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**Innovation, Start-ups, and Fiscal
Federalism in India: The Case for
State-Level R&D Support**

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Innovation, Start-ups, and Fiscal Federalism in India: The Case for State-Level R&D Support

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Abstract

Kerala has undertaken a wide range of initiatives to strengthen its innovation ecosystem, expand support for start-ups, and position the State as a competitive knowledge-driven economy. This working paper examines these initiatives in the context of the forthcoming Finance Commission deliberations, with the objective of articulating why Kerala's innovation-linked interventions merit enhanced fiscal support through grants-in-aid. The paper reviews Kerala's strategic investments in research infrastructure, start-up incubation, technology transfer, and sector-specific innovation missions, and assesses their alignment with broader national development goals. It also identifies the fiscal constraints that limit the scaling of these initiatives and underscores the need for targeted central support to sustain momentum. By presenting evidence on the economic and social returns of Kerala's innovation-driven development model, the paper argues that a calibrated approach by the Finance Commission can significantly strengthen the State's capacity to contribute to India's knowledge economy. Overall, the paper aims to provide a clear, evidence-based case for enhanced financial support to Kerala's innovation and start-up ecosystem, thereby enabling the State to consolidate its gains and pursue long-term, innovation-led growth.

Key Words: Innovation ecosystem; Start-up policy; Kerala; Fiscal federalism; Finance Commission; Grants in aid; Research and development; Innovation governance.

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1. Introduction

Since the institutions play an essential role in development, they need to be responsive to the socio-economic context and coevolve with the economy and the society. In India, one of the most influential institutions has been the Finance Commission (FC), with its prime constitutional mandate to recommend how much of the Union's revenue is to be devolved to the States (size of the divisible pool) and how much should be devolved to each State (read as subnational entities). Their role has been especially important because of the congenital inequality in the distribution of revenue and expenditure responsibilities between the Union and the States. As observed by the 15th FC, States together are responsible for over 62 percent of the combined expenditure of the Union and the States, whereas their revenue entitlement is only about 37 percent.

As the 16th Finance Commission embarks on its constitutional mandate to devolve resources between the union and the states, there is an imperative to recognise that the socio-economic context is distinctly different from what it was when the Finance Commission was conceived. In 1951, when the Finance Commission was established and its mandates were designed, the major issue, given the prevailing socio-economic context, was addressing underdevelopment and facilitating balanced regional development. But today, India is one of the fastest-growing economies in the world and is aspiring to become the third-largest one by the close of this decade. More importantly, India aims to become a developed economy by 2047. Since India grows only if the states grow, the Finance Commission needs to be cognisant of the paramount importance of devolution to the states to enable them to play their key role in accomplishing the national vision. It

is also to be recognised that on account of their differing capabilities, the states are not equally positioned to contribute towards the national vision.

From past episodes of economic growth, it is evident that hardly any country has achieved developed-economy status without substantial investment in science, technology, and an innovation ecosystem. Joseph Schumpeter, who “invented” innovation as a process of “creative destruction” in the form of new products, new processes, new markets, new materials, and new organisations, placed entrepreneurs at the centre stage of innovation. The available empirical evidence suggests that the start-up ecosystem serves as the breeding ground for entrepreneurs.

The Science Technology and Innovation Policy 2020 highlighted the role of Science and technology when it envisaged “To achieve technological self-reliance and position India among the top three scientific superpowers in the decade to come” and “to double the number of Full-Time Equivalent (FTE) researchers, Gross Expenditure on R&D (GERD) and private sector contribution to the GERD every 5 years” It recognised the role of states when it stated “each State will earmark a percentage of the state allocation for STI-related activities under a separate budget head”.

In this context, this study examines the state of science, technology, and innovation in India and the current status of the start-up ecosystem, offering specific recommendations for the 16th Finance Commission to help build a vibrant innovation system at the state level. Given the differential capabilities of states, it also articulates collaborative action points across states in the true spirit of cooperative federalism, which would facilitate

capacity building and catch-up among lagging states and could be supported by the Finance Commission.

The remainder of this paper is presented as follows. Section 2 provides an analytical background, outlining the landscape of India's innovation system. Here, the relevance of scientific knowledge, backed by the Science, Technology, and Innovation (STI) mode of learning and formal R&D, and of synthetic (experience-based) knowledge, backed by the Doing Using and Interacting (DUI) mode of learning, leading to informal innovation for development, has been articulated. Section 3 elaborates the broad contours of the regional innovation system in Kerala and highlights the strategy of transforming Kerala to a Knowledge economy. Section 4 analyses trends in investment in R&D and innovation at the national and sub-national level. India lags significantly behind other emerging economies in R&D and innovation. State-level R&D is also substantially low, calling for a significant increase in R&D and innovation effort. Finally, section 5 urges the Finance Commission to facilitate innovation-driven development and presents estimates of grants-in-aid to be provided to promote R&D and innovation at the state level.

2.0 The Landscape of India's Innovation System

India is a pioneer in the developing world to explicitly recognise the pivotal role of science, technology, and innovation in economic development and social transformation. It is evident from the Scientific Policy Resolution of India (1958), which stated,

“The key to national prosperity, apart from the spirit of the people, lies, in the modern age, in the effective combination

of three factors, technology, raw materials and capital, of which the first is perhaps the most important, since the creation and adoption of new scientific techniques can, in fact, make up for a deficiency in natural resources, and reduce the demands on capital”.

It continued,

“It is only through the scientific approach and method and the use of scientific knowledge that reasonable material and cultural amenities and services can be provided for every member of the community, and it is out of a recognition of this possibility that the idea of a welfare state has grown”.

Within this perspective, India has built up an elaborate system of policy measures and institutional arrangements to promote research in atomic energy, defence, space, and electronics. The other initiatives that laid the foundation for many of the achievements in the later years included, but were not limited to, the establishment of a nation-wide network of R&D labs with regional and national focus under the CSIR, the establishment of IITs, a large number of engineering colleges and universities for generating human capital. Agricultural research was promoted to usher in the Green Revolution and achieve food self-sufficiency. The Indian Patent Act of 1970 facilitated re-engineering through a process patent rather than a product patent. A liberal approach to FDI and foreign technology followed during the initial years of independence gave way to a much more restrictive regime to facilitate the development of the much-needed domestic technological capability and self-reliant development (Joseph & Abrol, 2012).

Liberalised policies, which began in the 1980s, evolved into Globalisation by 1991 and accelerated in the mid-1990s, when the WTO was formed with India as a founding member. As the economy got integrated with the world market, there has been increasing participation in the Global Production Network (GPN). The innovation systems also got globalized with India's active participation in the Global Innovation Network (GIN) and thus became an attractive location for undertaking R&D. Within such a context, the new initiatives within this framework of Science, Technology, and Innovation Policy 2013

- **Aatma Nirbhar Bharat** with a view to further strengthening our innovation system at the national, regional, and sectoral levels to hasten the process of making India an innovation-driven economic superpower.
- **Make in India**, which aimed at making India the most attractive global destination for Foreign Direct Investment (FDI) and developing India into a 'Global Manufacturing Hub' by facilitating investment and fostering innovation.
- **Digital India** to ensure that Government services are made available to citizens electronically by improving online infrastructure and increasing internet connectivity;
- **Start up India** wherein the eligible companies could get recognised as Start-ups by DPIIT so that they could avail a host of tax benefits, easier compliance, IPR fast-tracking
- **Atal Innovation Mission (AIM)**, the flagship project of NITI Aayog to promote innovation and entrepreneurship in the country. The AIM project serves as a platform for

promoting world-class innovation hubs and self-employment in technology-driven areas.

