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TECHNONATIONALISM AND EMERGING TECHNOLOGIES IN SMALLER STATES

Policy Report
April 2022

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Executive Summary

Technonationalism is a technological and industrial development strategy that stresses both economic and geopolitical self-sufficiency and self-reliance. As case studies of Israel and Taiwan have shown, technonationalist development strategies are being used to exploit the emerging “fourth industrial revolution”, particularly when it comes to such critical emerging technologies as artificial intelligence, quantum computing, and 5G networking. In keeping with the technonationalist model, governments have been extensively and intimately involved in this innovation process: by setting national policy and crafting national development plans; by funding research and development in academia, think tanks, and local industry; by encouraging start-up companies; by nurturing talent and expertise in new technologies; and by encouraging linkages and cooperation between the private sector and the state. At the same time, the application of technonationalist strategies has experienced setbacks and failures, not the least being “technology overreach”. Nevertheless, the technonationalist model will continue to appeal to many states as a shortcut to technological and industrial development.

Introduction

The term "technonationalism" was coined by the economist Robert Reich in the 1980s.[1] It describes a technological and industrial innovation strategy that stresses autarky (self-reliance) at the level of the nation state. At its most fundamental level, technonationalism entails the indigenous development of technology, for its own sake as much as for any economic benefits derived from it. Technonationalism is more than just a "security of supply" issue or a fancier word to describe protectionist economic and developmental policies. At the same time, technonationalism is as much about securing geopolitical and strategic autonomy as it is about achieving technological and industrial self-sufficiency when it comes to defence. Technonationalism serves broad, bold national strategic ambitions, particularly the emergence of a country as a modern, independent, even powerful, nation state. Samuels argues that technonationalism is nothing less than the "struggle for independence and autonomy through the indigenization of technology".[2]

Many countries, therefore, have frequently pursued linked strategies of economic and technological development to be more self-reliant and more independent. Developing nations and newly industrialised states have particularly pursued technonationalist strategies when it comes to fostering critical industrial sectors like iron and steel, automobiles, electronics, shipbuilding, and aerospace.

At the same time, technonationalism views self-reliance to be a crucial aspect of national security. Autarkic economic and technological development, as well as industrialisation, are viewed as directly aiding national defence (i.e., "security and development"). Therefore, technonationalism often entails the specific embrace of technology for national security. Technology is widely regarded to be a crucial element of military effectiveness and advantage. In theory (and often in practice), the possession of cutting-edge militarily relevant technologies equals more effective weapons systems, which results in greater military power, which in turn translates into greater geopolitical power. Sometimes, this involves the pursuit of purely military–technological innovations — both at the level of military research and development (R&D) and the establishment of a domestic arms industry — to boost national defence and strategic autonomy.

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1 Robert Reich, "The Rise of Technonationalism", *Atlantic Monthly,* May 1987.

2 Richard J. Samuels, *Rich Nation, Strong Army: National Security and the Technological Transformation of Japan* (Cornell University Press, 2018), p. ix.

Technonationalism is more than a statement of objectives or a set of goals — it is also a plan of action. The technonationalist model contains its own strategy for achieving autarky in armaments production, one that, paradoxically, involves the exploitation of imported technologies to eventually realise self-sufficiency. This process usually entails the course of moving from learning to innovating, of going from imitating technology to owning and advancing technology — in this case, for the creation and promotion of a national indigenous defence industry. As The Economist puts it, "The focus is laid on national goals through accessing foreign technology and the monopolization of technology." [3]

Samuels divides the technonationalist process into three stages: indigenisation, diffusion, and nurturing.[4] "Indigenisation" refers to the acquisition of technology and its insertion into the local technological and industrial base; since this technology typically originates from foreign sources (e.g., through technology transfers or licensed production), there is arguably a "techno-globalist" aspect to technonationalism at this phase, what some have described as a "techno-hybrid" model.[5] In any case, the technonationalist process is most critical for its "diffusion" and "nurturing" phases, in which the technology, however acquired, is assimilated and circulated throughout the national technology base and is further "processed" with localised inputs, i.e., indigenous R&D. The result is that the technology has been changed and advanced sufficiently that it has become something new and innovative.

The emerging "fourth industrial revolution" (4IR) — involving artificial intelligence (AI) and machine-learning, block-chains, new man–machine interfaces, automation and robotics, quantum computing, and the "internet of things" (IoT) — constitutes a new stage in technonationalism. The 4IR promises to create a new set of opportunities and challenges when it comes to how technonationalism and technonationalist strategies can leverage such technologies. Piggybacking on huge, 4IR-related leaps in the commercial sector, many countries around the globe are actively exploring the militarisation of cyber and information operations.

