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EDITORIAL ESSAY

China Innovation Challenge: A Reprise[1]

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To begin with, I wish to thank Editor-in-Chief Xiao-Ping Chen for her initiative to celebrate MOR's twentieth anniversary by inviting a series of essays under the seductive title 'MOR and Me', with the overarching subtitle 'Chinese management research: Looking back, current status, and future prospects'.

In 2014, I was fortunate and privileged to succeed the 'empress', Professor Anne Tsui, as the editor-in-chief of *Management and Organization Review*, published by the IACMR, which focuses on management research in the Chinese context. To my surprise, after accepting this honor, I discovered that this editorship involved a moral obligation to be on the ground in China to mentor PhD students and faculty, which I did for six years and had an awesome learning experience. Thank you, Anne!

The origin of this essay is the Inaugural Research Frontiers Conference, held at the Hong Kong University of Science and Technology (December 4–7, 2014), which launched my editorship. The purpose of the conference was to discuss 'China 2030: Building a Modern, Harmonious, and Creative Society', a 2013 report by the World Bank and the Development Research Center State Council. The discussions and lessons learned were published in *China's Innovation Challenge: Overcoming Middle-Income Trap* (Lewin, Kenney, & Murmann, 2016). Not surprisingly, China's innovation dilemma was examined against the background of widely accepted liberal democratic, deeply held beliefs, in which scientific and technological breakthroughs flourish in an environment of free markets, free speech, and democracy.

In 2007, China ranked 135th globally in terms of the gross domestic product (GDP) per capita (https://database.earth/economy/gdp-per-capita/2007/), which highlighted the challenge that it faced in escaping the middle-income trap. But, at the same time, it could take pride in having some of the world's most innovative tech companies. BCG (Boston Consulting Group) ranked Huawei, Alibaba, Lenovo, and Tencent among the 50 most innovative companies in the world.

What is more, less than ten years after the inaugural MOR Research Frontiers Conference (December 4–7, 2014), the 2023 Australian Strategic Policy Institute (ASPI) report concluded that China had leapfrogged the US and the advanced liberal democracies to become the world leader in 37 out of 44 critical fields in science and technology, and the US was the leader in only 5 (https://ad-aspi.s3.ap-southeast-2.amazonaws.com/2023-03/ASPIs%20Critical%20Technology%20Tracker_0.pdf?VersionId = ndm5v4DRMfpLvu.x69Bi_VUdMVLp07jw/).

The ASPI report concluded that China has positioned itself as a science and technology superpower spanning a range of crucial technology fields: defense, space, robotics, energy, the environment, biotechnology, artificial intelligence (AI), advanced materials, and key quantum technology. The world's top 10 leading research institutions in some technologies are based in China and, according to ASPI, together generate nine times more high-impact research papers than the next-ranked country (most often, the US). According to ASPI, in the prior five years, China had generated 48% of the world's high-impact research papers on advanced aircraft engines, including hypersonic engines, and hosted seven of the world's top 10 research institutions on that topic. The US is second in the majority of the 44 technologies examined and currently leads in areas such as high-performance computing, quantum computing, and vaccines.

During my editorship of MOR, I benefitted from engaging and interacting with many management, innovation, and economics scholars and PhD students in China (too many to acknowledge in this

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essay), to whom I am deeply indebted. However, it became evident to me, unlike many other scholars (see, e.g., Redding, 2023), that China's inimitable autocratic regime has a history of envisioning and fostering transformative capabilities that incorporated farsighted initiatives or outlined in a progression of forward-looking five-year plans (FYPs) and embodied in bottom-up competition among provinces.

For example, the rise of Chinese universities in global recognition is one of the greatest success stories in global higher education. To attain world-class status in higher education, the Chinese government, starting in 1985, developed three programs – Project 211, Project 985, and the C9 League. Project 211, founded in 1985, funded over 100 Chinese universities (out of 2,914 universities and colleges) with the purpose of elevating them to international academic standards by the end of the 21st century. Project 985 was launched during the commemoration of the 100th anniversary of Beijing University (May 1998). The newly stated goal was to create *9 elite universities* (from the top 39 universities under the 211 Project). It provided extraordinary funding to Tsinghua University, Zhejiang University, Shanghai Jiao Tong University, Xi'an Jiao Tong University, University of Science and Technology, Harbin Institute of Technology, Beijing University, Fudan University, and Nanjing University. In 2009, the C9 League was formed to formally recognize this elite group of Chinese universities, attract the most talented students worldwide, and share resources. The C9 League claims 3% of China's research scholars, receives 10% of national research budget, and produces 20% of cited academic papers in China.

