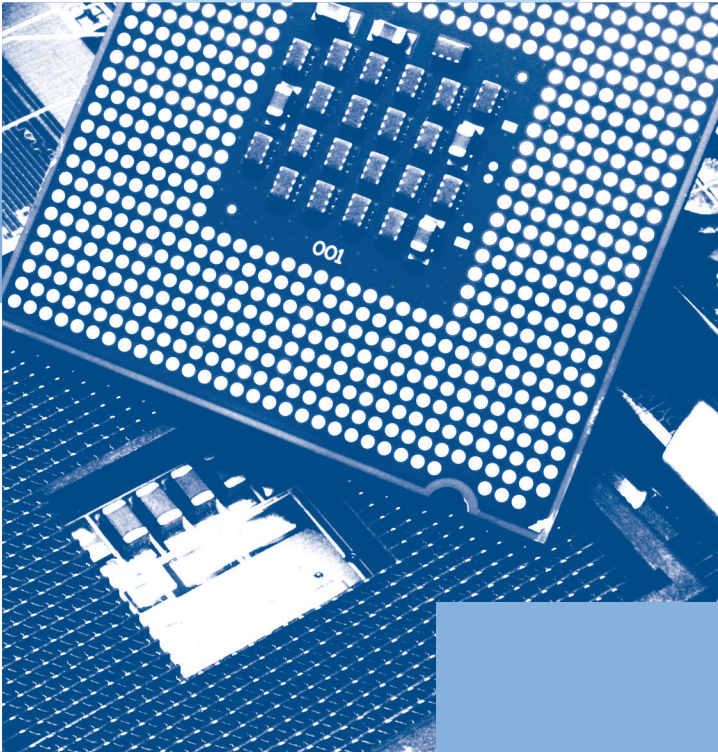




Deeptech in India: What can the State do?

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■ Introduction

Deeptech startups are ushering in a wave of innovation across the globe, ranging from fantastical flying cars to an increase in lifesaving drugs and medical technologies (Boston Consulting Group & Hello Tomorrow, 2021). Innovation from these deeptech startups is characterised by its roots in science and technology. According to the International Finance Corporation, “Deep tech is a term for technologies that are based on scientific or engineering breakthroughs and have the potential to be commercialized.” Deeptech includes a combination of insights from multiple disciplines such as biology and AI, nanotechnology and manufacturing, robotics and material sciences (Eastwood, 2023).

The strategic essence of deeptech lies in its ability to act as a catalyst that can accelerate the advancement of existing and other emerging technologies and lead to transformative solutions (Ye, 2023). For example, the advancement of digital twins has not only led to improvements in existing technologies like electric vehicles (Centre for Technology, Innovation and Economic Research, 2025) but has also contributed to the advancement of AI models by providing a wealth of training data (Cosmas et al., 2024). Similarly, the advancements in AI models are driving research around new materials for batteries, new pharmaceutical compounds (Centre for Technology, Innovation and Economic Research, 2025) and new methods for climate monitoring (Masterson, 2024).

The US and China are the largest startup ecosystems globally. Both countries have been deliberate in their approach to long term deployment of public funds for achieving technology leadership. Most deeptech startups receive funding from the state in the form of grants, subsidies, prizes or incubator support in higher education institutes, which are usually state supported. Steadfast government support and deeptech success stories have begun to attract private sector interest.

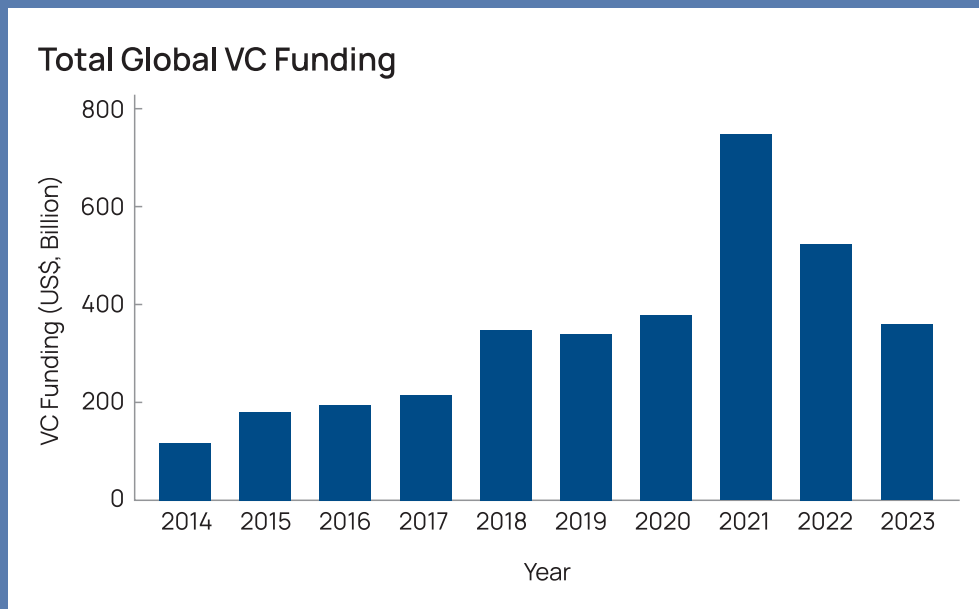
Global Investor Interest in Deeptech Startups

