

Can Asia come up with the next big thing in deep tech?

It has been a year since ChatGPT swept the world. Asia is now well-positioned to not just be a consumer of such technological breakthroughs, but a provider as well.

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What do high-penetration facial creams, stain-repellent T-shirts, self-cleaning kitchen counters and fast-acting chemotherapy drugs have in common? Deep tech and, to be precise, nanotechnology.

Although pedestrianised today by the widespread use of nanoparticles in commercial products, nanotechnology entered mainstream consciousness only in the early 2000s. It was by no means a new kid on the block but traces its roots to ancient civilisations that experimented with microparticles.

Key inventions and discoveries then triggered the rapid spread of nanotechnology in the last two decades. These include the invention of the scanning tunnelling microscope in 1981 that allowed for imaging surfaces at the atomic level. So pivotal was this innovation that it won its inventors Gerd Binnig and Heinrich Rohrer at IBM Zurich research laboratory the Nobel Prize in Physics in 1986.

The discovery of strong and lightweight carbon structures with unique electrical and optical properties – fullerenes in 1985

and carbon nanotubes in 1991 – enabled the creation of new materials and devices by manipulating matter at the atomic and molecular level.

These advances paved the way for new tools and techniques for nanotechnology research and development, making it one of the fastest-growing fields of science and engineering and a poster child for deep tech success.

The term “deep tech” has been increasingly banded about, simultaneously evoking awe and bewilderment. Awe because recent innovations have cultivated hopes of technology offering potent solutions to critical challenges such as environmental degradation and terminal illness. Yet also bewilderment, because technology is often seen as abstract, obtuse and potentially disruptive to our lives and value systems.

The term “deep tech” can thus fire the imagination while being riddled with contradictions and uncertainty. However, our experience with nanotechnology shows that we have actually been living with deep tech innovations and even taken them for granted, with deep tech hidden in plain sight.

The explosive emergence of generative artificial intelligence

(AI), best exemplified by ChatGPT, has similarly heightened our exposure to deep tech. No longer the preserve of university professors or industry scientists, everyone who uses a smartphone today is interacting with natural language processing across a multitude of apps and platforms that leverage the capabilities of large language models.

IT TAKES AN ECOSYSTEM

ChatGPT is nearing its first anniversary – it was officially launched on Nov 30, 2022 – so this is as good a time as any to ask whether we in Asia, who enjoy the fruits of deep tech, can become its producers instead. In other words, how primed is Asia to be a trailblazer in deep tech?

Further probing of the trajectories of nanotechnology and generative AI will reveal that deep tech innovations bear certain key traits. Grounded in cutting-edge scientific advancements and breakthrough technologies, deep tech innovations can potentially revolutionise entire industries and sectors, enhance productivity, and supercharge economic growth.

But deep tech is no trivial undertaking. Developing it

requires talent, investment, state support and a pro-innovation climate replete with incubation programmes for start-ups.

Successful deep tech incubation requires a convergence of factors, spanning research and development (R&D) to investment to regulatory frameworks that encourage experimentation. This is something that Asia – and Singapore – have already realised.

As Deputy Prime Minister Heng Swee Keat said at his recent opening speech at the Singapore Week of Innovation and Technology (Switch) organised by Enterprise Singapore: “This means building an ecosystem that allows innovative start-ups, big corporates, venture capital and government agencies, to tap each other’s complementary strengths and accelerate the path to achieving breakthroughs.”

Indeed, deep tech thrives in an environment where research institutions, universities and industries collaborate well, and seamlessly. Asia boasts several world-class research institutions, such as Singapore’s Agency for Science, Technology and Research (A*Star) and Japan’s Riken.

However, bridging the gap between research and commercialisation remains a challenge. Encouraging interdisciplinary collaboration and promoting partnerships between academia and industry are crucial steps, with universities serving as vital conduits through start-up incubation.

The Singapore Management University’s recently concluded Lee Kuan Yew Global Business Plan Competition, with its focus on technopreneurship, is a useful case in point. Arguably the largest university start-up competition in the world, the 2023 edition attracted a record high of more than 1,000 entries from leading universities hailing from 77 countries.

The top 53 shortlisted start-ups, of which 72 per cent were from Asean, Singapore and China, offered mostly deep tech innovations in areas such as

health, climate technology, computation and built environment.

The competition brought together venture capitalists, experienced founders, corporate partners and policymakers in the innovation ecosystem to advise and mentor the start-ups. They were connected to leading industry players such as Xora Innovation and Wavemaker, as well as key national agencies such as Enterprise Singapore, SG Innovate and National Research Foundation. Hailing from Sweden, the winning start-up Plastic-Fri, which transforms agricultural waste into sustainable packaging, was keen to expand to Asia through Singapore and was introduced to supermarket chain FairPrice for exploratory discussions.

