially if the Programme is focused solely on bureaucrats;
- Include some learning material that can be used by the participants' teams constructively - participants (often time-poor) pass on tasks to their teams who do not have access and interpret instructions subjectively;
- Reduce Programme length to six months from nine months.

In conclusion, our research has shown that each regional innovation system is unique and charting its own innovation trajectory. There are significant opportunities for cross-learning between India's states and for the Centre to identify and work closely with the innovation champions in states. Innovation today appears to be individual-driven in various states, and the key departments promoting innovation vary from state to state.

The Policy Accelerator offers an opportunity to bring together diverse individuals at various stages of their career in government to exchange ideas, and learn best practices not only from within the country but also from various governments across the world through the Policy Accelerator network of global policymakers.

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