Deeptech accounts for around 20% of all global Venture Capital (VC) funding (Boston Consulting Group, 2023). Irrespective of the ups and downs in global VC funding, the share of deeptech investing has remained constant worldwide and is likely to increase as investor appetite grows.

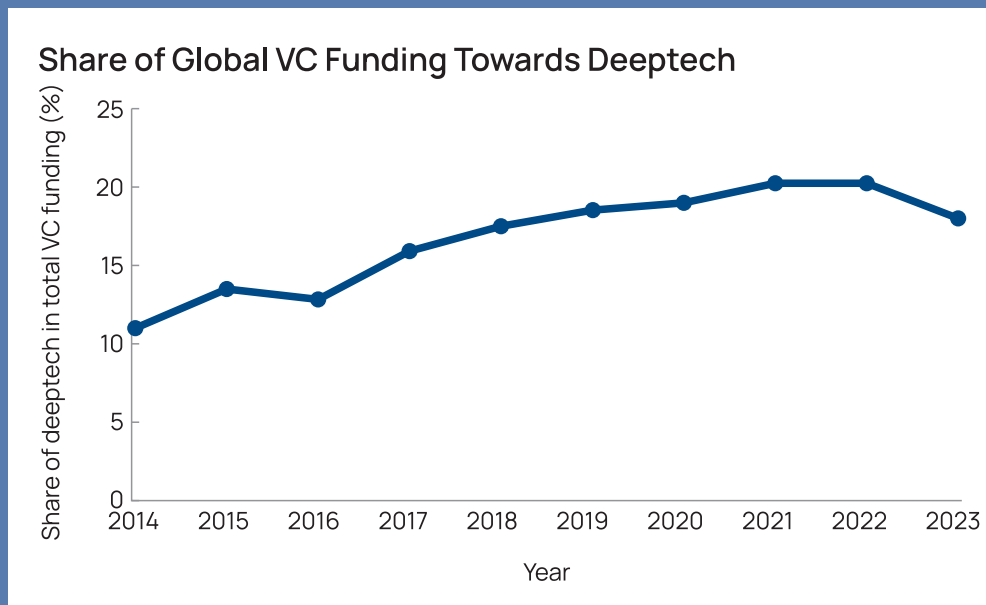
Deeptech seems to attract investor interest because of its latent market potential. Many deeptech startups are often developing technologies that are not yet mainstream but have transformative potential, thus likely to yield high returns for investors. Take the case of Impossible Foods. This deeptech startup was founded with the aim of creating plant based meat alternatives that would replicate the flavour, texture and even the cooking process of meat products. The startup achieved this through advances in food sciences and biotechnology. This has resulted in an estimated valuation of around USD 4 billion (Reuters, 2021). Impossible Foods was identified as a 'Technology Pioneer' by the World Economic Forum in 2016 (World Economic Forum, 2016) and ranked fifth in the XB100 list of the top 100 deeptech firms in the world (Bessemer Venture Partners & XPRIZE, 2023).

Investor interest in deeptech tends to tilt towards software or biotechnology applications, owing to cheaper technology development costs and faster turnaround times in these sectors. Unproven technology and unknown or unclear potential commercial applications makes deeptech startups in sectors like material sciences, photonics, battery technologies and quantum computing, unattractive investments for most VCs (Arora, Fosfuri & Rønde, 2024).