India's GDP growth rate has increased since globalisation. The share of manufacturing in GDP increased from about 9% in 1951 to over 17% by the mid-1990s. But we have not been able to move upward under the globalised innovation system, indicating strong signs of premature deindustrialisation (Joseph & Kakarlapudi, 2020). Our target of raising the share of the manufacturing sector to 25% GDP, with 100 million manufacturing employment set more than a decade ago, remains a distant dream. The outcome has been poor employment growth along with widening development divides within the country between regions and between individuals.

Evidence across the world also clearly indicates that economic development is the progeny of science, technology, and innovation. A very often used indicator of a country's capability in the sphere of innovation in general, and science and technology in particular, is Research and Development (R&D) expenditure. However, as rightly noted by the Science, Technology, and Innovation Policy 2013, viewed from a development perspective, "while we do need to increase R&D investment and efforts, this view of innovation is based on a myopic perception that restricts it to the confines of formal R&D". Over time, in the policy parlance, the focus therefore has shifted from narrow R&D based approach to a broader process of innovation system building.

The innovation systems approach, which has emerged as the most popular in innovation studies (Fagerberg & Sapprasert, 2011), refers to the relationships and interactions among actors engaged in the production, diffusion, and use of new and economically

useful knowledge. Here, innovation is seen as a process of generating knowledge through interactive learning among different actors, which is governed by the institutional architecture within which such interactions take place (Lundvall et al., 2009). According to this perspective, knowledge is the most important resource and learning is the most important process in the modern economy. Therefore, any inquiry into the development divide, both within and between countries, would inevitably lead us to the doorstep of the knowledge and learning divides.

Here, knowledge and innovation could be seen in terms of

- a) Scientific knowledge which is primarily backed by the Science, Technology, and Innovation (STI) mode of learning mainly through formal R&D, and
- b) Synthetic knowledge/experience-based knowledge, which is mainly an outcome of non-R&D-based, Doing Using and Interacting (DUI) mode of learning among different actors in the innovation system (Jenson et al, 2007; Joseph et al., 2021), leading to informal innovations.

In a sense, any innovation is bound to have both STI and DUI dimensions. Therefore, these two modes of learning may not be considered as mutually exclusive, and the distinction could be based on the primacy of the type of knowledge. Thus, while the STI mode of Innovation and the DUI mode of innovation are important, from a development focus, policy attention has been more on the latter, and the DUI mode of learning seems not to have received the attention it deserves.

There are, however, a number of studies showing that the DUI mode may be of much importance in the developing economy

context, where the innovations are mostly of incremental rather than radical. The improvisational attitude at the grassroots prevalent in many parts of emerging economies, such as India, is often locally called as *jugaad* (Krishnan, 2010), akin to *'appropriate technology'*, defined such technologies as a set of small-scale, labour-intensive technologies that are easy to operate and maintain, and have minimal harmful impact on the environment (Schumacher, 1973). A large number of studies on informal-sector innovation also, in a sense, highlight the DUI mode of learning (Bhaduri & Kumar, 2011; Kumar & Bhaduri, 2014). Shekar and Joseph (2022), Shekar et al (2023). Grassroots-level frugal innovators are individuals or a group of people who attempt to solve a given problem by adopting locally available ingenuity and, in doing so, create a novel solution. Most of these innovations happen with very limited support from the formal institutions, and hence, while such solutions are adept at addressing the local problem reasonably well, they often fail to scale up (Krishnan, 2010) primarily on account of the much-needed institutional support (Fressoli et al., 2014; Abrol & Gupta, 2014).

The Science, Technology, and Innovation policy (2020) has shown exceptional commitment towards building a vibrant and inclusive innovation ecosystem, promoting both STI and DUI modes of learning. Innovative initiatives include, but are not limited to

- “Hybrid funding models with enhanced participation from public and private sectors through the Advanced Missions in Innovative Research Ecosystem (ADMIRE) initiative.
- STI Development Bank to facilitate a corpus fund for investing in direct long-term investments in select

strategic areas on various long and medium-term projects, commercial ventures, start-ups, technology diffusion, and licensing, etc.

- Promote technology self-reliance and indigenization to achieve the larger goal of “Atmanirbhar Bharat” through a two-way approach of indigenous development of technology as well as technology indigenization, in alignment with national priorities, like sustainability and social benefit, and resources.
- Impetus to the mainstreaming of equity and inclusion within the STI ecosystem through an India-centric Equity & Inclusion (E&I) charter to be developed for tackling all forms of discrimination, exclusions, and inequalities in STI
- “One nation, one subscription” policy whereby, in return for one centrally-negotiated payment, all individuals in India will have access to journal articles.

3.0 Kerala’s Innovation System and Transition to a Knowledge Economy

3.1 The STI Landscape

Kerala is the pioneer among Indian states to realize the importance of innovation-driven development and the role of knowledge as a key resource for growth and transformation. The government of Kerala's focus on science, technology, and innovation has been very much in sync with its human development-driven development strategy, driven by public action. This got manifested in its substantial investment in education, especially higher education, with the active involvement of the private sector. The establishment of

government-aided private institutions as early as the 1960s tends to suggest that Kerala has initiated Public Private Participation (PPP) in education decades before PPP was articulated at the national level. The result has been the establishment of a higher education infrastructure for engineering, medical, arts, and science at the instance of various institutions established by the Government, government-supported institutions, and self-financing institutions. This indeed has paid rich dividends. With its higher education enrolment ratio (41.3%) way above the national average (28.4%) the state emerged as the major source of highly educated manpower and skilled labour force for other states. Evidently, Keralites account of substantial share of the IT manpower of all the leading IT companies in India. Thus viewed, the state of Kerala has contributed much to nation-building, which has not received the attention it deserves, especially in discussions of fiscal federalism. The state has built up a fairly vibrant regional innovation system consisting of 13 universities (1. Kerala Agricultural University; 2. Kerala Veterinary and Animal Science University; 3. Kerala University of Digital Sciences, Innovation, and Technology; 4. Cochin University of Science and Technology; 5. Kerala University of Health and Allied Sciences; 6. Kerala University of Fisheries and Studies; 7. Kerala University; 8. Calicut University; 9. Mahatma Gandhi University; 10. Sree Sankara Acharya University of Sanskrit; 11. Kannur University; 12. Malayalam University and Kerala Technological University; 13. Sreenarayanaguru Open University promotes studies and research across a wide range of areas relevant to development. In addition, there are different technical educational institutions, R&D centres, and schemes which include

- Centre for Engineering Research and Development

- Transportation, Engineering and Research Centre
- Product Design and Development Centre
- Reusable Building System in RIT
- Rural Technology Development Centre
- Student Satellite Launch Program
- Centre for Bamboo Technology
- Interdisciplinary Research Centres at Government Engineering Colleges
- Robotics and AI Nodel Centre
- Centre of excellence in Systems, Energy and Environment
- Centre for High-performance Computing.
- International Centre for Free and Open Software
- International Research Institute of Ayurveda
- India Innovation Centre for Graphene

In addition to the above, there are eight research institutes under the Kerala State Council of Science, Technology and Environment and the Kerala Development Innovation Strategic Council (K-DISC), which undertake various programmes to facilitate innovation-led development and the transition of Kerala to a knowledge economy.

