

Adam Segal, *Digital Dragon: High Technology Enterprises in China*

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Over the course of some 30 years of economic reforms, China has adopted a wide array of policies designed to enhance its technological capability and foster growth. This reform process culminated in China's launch in March 2006 of its ambitious *National Mid- and Long-Term Science and Technology Development Plan for 2006–2020* (the Plan). The Plan represents the ambition of sustaining economic growth and social development through homegrown innovation and increased government-led R&D investments. Among its various priorities, the Plan sets forth a bold quantitative target for China's innovation performance: by 2020, increasing to 2.5% China's ratio of gross expenditures on R&D to GDP. Additional targets of the Plan include increasing the share of technological progress in economic growth to 60%, increasing business expenditures on R&D, and achieving a top-five world ranking in both the number of invention patents granted to Chinese citizens and the number of citations of international scientific papers. Complementing the Plan, China aims to develop indigenous innovation in new products and nurture new industries so as to achieve a technological 'leapfrog' through 12 'mega' science and technology projects (such as the manufacture of large commercial aircraft and the development of space technology including moon exploration). In identifying projects like these, China has signaled that it will focus on specific areas for development while deferring action on others.

Adam Segal's book, published in 2003, skillfully constructs the backdrop to the historical changes that have occurred in China's innovation system before the introduction of this current, elaborate Plan. Through his investigation of nongovernmental high-technology firms (*minying keji qiye*) in the information industries, Segal details not only the development of this crucial feature of the science and technology (S&T) system in China, but also succeeds in providing a comprehensive

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explication of the transformation that has taken place in China's broader innovation system. Focusing on nongovernmental high-technology firms is critical to such a comprehensive account, as their successful creation represents the next step in China's progress toward building a modern, technologically based economy. As the recent introduction of China's S&T Plan suggests, there is a clear recognition on the part of its leaders that, without broad-ranging capabilities in high technology, China will find it difficult to join the likes of the United States and Japan as a modern economic and innovative superpower.

Segal takes us on a journey through the development of *minying* enterprises in four locales: Beijing, Shanghai, Xi'an, and Guangzhou. While he does not offer explicit justification for selecting these four cities, Segal does a thorough job of comparing and contrasting local government support for the *minying* in each case as well as showing corresponding differences in patterns of firm development. In the most successful case, Beijing's many primarily small-sized, science-based *minying* enterprises were at the center of technological development there, receiving generous financial support in the form of loans and foreign direct investment under the supervision of local governments for the purpose of facilitating development. In the least successful case, in Xi'an, the *minying* were mostly large-sized state-owned enterprises (SOEs) or were based on some form of hybrid ownership. These concerns were established mainly to complement SOEs, received only limited foreign direct investment (with most funding going to the larger SOEs rather than to the *minying*), and were subject to meddling and interference from the local government. Shanghai's case resembles Xi'an's more than Beijing's, while Guangzhou was heavily influenced by its proximity to Hong Kong and the latter's embrace of *laissez-faire* governing principles with little direct attention given to the *minying* as such.

Segal finds that local governments in each of these four cities interpreted central government policies differently, thereby achieving differential results in terms of the success of the *minying*: "In Beijing, during the 1980s and 1990s, a number of competitive nongovernmental enterprises emerged ... [but] during the same period *minying* enterprises languished on the margins of the local economy in Shanghai, Xi'an, and Guangzhou" (p. 4). The differences in outcomes are explained by differences in technology policy within their local contexts.

While the book's empirical results are valuable in their own right, its contribution runs deeper than a mere accretion of facts. Segal expands the state-development literature by situating the advent of the *minying* in the context of the interplay of central and local governments. Most notably, Segal illustrates how viewing the state as a set of relationships among central, provincial, and local government actors helps us understand development as the outcome of both competition and interaction between the central and local governments.

By situating his account of the *minying* within the context of the broader S&T policy changes that have taken place in China, Segal successfully provides the reader with a comprehensive picture of both the expanding scope and targeted focus of national S&T policy in China over the last 30 years. Such an account of China's broader S&T policies rests on a sound understanding of the effects of local institutions, local constraints, and local politics. While Segal does not make this connection explicitly, such an understanding of S&T policy accurately reflects the

changes that have occurred in China as it has attempted to move from a centrally planned to a market-oriented economy.

Had Segal been able to replicate the depth of analysis he achieves in his treatment of the various levels of governmental actors in providing an account of (a select number of) the *minying* founders—by tracing among other things their individual personal and professional development paths over a number years; their perceptions of local, provincial, and national government policies and support; and the outcomes of their firms in terms of new products and the impact of those products on Chinese society—the analysis would have been even more complete.

As China continues its seemingly inevitable metamorphosis into a major technological superpower, we must learn to appreciate the historical path dependencies that have been created in the transformation of its innovation system. By focusing on the *minying*, Segal offers us precisely such an understanding, and thereby a better appreciation of the direction in which China is currently heading in terms of innovation-led development.