Deeptech: Time to find a common definition to build capabilities

Deeptech is foundational to the strategic needs of a country

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“Deeptech” is a word we encounter with increasing frequency in public discourse. Yet, there is no single widely accepted definition of deeptech.

A coherent single definition is important since it is the starting point for formulating strategies to build capabilities in deeptech and translate these capabilities into products and solutions that make lives better.

One of us did a dipstick survey among college-educated Indian professionals working in diverse industries on:

What is deeptech?

Give an example of deeptech.

The responses were an eye-opener.

Deeptech for most meant startups working on innovative products using AI, space-tech, and biotech. Deeptech also meant products from these companies. Tesla, SpaceX, DeepMind, and BioNTech dominated the list of companies. Tesla’s car, Pfizer BioNTech mRNA Covid-19 vaccine, and SpaceX’s reusable rockets dominated the products mentioned.

While all of them said they have read about Indian deeptech startups, none were able to name an Indian deeptech startup or product. A couple of them mentioned ISRO and Mangalyaan!

These narrow and differing perceptions of deeptech made us dive deeper to attempt to define deeptech. As the name suggests, deeptech is primarily technology. One interesting interpretation of deeptech from researchers in ESADE and IESE Business Schools in Spain identifies five dimensions.

First, it is fundamental and is based on new significant scientific and technological advances. Second, it is complex and often at the intersection of multiple scientific and technological domains. Third, it needs time before it matures into a stable technological domain. Fourth, it is the foundational building block that leads to many different applications. Fifth, it can have a profound impact on humankind in the medium to long term.

We would like to propose a working definition based on what we have learned so far: Deeptech is a unique combination of emerging technologies that are complex, multidisciplinary and need time to mature.

Deeptech is foundational to the strategic needs of a country. It is the source of future applications in different sectors that have the potential for significant impact.

The Internet is a good example of something that is mainstream technology today but was deeptech when it was initially nurtured. Unpacking this example helps understand the definition proposed above.

Three needs of the USA in the 1960s converged to give rise to the Internet. First, the Cold War inspired the requirement for an efficient, fault tolerant, always-on military communication network.

Second, computing was increasingly becoming a must-have tool in science and technology research in universities. Allowing another university to access the unused computing resources of a university was efficient.

Third, influential US science administrators had an inspiration to have a giant modern-day Alexandria library with information accessible to all of the world’s citizens.

The Advanced Research Projects Agency (ARPA) started the Intergalactic Computer Network project publicly called ARPANET in 1963. Since connecting computers spread across cities

and towns in the USA was never attempted before, the project first had to identify the structure of the network.

The distributed structure was chosen since if one or more of the computers in the network was down, the network had to still function. A new framework to send information across this distributed network was developed and it was called packet switching.

Instead of modifying the computers in these universities to connect them to the network, the team decided to use a small computer in each of these locations to act as the packet switching interface between participating computers and the ARPANET. The first connection between two computers was successfully made in 1969. Soon many more computers were connected to the ARPANET using the same technology framework.

Soon, users had other needs. They not only wanted to access the computers but also wanted to send messages and files to other users on ARPANET. This was the genesis of email and the file transfer protocol (FTP) in the early 1970s. ARPANET was the backbone of the Internet which soon expanded to other US universities, later to other countries and became the Internet by the early 1990s.

The world wide web – the now ubiquitous www - was developed on the Internet. This became the foundation for the Internet-based industry that has among the world's most valuable companies.

A couple of observations emerge. First, deeptech is often a response to the strategic needs of a country. Many a time these needs may be common to many countries.

For example, the requirement of rapid and dramatic reduction of carbon dioxide emissions is a common need for the world including India that can set an agenda for deeptech today. This also provides an opportunity for India to collaborate with other countries to develop deeptech.

Second, it helps to be faithful to a rigorous definition in identifying deeptech. What we see in the mainstream Indian discussions of deeptech are mostly copycat applications of digital technologies like AI/ML, IoT, blockchain, 3D printing, robotics etc. We need to introspect on whether we need to be more careful on what we identify as deeptech.

Indian R&D and innovation will benefit if we push the boundaries to nurture real deeptech rather than be content with rebranding existing technologies as deeptech.

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