3.2 Kerala State Council for Science, Technology and Environment (KSCSTE)

From the perspective of STI mode of technological learning and innovation, the Government of Kerala established the Science, Technology and Environment Committee (STEC), and a number of research institutes were brought under its coordination as early as 1972, inspired to a great extent by the Science Policy Resolution.

In 2002, STEC was rechristened as The Kerala State Council for Science, Technology and Environment (KSCSTE) and transformed into an autonomous body under the Ministry of S&T, Kerala. The council promotes and implements programmes to increase the stock of knowledge in science, and fine-tunes policies that are significant for the sustained development of humanity. It aims at achieving excellence in basic research, academia-industry interactions, strengthening indigenous initiatives, building strong infrastructure, and developing a high-quality science education system in the state. This has been achieved through various schemes and programs, as well as the R&D organisations established by the council.

- There are eight institutions under the ambit of KSCSTE that undertake research work in specific, identified domains.
- The Centre for Water Resources Development and Management (CWRDM) was established by recognizing the need for catering to the R&D needs in the field of water management.
- **The Kerala Forest Research Institute (KFRI)** undertakes research in areas like forestry, biodiversity, etc., that are vital to the development of the Kerala State.

- **National Transportation Planning and Research Centre (NATPAC)** is undertaking research and consultancy works in the fields of traffic engineering and transportation planning, highway engineering, public transport system, inland water transport, tourism planning, rural roads, environmental impact assessment and transport energy.
- **Jawaharlal Nehru Tropical Botanic Garden and Research Institute (JNTBGRI)** is established with the vision of Conservation and sustainable utilization of the plant biodiversity of India, particularly of Kerala, for the well-being of its people.
- **Malabar Botanical Garden & Institute for Plant Sciences (MBGIPS)** is dedicated to the conservation and research on aquatic plant diversity, lower group plants, endangered plants of the erstwhile Malabar Region, as well as disseminating knowledge on various facets of plant sciences.
- **The Kerala School of Mathematics (KSoM)** has been setup as a joint venture of KSCSTE and National Board of Higher Mathematics, under Department of Atomic Energy, Government of India. The main objective of the institute is to promote Mathematical research in the country, particularly in Kerala.

3.3 Kerala Development Innovation Strategic Council (K-DISC)

As envisaged in the Science, Technology and Innovation Policy 2013, Kerala established Kerala State Innovation Council which

was transformed to **Kerala Development and Strategic Innovation Council (K-DISC)** with the mandate of spearheading the vision of building a competitive innovative and inclusive Kerala through the creation of a healthy, conducive ecosystem for transformative and bold innovations through new directions in technology, product, and process innovations. KSCSTE and K-DISC coordinate the research and innovation efforts of many institutions set up by the State Government, while the State Universities and Higher Educational Institutions carry out R&D and innovation at their respective levels. The K-DISC has evolved a holistic S&T strategy for Kerala's second-generation development challenges, without sacrificing inclusiveness and sustainability, through the following strategic initiatives.

- 1) **Young Innovators Programme** aims at democratising innovation and targets students, from every institution, across Kerala. Addressing concerns raised from various quarters on the lack of proficiencies of children in critical thinking and resourcefulness despite access to facilities and infrastructure, equity etc., the Innovation for Youth with Disability (I-YwD) project ensures innovation methodologies and opportunities for ideation and entrepreneurship reach youth with disabilities.
- 2) **'Manchadi - Teach Maths for Kerala'** and **'Mazhavillu- Teach Science for Kerala'** are programmes designed by K-DISC to address the need for innovation in education in a context wherein direct teaching methods have led students to expect information rather than seek it and that a strikingly lower number of children who can answer reasoning questions, problem-solving questions and questions involving critical thinking.

- 3) **'One District One Idea' (ODOI)** is an innovation challenge programme for manufacturing clusters and medium and micro-enterprise clusters.
- 4) **'One Local Government One Idea programme' (OLOI)** envisions empowering the Local Governments in Kerala to develop innovative solutions for their problems, going beyond traditional problem-solving approaches and looking at transformation models. OLOI also aims to support local governments in local economic development, service delivery and governance through innovation.
- 5) **'Accelerating adoption of Emerging Technology Solutions in Government'** is a programme where K-DISC works with partner departments to identify problems through Application Development Clinics.
- 6) K-DISC has developed a strategy of innovation-led development by creating Centres of Excellence in strategic areas like the Centre of Excellence in Microbiome, Centre of Excellence in Nutraceuticals, Kerala Genome Data Centre, Clean Energy Business Incubation Centre, and Kerala Open Talent CoE.
- 7) **The Accelerated Blockchain Competency Development (ABCD)** programme was established to make Kerala a Blockchain hub.
- 8) **The Electric Vehicle (EV) Consortium** was formed to create an ecosystem for manufacturing electric vehicles and components conducive to Indian conditions and utilizing indigenous resources.
- 9) **Kerala Medical Technology Consortium (KMTC)** aims to position of Kerala as the top Medical Devices and MedTech Hub in the country.

- 10) **Wayanad Smart Coffee project** aims to establish state-of-the-art processing facilities for coffee farmers to access higher value for their produce and provide solutions for problems caused by climate change.
- 11) **Under the Miyawaki programme**, a model for rapid urban forest development for Kerala was developed for carbon sequestration, biodiversity improvement, eco-restoration, and urban open space creation.
- 12) **Atal Community Innovation Centre** is a hub and spoke model innovation centre designed as a living lab for piloting innovation models in real-life contexts prior to scaling.
- 13) **The employability program of K-DISC** called the Kerala Knowledge Economy Mission aims at providing access for educated unemployed to opportunities in the capital-intensive, technology-driven enterprises in the private sector through demand-driven skilling programmes.

3.4 Kerala Start-up Mission

The **Kerala Start-up Mission (KSUM)**, founded in 2006, a decade before the Start-up India program was initiated at the national level, acts as a nodal agency for promoting innovation and entrepreneurship in the state, by supporting the state's startup ecosystem through various schemes and support programs. KSUM promotes technology-based entrepreneurship activities and creates the infrastructure and ecosystem required to support high-end technology-based startup businesses thereby guiding young minds who come up with innovative solutions.

With over 40,000 entrepreneurs and more than 5,000 startups, Kerala holds the distinction of being the most energetic start-up ecosystem in the country.

