
Guest Editor's Note

Re-engineering China's Innovation Machine

Since the beginning of the Xi Jinping administration in 2012, Chinese policy has shifted in certain clear and consistent directions. Xi has become much more concerned with security and has expanded the definition of security to include many non-traditional areas. The impetus for market-oriented reforms has faded, and in many areas, market reforms have gone backwards. Perhaps most strikingly, technology and high-tech industries have become the unrelenting focus of policymakers' attention and now sit at the center of both development strategy and national security strategy. These policy orientations are obvious to anyone following Chinese official media.

There is, however, much we don't know about how China is carrying out these policies. COVID-19 created a three-year period (2020–22) during which foreign researchers had no direct access to China, and even ordinary person-to-person contacts were abruptly severed. During this period, Chinese organizational and policy change—if anything—accelerated. To address gaps and lags in our knowledge, a conference was convened in Berlin on September 5–6, 2024 to share what we know about the specific institutions and initiatives the Chinese government has launched on science, technology, and innovation. The short papers in this special issue are revised versions of presentations made at this conference, organized jointly by the University of California Institute on Global Conflict and Cooperation (IGCC) and the Mercator Institute for China Studies (MERICS).

These papers demonstrate how the Chinese government has made—and is making—a massive effort to drive China toward a high-tech future, with an emphasis on high-tech industry. This effort does not just involve government setting policy and steering resources towards high-priority tech sectors. It also includes major, sustained actions to intervene directly in the market to create new kinds of organizations and new incentives for existing organizations in order to ensure that they support national goals and priorities. These interventions are unprecedented since the beginning of China's market reform era in 1978. Although they do not involve the abandonment of China's market economy, they do display a willingness to have the government directly intervene and shape markets and market-facing entities to accord with government objectives.

Most of the papers use the idea of the “innovation chain” as a loose heuristic framework, and this special issue is organized around the same concept. In part, this is

because there is substantial evidence that the Chinese government is thinking in this way as it designs policies and institutions.¹ The innovation chain envisions a series of activities that start with scientific discovery, proceed through engineering and prototyping phases, and culminate in an innovative product that meets either market or national security needs. This chain is a simplification of the richer and more complex innovation ecosystem, but it provides a useful way to organize critical government actions and achievements. The first two papers in this issue treat the innovation chain as a whole. Naughton emphasizes the conscious effort to reshape incentives, especially by revising targets and rewards in existing research institutes, creating new engineering entities, and forming consortia in which entities at different stages of the innovation chain sign medium-term—typically three-year—contracts with agreed targets and rewards. All of this is designed to align interests and make the innovation process faster and more efficient. Groenewegen-Lau tackles broad issues relating to the consistency of the entire program, especially focusing on distortions created by having national high-priority projects—the so-called “new-style whole-of-nation” system—along with a nationwide innovation ecosystem that thrives on diversity and competition.

In the following two sections, five papers each illuminate one crucial aspect of the innovation chain. Laha provides an explication of “organized scientific research” within China’s elite universities. This deals with the organization of activity at the very beginning of the innovation chain, and the elite scientists doing the basic science that provides the knowledge basis for new products, today and in the future. As Laha makes clear, the Ministry of Education—following national strategy—increasingly emphasizes “application-oriented basic research,” or goal-oriented research. More concretely, as Laha explains:

Organized scientific research shapes the work of universities by breaking down larger problems into smaller projects, some of which require expertise across different disciplines. Such an effort is team based and relies on recruiting relevant talent.

In other words, research should increasingly be inter-disciplinary and require the interaction of scientists of different backgrounds. For that to happen, we note, the government must also make an effort to provide different incentives and establish different key performance indicators to motivate academic scientists. Xi has repeatedly said that scientists should not just publish in prestigious journals but should also seek to contribute to practical, application-oriented research. These same principles are being used to re-engineer government-run “state key laboratories,” including those in the elite Chinese Academy of Science and Chinese Academy of Engineering.² A specialized study on the re-organization of those research institutes would be of tremendous value.