But connections, while a necessary first step, are not sufficient. To foster deep tech innovation, substantial investment in research is imperative.

In this regard, Asia has made notable strides. China, for instance, has significantly increased its R&D spending over the years, while countries such as South Korea and Japan have longstanding traditions of innovation-driven economies. Governments must not just provide patient capital for research, but also create incentives for private investment in deep tech ventures.

ROLE OF INVESTORS

In Western countries, investors seem more willing to commit money to research projects that are simply scientifically interesting, even if the promise of monetary returns is faint or distant. In Asia, it has been observed that venture capitalists and angel investors are more cautious and iterative in their approach. A process of education is therefore vital, and drawing them into university incubation programmes is an excellent way for these investors to apprise themselves of frontier technologies and their transformative potential.

The Creative Destruction Lab (CDL) programme, founded in the University of Toronto in 2012 by Rotman School of Management professor Ajay Agrawal, is exemplary in this regard. He founded this not-for-profit university incubation programme targeted at start-ups “with a great technology and a terrible business plan”. He brought on board exited entrepreneurs, successful operators, angel investors and venture capitalists as mentors for commercial strategies, renowned scientists to provide technical feedback on the innovations, and notable academics to offer insights on the economic impact of new technology.

Mentored by this confluence of expert stakeholders, many of the CDL start-ups have been able to successfully commercialise their technology, raising an estimated \$24 billion Canadian dollars (\$\$23.5 billion) in investments. The programme has since expanded across business schools in leading universities in North America, Europe and most recently in Australia. Asia could certainly benefit from a deep tech incubation programme of this nature to plug it firmly within this global deep tech community.

Regulators, too, can play a role in either stifling or nurturing deep tech endeavours. Striking the right balance between safety, ethics, and innovation is a delicate task. Asia has demonstrated agility in adapting regulations for emerging technologies, as seen in Singapore’s AI Verify initiative for AI innovations. However, harmonising regulations across countries to facilitate cross-border collaboration is an ongoing challenge.

Advancing deep tech also requires a deep talent pool. While Asia boasts a large reservoir of Stem (science, technology, engineering, and mathematics) graduates, they will need opportunities to enhance their skills, commercialise their offerings and tap global networks.

Public-private collaboration is also invaluable. Governments and industries must collaborate to

Even if the game-changing deep tech innovations of the past 50 years, including the Internet, smartphone communication, blockchain and mRNA vaccines, were developed in the West, there remains a compelling possibility that Asia could birth the next big thing in tech. The region’s strong focus on academic achievement and infrastructure development, coupled with strong state support, places it in a favourable position for deep tech innovation, especially in priority areas such as AI, urban mobility, food security and disaster management.

foster an enabling environment for deep tech start-ups. This includes offering grants, tax incentives, and regulatory sandboxes that allow experimentation while ensuring safety and ethical alignment.

At the same time, establishing strong ties with global innovation hubs will catalyse knowledge exchange and collaboration. Events such as Switch gathers key players from across the Global-Asia innovation ecosystem for knowledge exchange and networking.

ASIA’S PATENT ADVANTAGE

Critics assert that the recent generative AI wave has seen the United States leave China in the dust, with the West winning the race. But it would be premature to jump to such conclusions.

The current state of play can be better discerned by intellectual property filing indicators. Data

from the World Intellectual Property Organisation shows that in 2022, China, the US, Japan, South Korea and Germany led in patent filings. Despite China maintaining its position as the top contributor, there was a decrease in its growth rate for the second consecutive year, dropping from 6.8 per cent in 2021 to 3.1 per cent in 2022.

In contrast, India saw a remarkable increase of 31.6 per cent in patent applications, marking an 11-year continuous growth trend unmatched by any other top 10 filer. Reflecting a consistent pattern, the majority of intellectual property filing activities are now concentrated in Asia, which accounted for 67.9 per cent, 67.8 per cent, and 70.3 per cent of global patent, trademarks, and industrial designs filings in 2022, respectively.

Hence, even if the game-changing deep tech innovations of the past 50 years, including the Internet, smartphone communication, blockchain and mRNA vaccines, were developed in the West, there remains a compelling possibility that Asia could birth the next big thing in tech.

The region’s strong focus on academic achievement and infrastructure development, coupled with strong state support, places it in a favourable position for deep tech innovation, especially in priority areas such as AI, urban mobility, food security and disaster management.

Governments should articulate clear road maps and critical challenges for deep tech development, backed by sustained R&D funding and pro-innovation policies. With such measures in place, Asia can yet throw up the next deep tech invention that will be as commonplace as nanotechnology or generative AI.

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