3.4.1 Major Programmes implemented at school level

1. Industry on-campus,
2. Young Innovators Program,
3. Innovation on Campus,
4. Samagra Shiksha Kerala
5. STARS Project for girls in Vocational Higher Secondary
6. SHAKTHI Girls Entrepreneurship Empowerment-Program.

These initiatives aim to instil an entrepreneurial culture and create a pool of skilled individuals.

3.4.2 Major Programmes Implemented at the College Level

The Research and Innovation Network Kerala (RINK) - a project that fosters the development of a culture of entrepreneurship and shapes the research ecosystem. It aims to promote technological capabilities, products, and innovations from research institutions to the market. The initiative also facilitates the transfer of technology and intellectual property from research organizations to the marketplace.

3.4.3 Support to Start-ups

KSUM has initiated various grant schemes for start-ups to overcome one of the major obstacles in any start-up journey,

which is “capital”. Administered by the mission, the grant provides financial assistance and mentorship to start-ups developing viable business concepts. It includes an Idea Grant (up to 3 lakh rupees), a Productization Grant (up to 8 lakh rupees), and a Scale-Up Grant (up to 15 lakh rupees). R&D grants, specifically designated for research, are for hardware start-ups that emphasize substantial research and development.

Seed loans, aimed at encouraging and nurturing ventures rooted in emerging technology, serve as a financial boost for start-ups in Kerala. Such Units can avail themselves of subsidized loans with favourable terms, supporting their growth and innovation in the dynamic landscape of technological advancements.

The Patent Reimbursement Scheme supports start-ups and students by reimbursing patenting costs. The government offers subsidies of up to Rupees two lakhs for Indian patents and up to ten Rs 10 Lakhs for foreign patents.

The Technology Transfer & Commercialization Support initiative supports start-ups in India that acquire technology licenses or engage in commercialization activities with government research institutes. The funding is provided to start-ups to reimburse 90% of the total technology transfer cost. Start-ups involved in product development through these collaborations can receive substantial financial assistance, with a maximum reimbursement of up to 10 lakh rupees. This initiative aims to encourage technology transfer and commercialization efforts by fostering partnerships between start-ups and government research institutions, thereby promoting innovation and economic growth.

The **'Government as a Market Place'** is a scheme to facilitate government departments in directly procuring products from start-ups. This program serves as a platform for start-ups to showcase their products or services, enabling government agencies to directly support and procure from them. Through this initiative, start-ups can gain visibility in the government market and avail themselves of opportunities to provide services or supply products to government entities. The project has increased the procurement limit to Rs 50 lakhs, expanding the scope for start-ups to engage with government departments.

Fund of Funds, a SEBI-approved Alternative Investment Fund initiative by KSUM, brings together venture capital funds that are recognized by the Securities and Exchange Board of India. The project aims to attract more investments to the start-up ecosystem in Kerala. The state government, acting as a limited partner, works towards increasing the attractiveness of fund inflows to the state's start-up ecosystem. The initiative seeks to position Kerala as a favourable destination for venture capital investments, fostering the growth and development of start-ups in the region.

The Emerging Technology Hub is being set up at Thiruvananthapuram Technocity, covering 5 lakh square feet, and aims to make Kerala a new technology hub. Product design can be made easier by availing Super Fab Lab's services in Kochi. The lab spans 10,000 square feet at the Kalamassery Integrated Startup Complex. Apart from this, there are 23 mini-fab labs in Kerala, including the Future Lab in Kochi, for future technology experiments. Kerala Start-up Mission also provides Start-up Research Grant, Nidhi Prayas Grant, Start-up India Seed Loan, Research Innovation Challenges, and Market Support Scheme to support start-ups at various stages.

3.4.4 Accomplishments

1. Venture capital funding of Rs.5,500 crores
2. creation of 50,000 job opportunities
3. granted innovation grants and seed loans to support 778 startups,
4. Government grant of Rs.35 crores for these initiatives.

Kerala is recognized as one of the best states in India for Start-ups; the state has consistently supported grassroots efforts to accelerate innovation. The Government of Kerala launched the “Innovation Grant Scheme” to help Start-ups and entrepreneurs turn their unique ideas into full-fledged businesses. This scheme has been implemented by the Kerala Startup Mission, the State government's focal body for Startup-related activities and schemes (GoI, 2022). According to the National Report on States’ start-up ranking, Kerala has been performing outstandingly (see Box 1). Further, Kerala has been ranked first in Asia by the Start-up Genome’s Global Startup Ecosystem Report for the year 2022.

Box 1: Kerala’s Performance in Startup as per the National Report on State’s start-up ranking Source: National Report on State’s start-up ranking (2022)

Top Performers: Top Performers have shown significant growth in respective Startup ecosystems and have established initiatives to nurture the entrepreneurs of the state.

For the year **2018**, the top-performing states were Karnataka, Kerala, Odisha, and Rajasthan, while in **2019**, Karnataka and Kerala scored well on the board. In **2021**, Karnataka graduated to best performer and Kerala was joined by Maharashtra, Odisha, Telangana, and Jammu and Kashmir.



Source: National Report on State's start-up ranking (2022)

3.5 DUI Mode of Learning and Innovation

Science, Technology, and Innovation Policy (2013), released by the Government of India, acknowledged role of DUI (doing Using and Interacting) mode of innovation when it stated “while we do need to increase R&D investment and efforts, this view of innovation is based on a myopic perception that restricts it to the confines of formal R&D”. Kerala has been known for various innovation outside the formal R&D based innovation system that helped much towards development at the instance of various actors including numerous NGOs and individuals

3.5.1 Kerala Sasthra Sahithya Parishad

One of the well-known organisations that contributed broadly within the DUI mode of learning is the Kerala Sasthra Sahithya Parishad, which is the People's Science Movement of Kerala.

Founded in 1962, KSSP started its work on the science society interface with about 40 members as an organization of science writers in Malayalam. Over the past five decades it has grown into a mass movement with a membership over 50000, distributed in more than one thousand two hundred units spread all over Kerala. Started as a forum of science writers with the limited objective of publishing science literature in Malayalam, the local language, and popularizing science, it was soon realized that mere publication of literature or taking science classes was not enough, if the blessings of science were to reach the common people. It is engaged broadly in three types of activities: educative, agitate and constructive, in areas like environment, health, education, energy, literacy, micro planning and development in general. All the activities of KSSP are social and meant for changing the values and lifestyles of the people through mass mobilization. It is trying to liberate knowledge and take it to the common people at the grassroots level (Kumar 2021) Over the past five decades it has grown into a massive people's science movement, with a membership of about 50,000 drawn from all walks of life and distributed in about 1200 units within the state of Kerala.

3.5.2 Kudumbashree Mission

It is one of the organisational innovations that culminated in the formation of one of the largest women's networks in the world established in 1997, is the poverty eradication and women empowerment programme implemented by the State Poverty Eradication Mission (SPEM) of the Government of Kerala.