Figure 1: Share of Deeptech Funding has Remained Constant Despite Downturns in Total VC Funding



Source: KMPG Venture Pulse Q2 report (various years)



Source: Boston Consulting Group. (2023), "An investor's guide to deep tech"

There are lessons for Indian policymakers in how the American and Chinese deeptech ecosystems have evolved. Both countries have largely followed a model of supporting deeptech startups through Public Procurement of Innovation (PPI), grants and incubator support to early stage startups and private sector investments for later stage startups leading to commercialisation. Any efforts to simply imitate these policies without localising to the Indian context is likely to fail as the Indian research ecosystem is vastly different from those in the US and China, being heavily dominated by autonomous labs that have poor linkages with higher education institutions and industry. In this brief, we look at the deeptech ecosystem in India, highlighting four strategic levers in the policy space and their implementation pathways that can catalyse the ongoing transformation of the deeptech ecosystem.

■ **The Deeptech Ecosystem in India**

The government has shown significant commitment to furthering India's technology ambitions. Efforts include initiatives such as the Atal Innovation Mission, which was recently extended till 2028 with an allocation of INR 2,750 crores (USD 325 million), the National Quantum Mission with an allocation of INR 6,003 crores (USD 725 million), the India Semiconductor Mission with an outlay of INR 76,000 crores (USD 10,200 million) and the recently operationalised Anusandhan National Research Foundation which aims to receive INR 50,000 crores (USD 5,915 million) in the 5 year period of 2023 - 2028.

The Government of India has signalled that deeptech startups are crucial to transitioning to a knowledge-based economy (Office of the Principal Scientific Adviser to the Government of India, 2023). The recent cabinet approval of the Research, Development, and Innovation Scheme, with an outlay of INR 1,00,000 crores (USD 11,560 million) over six years, to bolster private sector R&D efforts and create a 'Deep-Tech Fund of Funds' is an interesting move in this direction (Press Information Bureau, 2025). While these efforts are welcome and significant in the Indian policy space, it is important to remain cognisant that we have a long way to go to not just catch up but surpass American and Chinese efforts (Holla, 2025).

Private sector funding in the Indian startup ecosystem is largely directed towards startups in e-commerce, alternative lending, retail

chains and enterprise software (Centre for Technology, Innovation and Economic Research, 2025). Recent estimates put funding towards deeptech startups to be between 9 - 12 per cent of total VC funding (The Economist, 2025), much lower than the global average of 20 per cent. Despite this, there is policy optimism on the eventual maturing and transformation of the deeptech ecosystem. There have been some notable deeptech startups to come out of India. Success stories include Agnikul Cosmos, which has developed single piece 3D printed rocket engines and has raised USD 42 million (Jacob, 2024) and Aether Energy, which has developed in house battery packs for its electric two wheelers and has completed its IPO with a market capitalization of USD 1.8 billion.

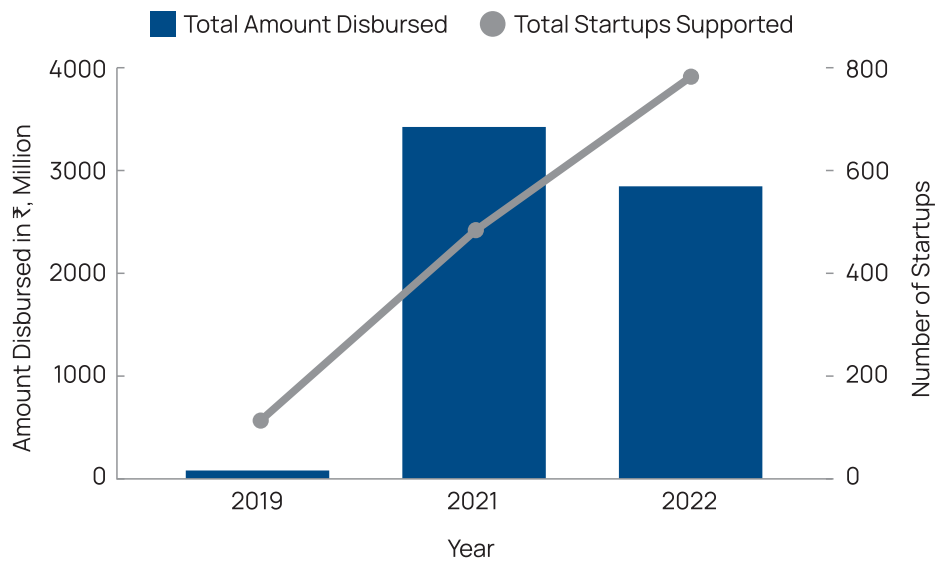
These early successes have occurred despite the challenges in the Indian deeptech ecosystem. The central government has put in place policies like the National Quantum Mission or the India Semiconductor Mission to remove some of these hurdles, but such efforts remain limited to specific sectors. To catalyse the growth of India's deeptech ecosystem, policymakers need to adopt an ecosystem lens rather than pick sectoral winners. The levers of change presented below provide policymakers with the pathways for ecosystem-wide growth and realise India's ambition of transitioning to a knowledge-based economy.