Laha also describes the increased attention universities are putting into engineering research centers. This relates directly to the paper by Conlé, which zeroes in on the New Research and Development Institutes (NRDIs), which are generally more like engineering research centers in that they focus on adaptive research and applications. Conlé writes about Guangdong province, which was a pioneer of the NRDIs, although they are now a national phenomenon. Flexible in ownership and compatible with market processes, NRDIs are ideally suited for lagging provinces to bring in talented individuals and

intellectual property from more advanced regions and even abroad. Although it is hard to think of Guangdong today as “lagging,” it did not initially have any top-flight universities or state labs, and the NRDI form was used to bring in top-quality resources. Engineering centers play an important role in translating scientific discoveries into useful applications and also an essential role in reverse engineering, in which completed competing products are disassembled, analyzed, and replicated in a crucial stage in the technology catch-up process.

Another paper, Brown’s “Accelerator State,” takes us into the business realm. Brown lays out the vast Chinese program to support small, specialized high-tech firms, especially start-ups. This program starts with technology incubators—giving support to firms in their earliest incarnations—and then “promotes” successful firms up a ladder of size and revenue. Perhaps the most striking stage of this gradual promotion process is that occupied by “Little Giants,” generally medium-sized but specialized technology suppliers. Consciously conceived as a complement to other aspects of the Chinese innovation system that may over rely on large state-owned firms, the Little Giants and associated programs show that the Chinese state is entirely willing to meld its technological aspirations with vigorous market operations in certain areas. China is happy to reward the entrepreneurs who start up small, dynamic firms, even though it may display discomfort with super-large private firms like Alibaba, regardless of their technological prowess. Brown appropriately labels this the “accelerator state,” which represents a central and indispensable part of the entire government effort to accelerate the innovation chain.

Technologically dynamic firms grow large, but none has grown so powerfully and in so many areas as Huawei. Hmaidī’s paper shows that Huawei has rebounded from the initial shock of U.S. sanctions and has adapted to a new reality. To be sure, this new reality is one of intimate cooperation with the Chinese government and—undoubtedly—the receipt of enormous amounts of support from the national government and the government of Shenzhen, where Huawei is headquartered. Indeed, as Hmaidī demonstrates, Huawei has increasingly become the dominant player in a number of areas adjacent to its initial focus on communications equipment, software, and design. This outcome probably reflects Huawei’s extraordinary expertise and lightning-fast managerial system, the massive support it has received from the government, and the absence of alternative companies or agencies that can play the same kind of role Huawei excels in. Almost certainly, Huawei is the organizing agent of several of the most important “innovation consortia” described in the first paper in this volume, although the company is careful to never declare its role in these quasi-governmental arrangements.

Finally, Arcesati’s paper situates China’s efforts in artificial intelligence (AI) within the context of international rivalry and exclusion. Arcesati shows that China has scrambled to catch up and recover from the shock of ChatGPT in the fall of 2022, and that U.S. technology sanctions have slowed that effort. However, the effort and resources Beijing has poured into AI has meant that China has, at a minimum, kept the gap from expanding and—by some measures—managed to reduce its distance behind U.S. technology leaders.

Put together, these papers show the impressive magnitude of China’s technology efforts and the extraordinarily eclectic—even indiscriminate—measures and organizations

that China has mobilized in service of its technological drive. Chinese leaders are sparing no effort to unify their technological resources in the service of a great national strategic cause.

NOTES

1. Jeroen Groenewegen-Lau and Michael Laha, *Controlling the Innovation Chain: China's Strategy to Become a Science & Technology Superpower* (Berlin: MERICS Report), February 2, 2023, accessed September 13, 2024, <https://merics.org/en/report/controlling-innovation-chain>.

2. Sun Ninghui 孙凝晖, "Strategic Thoughts on Reconstruction of State Key Laboratories under New Nationwide System." *Bulletin of Chinese Academy of Sciences* 37, no. 12 (2022): 1833–39 (in Chinese).