Various activities/ programs implemented by *Kudumbashree* mission include micro finance activities, formation of micro enterprises and marketing of its products, upgradation of micro enterprises to collectives and producer companies, activities in social development and balasabha, gender initiatives, livelihood activities in agriculture and animal husbandry, to name a few. Moreover, *Kudumbashree* is implementing the Government of India's flagship programs like PMAY, NULM, DDUGKY, NRLM, SVEP, MKSP etc

Kudumbashree has always been known for its social innovations based on DUI mode of learning. Over the years, *Kudumbashree* Mission has conceived many innovative social projects that have transformed the community and helped it to embrace the path of development. Innovations range from the Asraya project, which won the Prime Minister's Award for Public Administration, to the Kudumbashree School Project, which initiated a community education process for 43 lakh members for the first time. (For more details <https://www.kudumbashree.org/pic-topic-description/innovations?page=2>)

3.5.3 Grassroot Innovations

Table 1 presents data on grassroots innovations compiled from state-level books published by the National Innovation Foundation (NIF), and we divided them into product innovations and innovations in herbal traditional knowledge.

Table 1: Number of grassroots/traditional knowledge-based innovations across Indian States

Sl. No.	States	Product Innovations (No)	Herbal Knowledge-Practices (No)
1	Andhra Pradesh	20	12
2	Arunachal Pradesh	10	12
3	Assam	38	10
4	Bihar	12	12
5	Chhattisgarh	6	11
6	Eastern Himalayas	15	12
7	Delhi	12	6
8	Gujarat	41	12
9	Haryana	16	11
10	Himachal Pradesh	9	13
11	Jammu Kashmir	29	7
12	Jharkhand	6	12
13	Karnataka	26	10
14	Kerala	43	14
15	Madhya Pradesh	16	15
16	Maharashtra	18	12
17	Manipur	13	8
18	Meghalaya	3	10
19	Orissa	15	15
20	Punjab	15	6
21	Rajasthan	28	13
22	Sikkim	0	12
23	Tamil Nadu	33	10
24	Uttar Pradesh	28	16
25	Uttarakhand	19	12
26	West Bengal	17	12

Source: Compiled from State-level books on Grassroot innovations published by National Innovation Foundation

It is evident that Kerala has been a breeding ground for the DUI mode of learning, leading to different kinds of informal innovations, frugal innovations, grassroots innovations, and Jugaad. The state stands above other states even in terms of the absolute number of innovations.

Such grass roots innovations, like Njallani variety of cardamom developed by an ordinary farmer that won the national award, have significantly contributed to income and employment generation, reduced production cost and environmentally friendly cultural practices (See Box 2).

Box 2: Grassroots Innovation: Case of Cardamom in Kerala

Cardamom is mainly grown by small growers in the relatively backward evergreen forests of the Western Ghats region in Kerala, Karnataka, and Tamil Nadu. The yield of cardamom during the 1980s was around 70-80 kgs per ha. Though there was a growing market in oil-rich Arab countries, the cardamom sector faced heightened competition from Guatemala, with an average productivity of over 300 Kg/ha. Hence, the dream of cardamom growers was to reach a yield of 300 kg/ha, comparable to that in Guatemala. Though the research institutes developed different new varieties, none succeeded in addressing the challenge.

Thanks to a variety developed by a small farmer, today there are gardens with yields of more than 900 Kg/ha, and cardamom production in Kerala increased from about 3,000 MT during the 1980s to over 24,000 MT at present. This new variety, Njallani Gold, named after the small farmer Mr Joseph Njallani, who developed this variety, has diffused widely into the whole cardamom growing areas in Kerala, Karnataka and Tamil Nadu (Joseph and George 2010). Njallani Gold has a yield potential of over 600kgs /ha for which he received National Innovation Award from the National Innovation Foundation in 2001.

Following Njallani, other small growers developed varieties with different cardamom characteristics and received national innovation awards from NIF. These varieties include Wonder

cardamom, White flower cardamom, Panikulangara Green Gold, and PND Vaiga. Today, more than 90% of cardamom growers in India uses the cultivars evolved by the farmers.

Apart from developing new plant varieties, small farmers have also developed innovative cultural practices for plant propagation and planting. The innovations in plant propagation and cultural practices almost halved the time lag between planting and harvesting, considerably reduced the cost of cultivation, and helped reducing soil erosion.

Source: Joseph and Zhang (2019)

However, even in a state like Kerala, which is known for its decentralized development planning, in which about 25% of the plan fund is devolved to local governments, there is hardly any funding available to promote such innovations.

3.6 Kerala and the Knowledge Economy

Kerala stands at a critical juncture in its economic development trajectory, marked by a transition towards a knowledge economy through the effective harnessing of the innovation system that has evolved. The strategy is spearheaded by the Kerala Development and Strategic Innovation Council (K-DISC) and the Kerala State Council for Science, Technology, and Environment (KSCSTE) with the active involvement of all the actors in the regional innovation system. Given the limitations of the state's industrial base, there is a need to develop a new model integrating startups, sunrise industries, knowledge industries, and local governments. In this context, the new strategy involves fostering the synergies between knowledge creation, technology transfer, and market

dynamics with a view to generating new income and employment generation opportunities (Shekar and Unnikrishnan 2023)

Kerala's journey towards a knowledge economy is shaped by its resource endowments. The state's basic endowments are not conducive to a conventional investment-led growth model. Kerala's economic base is dominated by low-productivity, low-value-added units. While Kerala relies heavily on foreign remittances, the transition to a knowledge economy presents opportunities to diversify revenue streams. By channeling remittances into productive investments in innovation, entrepreneurship, and infrastructure, Kerala aims to stimulate economic growth and reduce its dependence on external inflows.

Several factors propel Kerala's transition into a knowledge economy. The state boasts a well-educated and skilled workforce, providing a solid foundation for knowledge-intensive activities. Additionally, Kerala's robust public education system and high literacy rates foster a culture conducive to learning and innovation. Moreover, the proliferation of digital technologies facilitates the dissemination of knowledge and enables participation in the global knowledge economy.

The state has thus embraced innovation as a key driver of economic growth. Innovation is also necessary to address second-generation problems in Kerala, including a high rate of educated unemployment, heightened social consciousness of environmental rights, and an ageing population, among others. The transition to a knowledge economy brings to the forefront the opportunity to address unique problems in Kerala. Challenges such as urban sprawl, social inequalities of the outliers and immigrants, and complex micro-regional issues demand integrated and innovative

solutions. Transitioning Kerala's low-value-added, low-diversification enterprise to high production, high productivity requires knowledge input. The growth story of MSMEs traced by Balagopala (2022) emphasizes this. Transforming Kerala's economic base from its current low-productivity regime to a high-productivity knowledge economy holds immense promise for driving sustainable economic growth, fostering innovation, and improving living standards.