■ Deepen Public Procurement of Innovation

PPI is a demand side policy instrument which can be consequential for India's deeptech ecosystem. Public procurement can act as a first market for deep tech innovations and induce large positive multiplier effects. The government as a buyer can reduce risks associated with new and unproven technologies, create new markets and incentivise R&D investments across the ecosystem (Chiappinelli, Giuffrida & Spagnolo, 2025).

Data on the full extent of PPI is not publicly available in India. We used procurement data submitted by states as a part of the States Startup Ranking as a proxy to gauge state procurement interest in startups. While this data is not specific to deeptech, one may assume that at least part of the startups being commissioned work are deeptech startups. Other modes for PPI such as contracts or awards through union departments or through specific competitions are not included in this analysis.

Figure 2: Procurement from Startups Across States (2019, 2021, 2022)



Source: State Startups Ranking (various years)

Note: Data for 2020 is not available

A total of 1,380 startups received work orders from state governments across 2019, 2021 and 2022 or around 2 per cent of the startups created across the three years. The total amount disbursed to these startups was INR 6,259.9 million (USD 82 million) with the average amount of the work order being INR 4.5 million (USD 59,710). It is likely that some of these numbers may be underreported or overreported as there is no institutional obligation to record this data.

The use of pilot projects as work orders has become a common way for state governments to engage with startups. The Maharashtra Startup Week Programme is an interesting example of the state procuring innovation. Under the programme, startups across the country are invited to apply and help solve problems in the state across 8 select sectors. The startups are expected to have a minimum viable product and demonstrable proof of concept. After several rounds of evaluation, 24 startups are selected and granted work orders by different departments of the Government of Maharashtra based on their requirements. Our evaluation of the programme found that the low value of contracts and absence of any pathway to bigger contracts is a deterrent for startups in general (Joshi et al., 2020). The use of pilots allows governments to procure innovation from startups at a small scale without contravening the General Financial Rules (GFR).

A major challenge in fully using the PPI instrument as a powerful catalyst for the deeptech ecosystem is the current set of GFR. GFR does not recognise PPI as a separate independent section. Rules like lowest value and other restrictive bidding practices (which are important for other government procurement) are applied indiscriminately for innovation as well. Under the current clauses, there are no distinctions between product procurement and functional procurement.

In case of deeptech startups, especially defence and aerospace startups, the situation is more complicated. Issues of PPI and IP ownership go hand in hand. Governments will often introduce restrictive clauses in procurement contracts that claim part or full ownership over the IP generated by the startup or prevent the startup from seeking business from other government or private entities. This is antithetical to the role of government as a market creator and has an unfortunate side effect of making deeptech startups even more unattractive for investors.

■ Hone Capability and Choicemaking

Apart from PPI, other commonly deployed policy instruments are state investments in deeptech through grants and subsidies. The pivotal role that the US government played in funding technologies that are commonplace today through grant programs like SBIR is well known. In India, entities like the Biotechnology Industry Research Assistance Council (BIRAC) have had limited success in supporting deeptech startups (Biotechnology Industry Research Assistance Council, 2017).

A key differentiator for the success of such programmes is the technical capability and choicemaking ability of decision makers. The ability to choose potential technologies or startups for government support has to be finely honed not only through developing a deep understanding of the technology but also having a firm grasp on startup's market capabilities and existing market conditions. It requires an understanding that financing deeptech innovation is different from traditional startup financing. The timeframes and risks associated with technology development are longer than typical startups (Nedayvoda et al., 2021).