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[3] "Techno-nationalism", in *Figuring Things Out* (blog), 14 December 14 2011, https://dinakarr.blogspot.com/2011/12/techno-nationalism.html.

[4] Samuels, *Rich Nation, Strong Army*, pp. 33, 42–56.

[5] Samm Tyroler-Cooper and Alison Peet, "The Chinese Aviation Industry: Techno-Hybrid Patterns of Development in the C919 Programme", *Journal of Strategic Studies* 34, No. 3 (June 2011), pp. 385–387.

Therefore, there has been a growing interest in harvesting emerging critical commercial technologies for their military potential. This process, commonly known as civil–military integration — and more recently military–civil fusion (MCF) — has considerable potential to revolutionise the way militaries develop and produce defence-critical systems. MCF holds promise in adapting commercial 4IR technologies, especially information technologies, to military purposes. Consequently, the proliferation of military-relevant technologies is no longer simply a matter of immediate end-use but of all its potential uses.

Increasingly, therefore, technonationalism also includes the development of and exploitation of advanced dual-use technologies, that is, commercial technologies that can be spun onto military purposes. Technonationalism stands at the intersection between economic/technological development and national security. This new state of affairs, together with the growing ubiquity of such advanced commercial technologies, could especially permit smaller states to cherry-pick breakthroughs to take the lead in cutting-edge technology sectors.

The technonationalist model has long attracted smaller states wishing to shortcut or accelerate national economic or industrial development.[6] It has been widely employed during the second and third industrial revolutions, and it is likely to be attempted in some states to participate in the 4IR. Again, technonationalism is more than a mere driver of economic growth or technological–industrial expansion. It is also intended to serve important strategic objectives of increasing national self-reliance and autarky. This increased autonomy, in turn, is expected to contribute to greater independence and perhaps even greater clout in global affairs.

[6] There are various scholarly definitions of what constitutes a “small state”. See, for example, Godfrey Baldacchino and Anders Wivel, “Small States: Concepts and Theories”, in *Handbook on the Politics of Small States*, ed. Baldacchino and Wivel (Edward Elgar Publishing, 2020). For the purpose of this paper, small states possess most, if not all, of the following characteristics: a relatively small population, a relatively small physical size, an open economy (i.e., one that depends on foreign trade and investment), and a relative vulnerability (politically and security-wise) in international affairs. Moreover, when it comes to technological development, small states are often compelled by limited economic or manpower resources to specialise in certain niches.

The Cases of Israel and Taiwan

These are tempting goals, and, as such, many countries around the world have pursued technonationalism when it comes to economic, technological, and industrial development. Israel and Taiwan can be viewed as classic examples of technonationalist development, and they share many characteristics when it comes to security, defence, and technology. Both are small countries with relatively small populations and little strategic depth, facing regional proximate threats or nearby adversaries. Both countries also place a great deal of importance on advanced military technologies for national defence. Each sees technology to be a critical force multiplier when it comes to national security and defence, and the idea of leveraging advanced military–technological capabilities as much as possible is an inarguable one. In conjunction with this approach, achieving a high degree of self-sufficiency in sophisticated armaments has long been a priority for both countries. As such, both countries have by design created and nurtured a clutch of indigenous defence industries, with the intention of meeting — as much as it is financially and technologically feasible — national requirements for the acquisition of advanced weapons systems and other types of military equipment.

In this regard, Israel and Taiwan are fortunate in that they are islands of superior economic and technological development within their respective regions, boasting considerable industrialisation, state-of-the-art high-technology sectors (companies, laboratories, universities, technology incubators, and the like), and highly educated workforces. They therefore possess many indigenous capacities and competencies that can be exploited for advanced military–technological innovation and development. Israel, for example, has pioneered many original, state-of-the-art military systems, including drones, stand-off precision-guided weapons, missile defences, electro-optical systems, systems for command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR), etc. For its part, Taiwan has "deliberately skewed its overall industrialization strategy toward technology-intensive industries" in order to "stay a few jumps ahead" of China, its main rival and security threat.[7] This has, theoretically at least, bolstered their capacities for advancing self-reliance in R&D and manufacture of cutting-edge — or even novel — military equipment.