4.0 Research and Development: National, Subnational

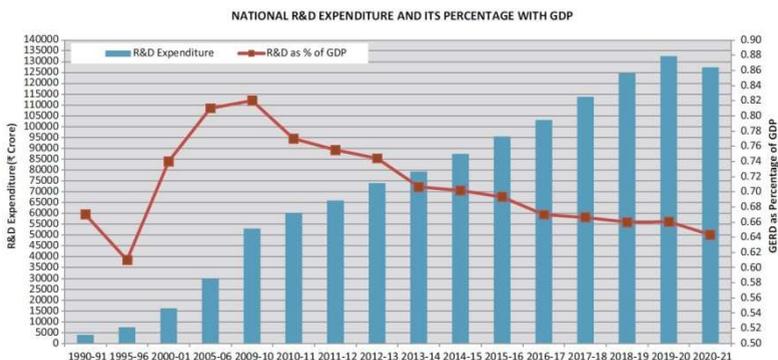
4.1 National Trends

In a World Bank study, Cirera and Maloney (2017) observed an 'Innovation Paradox' in developing countries, wherein they argued that, notwithstanding the significant return from investment in R&D, developing countries in general invest substantially less in R&D when compared to their developed country counterparts. This is especially true of India. The Department of Science and Technology, Government of India, publishes a report titled "Research and Development Statistics at a Glance" on an annual basis, which is the only authentic source of R&D in India. The report also publishes data on R&D by different actors as well as R&D by other countries.

According to the latest report for 2022-23, India's gross expenditure on R&D (GERD) at current prices increased from Rs. 60,196.75 crore in 2010-11 to Rs. 127,380.96 crore in 2020-21. But in terms of R&D intensity (R&D as a proportion of GDP), the commonly used measure of R&D performance, it is rather surprising that India has been showing a downward trend

from 2009-10 onwards. It declined from 0.82% in 2009-10 to 0.64% in 2020-21. This needs an urgent trend reversal.

Figure 1: National R&D expenditure and R&D intensity (R&D as % of GDP)



Source: Department of Science and Technology, Research and Development Statistics at a Glance 2022-23.

R&D in India is mainly driven by the Central Government (43.7%), State Governments (6.7%), Higher Education (8.8%) and Public Sector Industry (4.4%) with Private Sector Industry contributing 36.4% during 2020–21.

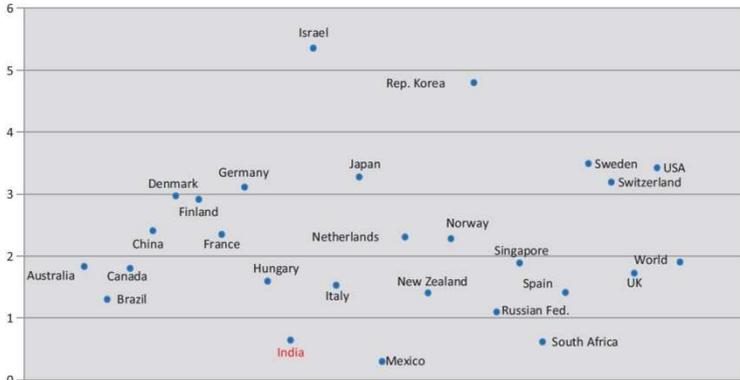
Table 2: Share of Major Actors in R&D

Central Government	43.7
Private Sector Industry	36.4
Higher Education Sector	8.8
State Sector	6.7
Public Sector Industry	4.4

Source: Same as Fig 1.

It may be instructive to compare the R&D performance on India with that of OECD and other emerging countries (See Fig 2). While India spent only about 0.64% of its GDP on R&D, the same percentage amongst other emerging countries like Brazil (1.3%), the Russian Federation (1.1%), China (2.4%), and South Africa (0.6%) is significantly higher than that of India. Most developed countries spent more than 2% of their Gross Domestic Product (GDP) on R&D. It is especially notable that, during the early 1990s, China's R&D intensity was lower than India's. But today, the R&D intensity of China is more than three times that of India (see Fig. 2)

Figure 2: R&D Expenditure as % of GDP for Selected Countries, 2020



Source: Source: Department of Science and Technology, *Research and Development Statistics at a Glance 2022-23*.

4.2 R&D in Indian States

Regrettably, reliable State-level data on R&D is not available. We use data published by the RBI. The RBI compiled this data from keyword searches of state-level budgets. The report, prepared as per the request of the Principal Scientific Advisor to the Government of India, essentially reports the allocations in the budget heads of account wherein the term ‘Research’ has been mentioned to arrive at an estimate of state-wise R&D expenditure for the period from Accounts 2018-19 to BE 2020-21 (Table 3). Needless to say, such a method has its limits. Yet in the absence of other sources of data, we consider it as a starting point for raising certain key issues for our consideration.

It is evident that the observed R&D intensity in 2018-19 across all states was only 0.2%, which is well below the R&D intensity for India (0.64), but increased to 0.3% by 2020-21 (BE), recording an annual growth rate of 14%. This suggests an increasing awareness among states to invest in R&D and innovation. At the same time,

we observe significant interstate variation in the current level of R&D intensity, indicating differential capabilities among states to engage in such activities. According to this report, Kerala's research spending as a percentage of GSDP has been consistently 0.3%.

Table 3: Expenditure on Research as percentage to Gross State Domestic Product

States	2018-19 Accounts (Rs Crore)	% to GSDP	2019-20 RE (Rs Crore)	% to GSDP	2020-21 BE (Rs Crore)	% to GSDP	Average Growth Rate
Andhra Pradesh	3303.20	0.40	1356.70	0.10	2187.00	0.20	1.1
Arunachal Pradesh	82.20	0.30	175.20	0.60	275.90	0.90	85.3
Assam	408.70	0.10	596.90	0.20	479.60	0.10	13.2
Bihar	2094.60	0.40	3382.00	0.60	3139.70	0.50	27.1
Chhattisgarh	517.90	0.20	1169.10	0.40	1087.30	0.30	59.4
Goa	244.60	0.30	374.90	0.50	580.30	0.70	54.0
Gujarat	2560.60	0.20	3160.00	0.20	3706.00	0.20	20.3
Haryana	1468.80	0.20	2061.70	0.20	2617.10	0.30	33.7
Himachal Pradesh	970.40	0.60	979.80	0.60	992.80	0.50	1.1
Jharkhand	860.90	0.30	622.70	0.20	802.20	0.20	0.6
Karnataka	3652.50	0.20	3504.80	0.20	3824.70	0.20	2.5
Kerala	2581.40	0.30	2527.70	0.30	2954.30	0.30	7.4
Madhya Pradesh	1652.60	0.20	1428.80	0.20	1503.50	0.20	-4.2
Maharashtra	3368.30	0.10	4333.70	0.20	4476.90	0.10	16.0
Manipur	32.20	0.10	272.60	0.90	207.80	0.60	361.4
Meghalaya	44.40	0.10	59.60	0.20	84.90	0.20	38.3
Mizoram	91.70	0.50	144.00	0.70	71.70	0.30	3.4
Nagaland	47.80	0.20	104.90	0.30	163.70	0.50	87.8
Odisha	1261.60	0.30	1361.70	0.30	1872.20	0.30	22.7
Punjab	709.10	0.10	772.90	0.10	1160.20	0.20	29.6
Rajasthan	293.30	0.00	310.60	0.00	342.70	0.00	8.1
Sikkim	66.80	0.20	44.50	0.10	54.80	0.10	-5.1
Tamil Nadu	2314.70	0.10	2968.50	0.20	4504.70	0.20	40.0
Telangana	911.60	0.10	801.30	0.10	938.30	0.10	2.5
Tripura	45.70	0.10	51.60	0.10	57.20	0.10	11.9