Decision makers, especially in grant making situations, are often pressed for time and do not have a complete technical and regulatory

understanding required to make an informed decision on supporting deeptech or breakthrough technologies. The decision makers should be in a position to call upon experts and in-house knowledge work to aid their decision making.

Technology monitoring and critical insights on emerging trends are indispensable to growing a deeptech ecosystem. It is concerning that the draft Deeptech policy fails to address this (Office of the Principal Scientific Adviser to the Government of India, 2023). It is imperative to direct at least some resources within the policy sphere to hone in-house capabilities and choice making abilities to support long term structural support for the deeptech ecosystem. It may be worthwhile to revisit the mandates of institutions like TIFAC that were established to 'assess the state-of-art of technology and set directions for future technological development in India in important socio-economic sectors.'

Occasional knowledge sessions on emerging trends and technologies can be conducted for a wider group of policymakers from scientific agencies and states through ongoing efforts at the Capacity Building Commission.

■ **Lower Systemic Barriers for Technology Development**

Ideas for technology development can occur in any part of the country. The translation of ideas to products requires democratised access to public infrastructure for R&D. A study of defence startups in India pointed to how a lot of talent is coming from tier 2 and tier 3 cities citing a potential opportunity to nurture talent in academic institutions that do not feature in the top NIRF or INI lists (Joshi, Atrawalkar & Nabar, 2023). The lack of access to lab equipment, testing facilities, domain experts and reliable data often results in siloed technology development in some pockets of the country.

The cost of developing technology has dropped considerably over the past decade. The availability of data, reduced equipment costs and improved infrastructure have contributed to this. There are ongoing efforts on improving digital public infrastructure (DPI) which has led to some successes like the United Payment Interface (UPI)

(Press Information Bureau, 2024). India needs to develop its compute capacity. Our public infrastructure for R&D remains underdeveloped and underutilised.

There are lessons for India in how China has competed with the US on AI (and other digital technologies) through long term structural investments in infrastructure and opening up borders to attract expertise from around the world.

■ **Make University Incubators Count**

Deeptech startups often come out of the university system, with local deeptech ecosystems anchored around specific universities (Jack, 2024). There exist numerous global examples of university incubators being enablers of success for deeptech startups like The Engine situated within MIT or the Princeton Innovation Center BioLabs. India too is mimicking this model, with academic institutions hosting nearly two thirds of the nation's incubators (Centre for Technology, Innovation and Economic Research, 2025). However, to truly make Indian university incubators perform on par with their global counterparts some structural concerns must be addressed.

India stands out globally, with government funded research predominantly conducted in autonomous labs rather than universities. This has resulted in most Indian academic institutions not having the funds for purchasing cutting edge equipment or attracting talented researchers. The lack of equipment and researchers has led to university incubators not being able to provide the kinds of support needed by deeptech startups like research mentorship or specialised facilities.

Strengthening the link between universities and autonomous labs can enable incubators to better support deeptech startups. This can be achieved through faculty mobility programs or the integration of autonomous labs within the university ecosystem. It will also have a multiplier effect, enabling a greater flow of research ideas and funding into universities, leading to more students and faculty undertaking cutting-edge research that can translate into deeptech spinouts.

■ Conclusion

The success of homegrown deeptech startups like Agnikul and Aether are a testament to India's technology prowess. The Indian deeptech ecosystem has gained momentum due to a combination of efforts from the government, the private sector and academic institutions. As the Indian deeptech ecosystem matures, it is important to recognise and address structural and systemic hurdles likely to jeopardise this momentum.

This would require a concerted effort around improving the capacity and capability of the state apparatus. Effective implementation of policy instruments like PPI is dependent on the quantity, quality and even distribution of officials. PPI cannot occur only at the union government level but must be distributed across state and district administrations. Building distributed capability across the nation will allow the best ideas to be identified and supported regardless of their place of origin and lead to an administration better equipped to catalyse and regulate the deeptech ecosystem.

The Indian deeptech ecosystem is at an inflection point. The policy side levers of change presented in this brief will enable the upward trajectory of the ecosystem. Policymakers should consider that the implementation of the reform efforts mentioned should be directed at improving the deeptech ecosystem in India rather than a certain technology of interest. There is an inherent risk of stunted growth in picking and choosing technologies due to the accelerated pace of technological change. The interests of the nation are better served in developing a thriving ecosystem of deeptech startups that will develop the technologies of the future.

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