The Double First-Class University Plan was founded in 2015. The goal of this program is to comprehensively develop C9 universities and their faculties into world-class globally ranked universities by the year 2050. The intent was to raise the ranking of the top 30 universities to join the list of the top 100 leading universities worldwide. Zhang, Patton, and Kenney (2013) documented the success of this program in terms of the number of publications in top international science and technology journals and citations to them.

However, the Double First-Class University Program was preceded by a far more audacious farsighted idea articulated by Deng Xiaoping, China's paramount leader (December 1978), who expressed his vision of sending thousands of students and researchers abroad as a key element in a long-term national strategy to raise the human capital endowment of Chinese science and technology. This initiative encouraged large numbers of outbound students and scientists to study and work at universities and institutes in the US, Europe, and elsewhere. It exceeded all expectations of success. Between 2000 and 2017, for which data were available, the number of Chinese students studying abroad totaled a cumulative 8,373,700, of which 4,589,999 (55%) returned to China and contributed immeasurably to its human science and technology capital.

China's leading research position implies that, in the long term, it is positioned to excel in technologies that do not yet exist. In the near term, coupled with successful strategies for translating research breakthroughs, cutting-edge product designs that are integrated into optimized advanced manufacturing producers could enable China to dominate the global supply of certain critical technologies, such as cost-competitive wind turbines, solar panels, world-class advanced manufacturing (Global Industry 4.0), ship building, railroads, infrastructure projects, and nuclear power.

The US awakening to China's leapfrogging the US in science and technology resulted in the CHIPS (Creating Helpful Incentives to Produce Semiconductors) and Science Act and the IRA (Inflation Reduction Act), both of which were passed by the Biden administration in 2022, and are considered in China as the start of a long technological cold war between China and the US (Tung, Knight, Ghauri, Prashantham, & Fang, 2023). The CHIPS Act's goal is to build and control advanced semiconductor chip design and fabrication in the US as well as deny access to advanced semiconductor fabrication located in the Netherlands and Japan.

Perhaps more surprising is China's disruption of the global internal combustion engine industry (Kenney, Lewin, Shu, & Mei, 2024). The rise of China's electric vehicle (EV) battery industry illustrates the country's transformative capabilities embedded in an indigenous, competitive startup, bottom-up entrepreneurial culture, expedited by top-down direction of overarching goals (or ideas) that originated in the ninth FYP (1996–2000) and were updated in the twelfth FYP (2011–2015) incorporating lessons learned up to that point as a result of the fierce competition among provinces, cities, and startups.

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The nascent EV industry rapidly expanded to over 300 EV brand foundlings, most of which have been selected out. The industry has evolved into a fiercely competitive ecosystem, which at the time of this writing involves 18 Chinese EV manufacturers, 13 battery manufacturers, and many suppliers of other adjunct components and software. In 2023, China sold a record 8,095,078 EVs (an increase of 37% over 2022), enabling China to claim a domestic market share of 37% (Kane, 2024). More than 2.2 million EVs were sold in China in the third quarter of 2023, and the market for passenger EVs grew 27% over 2022. In 2023, 1.6 million EVs were sold in the US (mostly Teslas) and nearly 800,000 in Europe. In other words, sales of EVs in China equaled sales in Europe and in the US combined (O'Donovan, 2024). By 2022, China had caught up to Germany in exports of passenger vehicles, mostly EVs, and was projected to reverse the negative trade balance with Germany in auto sales by 2024. By 2023, China had exported 4.91 million vehicles (mostly EVs), making it the world's largest exporter of automobiles.

How did China metamorphose itself to become an innovation powerhouse (though without escaping the middle-income trap) over the past 46 years? In his speech, 'Haier Is the Sea' (reprinted and deconstructed in *Management and Organization Review*, Volume 12, Issue 4, December 2016), Chairman Zhang Ruimin expressed his deep belief in Daoism, observing that the world around the company is unpredictable, that nothing in the universe is fixed, and that everything is changing all the time. In other words, the world is essentially uncontrollable, and, therefore, Haier employees must always be ready for change. Readiness for change is fundamental to China's complex adaptive ability, through which a society can adapt over time. In China, this process is a duality of simultaneous adaptation from the top down and from the bottom up.

