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中国如何成为科技教育强国?

How to Make China an S&T Education Powerhouse?

Translated by Saranya

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This translation is the fifth part of a series where articles on Artificial Intelligence in China shall be translated from Chinese to English. This limited series on AI is translated by Saranya. The first issue on AI in China, *ICS Translations I*ssue No. 47, can be accessed here; the second issue, *ICS Translations* Issue No. 50, can be accessed here; the third issue, *ICS Translations* Issue No. 52 can be accessed here; and the fourth issue can be accessed here.

Summary:

This article has been written by Zheng Zhigang, a professor of finance at Renmin University of China. He puts forth suggestions to make China a leader in science and technology. He advocates that in terms of research motivation, China should move away from the inertial mindset of catch-up and pursue research and development based on market needs. In terms of talent development, he emphasises nurturing individual talents and their unique abilities, instead of focusing solely on a team-based approach.

Recipients of the Two Bombs and One Satellite Meritorious Award.
Source: finance.sina.com

Translation:

In early September, I had the privilege of attending a two-week seminar themed on revitalising science and technology (S&T) education. Most of the participants were scholars hailing from engineering backgrounds, with very few scholars coming from the humanities and social sciences. Notwithstanding the wide spectrum of academic backgrounds, one common theme that piqued everyone’s interest was how to turn China into an S&T education powerhouse (in the near term). This undoubtedly drew every scholar with a sense of social responsibility and national pride to the seminar. Some of the invited scholars shared fascinating insights based on their research and educational experiences, as well as detailed observations of outstanding teams around them. The discussions covered a wide range of elites from the S&T world, including the late Deng Jiaxian and Yu Min – the distinguished scientists behind China’s “Two Bombs, One Satellite” programme – Wang Xuan, the inventor of the Chinese character input method and the founder of Peking University Founder Group, and Zhou Guangzhao, who passed away recently. The discussions also featured the academicians currently active in frontier research, as well as young scientists involved in major national S&T projects. Notably, the way that eminent scientists such as Deng Jiaxian and Yu Min created technological brilliance under such difficult circumstances during their time through tenacity in their research and collaborative teamwork, left a profound impression on all participants.

Of course, reviewing the past is aimed at envisioning a better future. As the discussions progressed, the issue of positioning China as a future leader in S&T education emerged as the primary concern among the participants. So, how can we make China an S&T education powerhouse?

First, we need to move beyond technological catch-up to frontier research.

During Deng Jiaxian's era, our scientists had to work as a team, overcome obstacles, and rapidly achieve something from nothing amid a complex global situation. The sole objective was to achieve a mutual balance in strategic choices with other major powers. At the time, the research goals were fairly clear: we should have what others had. Perhaps, this scientific research paradigm can be summed up as "catch-up research".

Adopting a combative strategy through large-scale operations was certainly the appropriate approach for catch-up research because the research goals were clear and precise. Especially after the founding of the People's Republic of China and experiencing the Liberation War and the Korean War, we could seamlessly replicate the experience of organising military operations in catch-up research. While the objectives of catch-up research were clear, the social and cultural environment at the time made it easy for people to accept and adapt to this large-scale team-based research and development (R&D) model. Therefore, the remarkable scientific achievements of Deng Jiaxian's era cannot solely be attributed to the tireless efforts of scientists of that era. They were also a by-product of that era itself. The purpose of emphasising this point is to highlight the historical uniqueness of that era which cannot be replicated.

However, research goals today have become ambiguous, making it difficult for anyone to predict the next technological breakthrough. Remember how Bill Gates was initially not optimistic about the Internet, and Jack Ma and Pony Ma were similarly sceptical about cloud computing, yet these technologies became popular worldwide at an unprecedented pace, driving human society into a new era.

It is important to note that the R&D institutions developing the products and services, which are now leading the tech wave, are independent research institutions organised as profit-driven enterprises.

Even though they and others sometimes refer to them as "teams", these teams are fundamentally different from the national team led by Deng Jiaxian back in the day. With the support of market capital, OpenAI used a non-profit vision and an effective organisational structure to launch the new generation of artificial intelligence (AI), ChatGPT, in just seven years, without any financial backing from the United States (US) government. During these years, like most commercial organisations, OpenAI also experienced governance crises, such as founders being threatened with dismissal and frequent reports of core researchers leaving or switching jobs. OpenAI nonetheless remained the leader in AI development.

In contrast to the catch-up research of Deng Jiaxian's time, contemporary research lays more emphasis on innovation. There are a few key differences between the two. Firstly, the former served national strategic objectives while the latter focuses on corporate profit maximisation. Secondly, the former had clearly defined research goals, while the latter's objectives are more ambiguous. Thirdly, the former was mainly funded by the state while the latter mostly relies on corporate funding raised through projects. Finally, the former was primarily organised through state institutions while the latter operates through private institutions.

Second, we need to change the approach towards talent development from team-based to individualised.

When it comes to scientific research, nurturing high-quality scientific and technological talent is pivotal. At this seminar, an esteemed academician who leads a team hailed as the "best educational team" made a wonderful presentation. This academician has made a significant contribution to talent development. He has composed professional songs, organised "flag-presenting" ceremonies for faculty and students, arranged inter-university academic seminars, and even started research-related online open lectures on weekends. These efforts have attracted many young students and inspired them to be passionate about research and actively pursue this rather unpopular path. The academician's vivid and passionate presentation won rounds of applause from participants.