Uttar Pradesh	5087.70	0.30	7129.90	0.40	8028.30	0.40	26.4
Uttarakhand	639.80	0.30	713.90	0.30	876.40	0.30	17.2
West Bengal	2265.60	0.20	2146.70	0.20	2342.40	0.20	1.9
All States	37578.7	0.21	42556.7	0.22	49332.6	0.3	14.6

Source: Based on Reserve Bank of India (2021) Research and Development Expenditure of States and UTs,

4.3 Kerala R&D Budget

Indicative of the immense importance that Kerala provides to science technology and innovation for the development of the state, the Government of Kerala, for the first time in this country, prepared an R&D budget sequel to the Kerala budget 2023-24. The total R&D expenditure for the year 2023-24 was estimated at Rs 3482 crore, which was about 0.31% of the GSDP for the year 2024-25 (BE). This estimate is broadly in line with the RBI's estimate. The second edition of Kerala's R&D budget was prepared for the year 2024-25. The total R&D expenditure by the Government of Kerala was estimated at Rs 3678 crore, indicating a marginal decline in R&D intensity to 0.28% from 0.31% during the previous year. The distribution of expenditure across different activities is presented in Table 4.

Table 4. R&D Expenditure in Kerala 2024 – 25 (BE) (Rs lakhs)

No.	Sector	Estimates of	Share (%)
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		R&D expenditure	
1	Medical Health Family Welfare and Sanitation	87104.55	23.68
2	Education R&D	170640.35	46.39
3	Labour Research	66.12	0.02
4	Infrastructure Research	6456.37	1.76
5	Agricultural Research	54095.94	14.71
6	Industrial Research	34443.35	9.36
7	Social Security and Welfare	3583.86	0.97
8	Welfare SC/ST	984.17	0.27
9	Environmental Research	1431.64	0.39
10	Housing and Urban Development	1282	0.35
11	Others	7138.92	1.94
12	Fiscal Research	624.52	0.17
	Total	367851.79	100.00

Source: Government of Kerala (2004), Research and Development Budget 2024-25, Finance Department.

In India, there is an urgent need to make the innovation system more vibrant at the national, sub-national (regional), and sectoral levels by strengthening the institutional architecture that facilitates learning, innovation, and competence-building systems at all levels. Here, the role of States could be articulated at two levels, both interrelated. First, increased investment in R&D both by the state and private sector for the creation of scientific knowledge and to promote the creation of synthetic knowledge generated at the instance of all the actors in the innovation system. Secondly, ensuring the effective use of both scientific and synthetic knowledge to facilitate innovation-driven development.

5.0 16th Finance Commission and Innovation-driven Development

In a context where India is aspiring to be a developed economy by 2047 and given the historical evidence of the role that science, technology, and innovation played in all the past development episodes across the world at the instance of entrepreneurs, we underline the need for increased spending on R&D, innovation, and start-ups in India. This is especially because R&D intensity in India at present is only 0.64%, which compares very poorly with the emerging economies and OECD countries. More importantly, R&D intensity has been declining since 2009-10.

In achieving innovation-driven development, we envisage a greater role for the state governments. However, as already noted, the state-level R&D activity needs much improvement, given the very low level of state-level R&D intensity, which is only 0.3% of the GSDP in 2021-22 (BE). At this juncture for the aspiring India, we make the case for raising the present state-level R&D intensity to at least 0.6% of the GSDP in the terminal year of the 16th Finance Commission award, 2030-31.

Since many of the innovations in one state may be of relevance in addressing developmental issues in other states, knowledge, and innovation-driven development strategy could be construed as the most appropriate means of fostering cooperative federalism by encouraging collaboration between states. Viewed in this perspective, the allocation to states could also be performance-based, with higher allocations for projects involving horizontal collaboration (between states), in which knowledge and innovation are shared.

The key question is how to accomplish this. Apart from the distribution of the net proceeds of taxes from the union to the states, the constitutionally entrusted core function of the Finance Commission is to determine the principles that should govern grants-in-aid, assess the needs of states in relation to such norms developed and applied to both revenue effort and desirable levels of expenditure, and thereafter recommend grants in specific sums.

Given the reduced size of the divisible pool on account of the growing share of cess and surcharges, as observed by the 15th Finance Commission and scholars of eminence, it is not advisable to make any allocation from the divisible pool. A case, however, has been made for a) increasing the size of the grants in aid and b) investment in innovation (both in STI and DUI mode) as an important criterion for the distribution of grants in aid among the states to ensure that the state level R&D is raised at least to the level suggested above (0.6% of the GSDP).

Table 5: Estimates of Grants in Aid for R&D and Innovation for the States during the 16th Finance Commission Period

Year	2026-27	2027-28	2028-29	2029-30	2030-31	16 th FC Period
GDP (Rs Crores)	39767340	44141748	48997340	54387047	60369623	
Targeted R&D intensity (% of GDP)	0.4	0.43	0.47	0.5	0.6	0.48
Targeted contribution by States (% of GSDP)	0.31	0.33	0.36	0.39	0.45	0.37
Expected Grant in Aid from 16th FC (% of GDP)	0.09	0.1	0.11	0.11	0.15	
Grant in Aid from 16th FC for all the states (Rs Crore)	35790	44141	53897	59826	90554	284209

Source: Own estimates.

Our preliminary estimate of grants-in-aid for innovation and start-ups is presented in Table 5, where the following assumptions are made. First, the GSDP of states in general will grow at a rate of at least 11 percent per annum at current prices. Secondly, the R&D intensity at the state level will be gradually increased to reach 0.6% by the terminal year of the 16th Finance Commission. The state-level R&D intensity would increase by 0.03% annually, reaching about 0.45% by 2030-31. Given this scenario, the expected contribution from the Finance Commission to achieve the above level of R&D intensity would be about 0.09% of the GSDP in the initial year and 0.15% in the terminal year. The total grants-in-aid for state-level R&D from the 16th Finance Commission over the entire period is estimated at Rs 2,841 Lakh Crore.

5.1 Grants in Aid for R&D and Start-up in Kerala

We hasten to add that given the difference in the initial endowments, the states are not equally positioned to invest in innovation and entrepreneurship. Accordingly, the Finance Commission should prioritize states with higher levels of capability to maximize the initial returns from such investments. Viewed in this perspective, the R&D intensity in certain states, such as Kerala, may be set at a higher level than the all-state average.