The evolution and development of social ecosystems naturally encompass different understandings of change, the rate of change, and the pursuit of innovation. However, Ashby's law of requisite variety (1958; Boisot & McKelvey, 2011) requires that the rate of internal change must exceed the comparable rate of external change. It is not that any culture is better at innovation than other cultures but, rather, that developmental ecosystems create different attitudes toward change, the pursuit of innovation, and acceptance that some embedded practices are obsolete and should be discarded. Deng's opening of China's economic ecosystem introduced the market dynamics regime as a complement to Justin Yifu Lin's theory on the role of institutionalism in economic development (Lewin et al., 2016). And it is my view that the Chinese population, possibly more than any other population in the world, has had to relentlessly adapt to radical change, since 1978, in every aspect of the economy and society.

Ren Zhengfei, the founder of Huawei, summarized this challenge to his employees: first, adopt and master the best in class Western management practices and, then, and only then, innovate to best fit the Chinese context (Wu, Murmann, Huang, & Guo, 2020).

The reality is that, through effectively adopting and then advancing many technologies and management practices, China has emerged as a world-class competitor in almost every industry and technology: rail, ship building, advanced manufacturing robotics, passive nuclear power, nanoscale materials, photonic sensors, synthetic biology, supercapacitors, lithium and solid-state electric batteries, and AI. In 2022, based on its investment in industrial 'robotic workers', China ranked third, after Germany and Japan, in terms of the density of its robotic workers installed per 10,000 manufacturing employees.

However, a new order of world trade could be ushered in by the emerging multipolar global environment, as discussed by the *Economist* (May 9, 2024):

> The liberal international order is slowly coming apart. Its collapse could be sudden and irreversible. For years the order that has governed the global economy since the second world war has been eroded. Today it is close to collapse. A worrying number of triggers could set off a descent into anarchy, where might is right and war is once again the resort of great powers. Even if it never comes to conflict, the effect on the global economy of a breakdown in norms could be fast and brutal.

Such a multipolar world, however, does not have to usher a world war. It is more likely that China is anticipating a multipolar world and is in the process of establishing an institutional framework for

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leading a new trade block dependent on China who will join one or all four national policy pillars initiated by President Xi Jinping: the Belt and Road Initiative (BRI), the Global Development Initiative (GDI), the Global Security Initiative (GSI), and the Global Civilization Initiative (GCI). These four pillars present China as the largest country in the world that is self-sufficient, politically stable, open, and widely accommodative of international cooperation that could lead to reform of the global trade order (currently shaped by the World Trade Organization). At its core, the GSI, released in 2022, advocates and supports *noninterference* in the internal affairs of other countries. In other words, it acts as a counterpoint to the morality and criticism of authoritarian regimes by liberal democratic countries. Behind the rhetoric, the GSI is designed to counter US strategic alliances that are intended to contain China, establish national security as a precondition for global economic development, and promote absolute sovereignty (i.e., that the safety of one state should not come at the expense of another). China and Russia have relied on this framing to rationalize Russia's invasion of Ukraine, accepting Russia's perspective that Russia's 'special operation' in Ukraine was justified to prevent further expansion of NATO (North Atlantic Treaty Organization) from threatening Russia. This new order of world trade can be expected to strictly enforce intellectual property rights. Trade will undoubtably increase within trading blocs, but the impact on global trade between blocks is not clear. Much will depend on the clustering of countries around the US or China (or other trade blocks such as the renewed BRICS) and on the ability of multinational enterprises to triangulate among countries in different trade blocs (e.g., Jha, Awate, & Mudambi, 2023).

To me, this suggests that China management and strategy scholars need to focus on how MNEs headquartered in any location (China, India, Indonesia, Africa, EU, US, etc.) have to adapt their businesses to operate within trading blocks, independent of headquarters location, while taking account of the impact of defensive tariffs that advanced countries are prepared to impose on China. For example, what are EU internal consequences if Spain agrees that Chinese EV manufacturers can locate in Spain and export to countries in the EU or locate in Mexico and export to the US and Canada. The disruption of the high wage, high employment internal combustion engine industry could be politically and economically very disruptive. Moreover, the unfolding of the digitization/AI age combined with rising global decarbonization priority opens both a new arena of competition affecting the definition of work, careers, and quality of life as well as collaborations across trade blocks to address global warming.

Note

1. This essay is inspired by my Keynote Address, 'China Innovation Challenge in the Age of Digitalization: The Crucial Role of China Transformative Capacity', presented at the 10th International Symposium on Management of Technology Innovation and Management in the Digital World, June 10–11, 2023, Zhejiang University, Hangzhou, China.

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