However, as the applause withered, many participants rightly pointed out that the best outcome of such a talent development model is merely the replication of this academician, leading to the creation of

second, third, and subsequent versions of the same individual. Moreover, it will be quite challenging for his followers to surpass him, since he has already set a benchmark in this field. These comments reminded me of an IPO (Initial Public Offering) pricing culture in US venture capital circles. If an entrepreneur graduated from a prestigious university, that's great – their company's IPO pricing will be substantially higher than those who graduated from a non-prestigious school. If the entrepreneur dropped out of a prestigious university, that's even better – their company's valuation will be even higher than those with prestigious alma maters. There are many well-known tech figures who dropped out of prestigious universities, such as Bill Gates, Sam Altman and Elon Musk.

In today's tech competition, while China certainly needs a workforce of uniformly trained tech professionals, like the "XX Iron Army" this academician strives to build, perhaps what we need more are tech professionals with unique personalities, such as Musk and Altman. They are imaginative about tech inventions, unconventional in their approach, flamboyant in life, informal in conduct, and even controversial in their private lives. One of the participants shared the view that technological innovation tends to be more dynamic in countries and regions that embrace diversity, such as those that are inclusive of the LGBTQ+ community.

Third, we need to diversify R&D investments from being primarily driven by state-led projects to becoming enterprise-centric by attracting market investments.

Today, there is no state capital invested in any of the US companies that lead the global tech scene, be it Elon Musk's SpaceX, Sam Altman's OpenAI, or early tech leaders such as Apple and Microsoft. These tech companies, which many Chinese would call "private enterprises", often feature in the top Fortune Global 500 companies.

During the seminar, a scholar shared an interesting story. With the support of state funding, our national research institutions invested significant manpower and resources into deep-sea exploration research. A recent breakthrough was reaching a depth of 10,000 meters, making China the only country with this technology. The scholar casually mentioned that the average depth of the South China Sea is only 3,000 to 4,000 meters. So, they had to travel to the

Mariana Trench, which reaches depths of 7,000 meters, to conduct tests for their research. I noticed that many scholars in the audience shook their heads in disapproval upon hearing this. The developers of such technology will likely win some national awards, but what is the point of catch-up research that is disconnected from market needs and consumes enormous manpower and resources, without regard for costs, simply to surpass others, or for the sake of research itself? This exposes the pitfalls of the catch-up mentality shaped by long-term technological lag. China has been paying a huge price for the catch-up mentality throughout its scientific and technological history, and it is foreseeable that China will continue to pay the price for this mindset for a long time.

In contrast, I have noticed an emerging trend of "cost-saving innovation" in the US tech sector. Launching manned spacecraft into space is not a new invention, but Elon Musk-led SpaceX, a "private enterprise" in the view of many Chinese, is dedicated to making launch vehicles reusable and launching multiple satellites with a single rocket instead of just one. While Musk's initial motivation might have been achieving profitability as a private enterprise by reducing costs, this approach led to significant technological innovation. This model is quite different from state-funded projects where "other people's money is spent on other people's work". Moreover, the global scientific community advocates for tolerance of failure in scientific research. State-funded projects are not subject to the constraints of profit-driven capital and are granted leniency under the prevalent culture of tolerance for failure in scientific innovation. Given such inefficiency and limited resources, China cannot be expected to produce many technological outputs that are genuinely competitive in the market.

At the seminar, the anecdotes shared by a member of Wang Xuan's team at the Peking University Founder Group struck me for two reasons. First, China does not actually lack scientists who are willing to stand out, persevere, and forge ahead in challenging conditions according to their own will. During the Cultural Revolution, Wang Xuan consistently listened to the so-called "enemy station" BBC to improve his English, leading to suspicions of espionage and prolonged investigation. This laid a solid linguistic foundation for Wang, who had never received formal education abroad and enabled him to later read scientific literature easily and invent the Chinese character laser phototypesetting system. Second, the

Peking University Founder Group founded by Wang Xuan, underwent restructuring after filing for bankruptcy a few years ago. I think that while coming up with a good research project in China might not be difficult, the challenge lies in building a competent company to efficiently commercialise these products in an organised manner, and in shaping a sound corporate system for sustainable business development. We only focus on heavy investment in the S&T sector and nationwide systems. However, without a healthy corporate development ecosystem to support high research efficiency, many excellent projects like Founder will not be sustainable. After hearing about cutting-edge technological achievements shared by leading domestic scholars, I did not feel any joy or relief. Instead, I felt more burdened than ever before. I felt the heavy responsibility weighing down on the shoulders of our social scientists and economists.

To return to our initial question: how can China become a true global leader in S&T education? In terms of research motivation, we need to proactively overcome the inertial mindset of catch-up research and let enterprises drive R&D initiatives as per market demands. In terms of talent development, we need to embrace and encourage individualistic talents, rather than taking a team-based approach. In terms of research funding, we need to move from project-based R&D funding to enterprise-centred funding, attracting market investments and venture capital. Perhaps one day, when China has a great deal of enterprise-led innovative research projects and numerous tech professionals like Musk and Altman (without any title or national grant support), China will be much closer to becoming a powerhouse of S&T education.

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The views expressed here are those of the original author and not necessarily of the translator or of the Institute of Chinese Studies.

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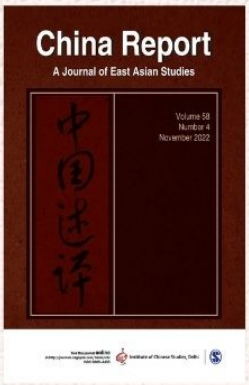

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