Table 6: Estimates for Grant in Aid for R&D and Innovation for Kerala (Rs Crore)

Year	2026-27	2027-28	2028-29	2029-30	2030-31	16 th FC Period
Kerala's Expected GSDP	1630378	1809719	2008788	2229755	2475028	
Targeted R&D intensity (% of GSDP)	0.48	0.56	0.63	0.69	0.75	0.62
Targeted Contribution by Kerala (% of GSDP)	0.35	0.43	0.5	0.57	0.6	0.49
Expected Grant in Aid from 16th FC (% of GDP)	0.13	0.13	0.13	0.12	0.15	
Amount expected from 16th FC for Kerala (Rs Crore)	2119.49	2352.64	2611.43	2675.71	3712.54	13471.81
Total Expected FC grant for R&D all states	35790.6	44141.7	53897.1	59825.8	90554.4	284209.6
Share of Kerala in total R&D Grant (%)	6.0	5.4	4.9	4.5	4.1	4.70

Source: Own estimates

In arriving at the grants-in-aid for Kerala, we assume a GSDP growth rate of 12% per annum at current prices and an increase in R&D intensity to 0.75% in the terminal year of the 16th Finance Commission. Assuming also that the state's own R&D intensity will be gradually increased to 0.6% of GSDP in the terminal year, the required grants-in-aid have been estimated at 0.15% of GSDP (see Table 6). For Kerala total grants in aid for the five years is estimated at Rs 13471.8 Crore, which is about 4.8% of the total grants in aid to be given to all the states.

It is also worth noting that during the initial year, Kerala, with 4.7% of the national GDP, would account for 6.0% of the total Finance Commission support for R&D. Kerala's share is expected to decline to 4.1% in the terminal year. The implicit assumption in the above estimate is that since Kerala is shown to have a higher capability to invest in innovation and start-ups, the return on such investment would be higher in the short run. As lagging states build capability, their share would gradually increase, with a corresponding decline in Kerala's and other similarly positioned states' shares.

Although the informal sector is often acknowledged as a source of income and employment, its role in fostering grassroots innovations remains underrecognised. It appears to be the case even in Kerala, where the local self-governments receive almost 25% of the plan funds and often perceived as a model of democratic decentralisation. It is surprising that a large number of grassroots innovators who were honoured with national awards received hardly any support from local self-governments. This needs to be compared with the context in China, wherein the grassroots innovators, farmers, farmer groups, and artisans, for example, could apply for "research" support from their local

bodies. In this context, 16th Finance Commission would do well if a part of the grants in aid for the local self-governments is provided for fostering the local innovative capabilities of the people at the grassroots.

Conclusion

The paper makes a strong case for explicitly recognising innovation and knowledge creation as merit goods within India's fiscal federal framework. Given the erosion of the divisible pool due to rising cesses and surcharges, innovation financing cannot rely solely on tax devolution. In this context, grants-in-aid emerge as the most appropriate constitutional instrument for supporting innovation-driven development. The proposed framework, whereby the 16th Finance Commission supports a phased increase in state-level R&D intensity to at least 0.6% of GSDP, offers a pragmatic and fiscally responsible pathway. Further, performance-linked and collaboration-oriented grants can incentivise inter-state knowledge sharing, thereby strengthening cooperative federalism. States with demonstrated innovation capability, such as Kerala, can function as innovation hubs, generating spillovers that benefit lagging states over time.

The transition to a knowledge economy is neither automatic nor costless. It requires sustained public investment, institutional coordination, and fiscal imagination. This working paper argues that the 16th Finance Commission has a historic opportunity to redefine intergovernmental fiscal transfers by embedding innovation and start-ups at the heart of India's development strategy.

By doing so, the Commission can enable states like Kerala to consolidate their innovation gains, support capability building in lagging regions, and collectively steer India towards an innovation-driven, inclusive, and sustainable growth trajectory.

References

- Abrol, D., & Gupta, A. (2014). Understanding the diffusion modes of grassroots innovations in India: A study of Honey Bee Network supported innovators. *African Journal of Science, Technology, Innovation and Development*, 6(6), 541-552.
- Balogopal, C. (2022), *Below the Radar: The story of how modern manufacturing grew by stealth in Kerala*, DC Books Thiruvananthapuram
- Bhaduri, S., & Kumar, H. (2011). Extrinsic and intrinsic motivations to innovate: tracing the motivation of 'grassroot' innovators in India. *Mind & Society*, 10, 27-55.
- Cirera, X., & Maloney, W. F. (2017). *The innovation paradox: Developing-country capabilities and the unrealized promise of technological catch-up*. World Bank Publications.
- Fagerberg, J., & Sappasert, K. (2018). National innovation systems: the emergence of a new approach. In *Innovation, Economic Development and Policy* (pp. 305-315). Edward Elgar Publishing.

- Fressoli, M., Arond, E., Abrol, D., Smith, A., Ely, A., & Dias, R. (2014). When grassroots innovation movements encounter mainstream institutions: implications for models of inclusive innovation. *Innovation and Development*, 4(2), 277-292.
- Government of India (2013) Science technology and innovation policy 2013, Ministry of Science and Technology New Delhi.
- Government of India (2020) Science technology and innovation policy 2010, Ministry of Science and Technology New Delhi.
- Government of Kerala (2004), *Research and Development Budget 2024-25*, Finance Department.
- Joseph, K. J., & Abrol, D. (2009). Science, technology and innovation policies in India: Achievements and limits. *BRICS and development alternatives: Innovation systems and policies*, 1(101).
- Joseph, K. J., & Kakarlapudi, K. K. (2014). Innovation and development in India: Changing paradigms and trajectories. In Ashima Goyal (ed) *Handbook on Indian economy for the 21 Century*, Oxford, 793-823.
- Joseph, K. J., Kakarlapudi, K. K., & Joseph, A. (2020). Deindustrialization and innovation under globalization: An Analysis of India's catch up in manufacturing. *Nova Economia*, 30(spe), 1199-1224.
- Joseph, K. J., Kakarlapudi, K. K., & Arun, T. (2021). Reconciling higher productivity with innovation paradox: mode of

- learning and innovation in India's manufacturing sector. *Innovation and Development*, 11(2-3), 323-342.
- Kumar, H., & Bhaduri, S. (2014). Jugaad to grassroot innovations: Understanding the landscape of the informal sector innovations in India. *African Journal of Science, Technology, Innovation and Development*, 6(1), 13-22.
- Lundvall, B. Å., Joseph, K. J., Chaminade, C., & Vang, J. (Eds.). (2009). *Handbook of innovation systems and developing countries: building domestic capabilities in a global setting*. Edward Elgar Publishing.
- Krishnan, R. T. (2010). *From Jugaad to systematic innovation: The Challenge for India*, The Utpreraka Foundation, Bangalore.
- Reserve Bank of India (2021) Research and Development Expenditure of States and UTs, RBI Mumbai.*
- Shekar, K. C., & Joseph, K. J. (2022). Determinants of innovation and interactive learning in informal manufacturing enterprises in India. *Science and Public Policy*, 49(3), 427-440.
- Shekar, K. C. & Unnikrishnan P V (2023) Building a holistic innovation ecosystem: the role of Kerala Development and Innovation Strategic Council (K-DISC), *Economic and Political Weekly*, 58 (49).