As case studies of Israel and Taiwan have shown, technonationalist development strategies are still being used to exploit the emerging 4IR, particularly when it comes to such critical emerging technologies as AI,

[7] Janne E. Nolan, *Military Industry in Taiwan and South Korea* (Macmillan, 1986), p. 49.

quantum computing, the IoT, and 5G networking. In keeping with the technonationalist model, governments have been extensively and intimately involved in this innovation process: by setting national policy and crafting national development plans; by funding R&D in academia, think tanks, and local industry; by encouraging start-up companies; by nurturing talent and expertise in new technologies; and by encouraging linkages and cooperation between the private sector and the state. Since there is usually a parallel objective of applying technological breakthroughs to the requirements of national security and defence, the current technonationalist approach towards the 4IR generally entails the spin-off of critical emerging technologies to military use; as such, MCF is increasingly a key subset of current technonationalist strategies.

(I) Israel

According to Adamsky, Israeli security policy emphasises maintaining a "qualitative edge" over potential adversaries in order to offset the latter's likely numerical advantage.[8] Given this faith in technology as a key force multiplier, continuous technological innovation has long been a "central tenet" of Israeli security policy.[9] This has meant investing considerable resources in innovative technologies, reflected in part by high levels of defence R&D spending. Just as important has been the creation and nurturing of an "ultrasophisticated and innovative defence industry".[10]

The growing importance of 4IR technologies is not lost on the Israelis, both in terms of overall economic development and, increasingly, in the military realm. Consequently, one of the basic conditions for the development of 4IR technologies in Israel has been the low barriers between the state's civil and military sectors. Israel's military has developed in close interaction with the civilian sector since its early days. Since the establishment of the state of Israel, the content and forms of cooperation between the defence and civilian sectors have remained very strong. Beginning in the late 1960s, the rapid growth of the defence industry provided employment opportunities in the state's peripheral and less developed areas and for newly immigrated scientists and engineers, while also creating the foundations of a high-tech sector and elevating the overall standard of Israeli industry.

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[8] Dima Adamsky, *The Culture of Military Innovation: The Impact of Culture on Military Affairs in Russia*, the US and Israel (Stanford University Press, 2010), pp. 113–115.

[9] David A. Lewis, "Diversification and Niche Market Exporting: The Restructuring of Israel's Defence Industry in the Post-Cold War Era", in *From Defence to Development: International Perspectives on Realizing the Peace Dividend,* ed. Ann Markusen, Sean DiGiovanna, and Michael C. Leary (Routledge, 2003), p. 130.

[10] Adamsky, *The Culture of Military* Innovation, pp. 125–126.

The growing involvement of Israel's high-tech companies in 4IR technologies significantly enhances the potential for 4IR exploitation. As of 2018, about 230 start-ups in Israel were focused on 4IR-related technologies, including AI, robotics, IoT, big data, energy, operation optimisation, autonomous vehicles and drones, and nanotechnology. Israel has particularly begun to focus on AI, and the Israeli government has been encouraging the advancement of R&D on AI at the national level, with a view to turning it into one of the future pillars of Israel's high-tech industry and national defence. Following discussions in 2018, led by the prime minister, an ad-hoc committee headed by the former heads of the defence ministry's Directorate of Defence Research and Development (DDR&D) and the Israel National Cyber Bureau consolidated a proposed national plan to strengthen Israel's national security, focusing on the development of advanced AI infrastructure and capabilities. One of its conclusions was that Israel should make a concentrated effort to place itself as one of the world's five leading countries in the AI field. Over the next several years, therefore, the Israeli government plans to invest over S$1 billion in AI. Under the auspices of Telem, the National Infrastructure Forum for Research and Development, Israel will establish a multi-year national plan to accelerate R&D on AI. Stages in the plan will include the building of a supercomputer, the creation of programming languages in Hebrew and Arabic, the promotion of a cadre of AI academic researchers, and, finally, the creation of a regulatory environment to support AI development and application.

(II) Taiwan

Taiwan is undertaking similar national initiatives to build up its AI capabilities. Taiwan is home to one of the strongest and most comprehensive information technologies (IT) ecosystems in the world, especially in the areas of semiconductor manufacturing and integrated circuitry design. It also possesses a high-quality workforce, particularly a large pool of highly capable but relatively inexpensive engineering talent. At the same time, the supply of domestic talent is still deemed to be insufficient to meet rising demand, especially when it comes to such 4IR technologies as AI.

Consequently, Taiwan has implemented several technonationalist development programmes, centring on 4IR technologies. These include the "5+2 Innovative Industries Plan", the "Forward-Looking Infrastructure Development Programme", the initiative for "Advancing Forward-Looking Semiconductor Talent and R&D/A National Strategy for Semiconductors", and the "Taiwan AI Action Plan". All these programmes are being run under the auspices of Taiwan's Executive Yuan (the executive branch of Taiwan's government) and are supposed to serve as the central driver of Taiwan's industrial growth in the next era and forge a new model for sustainable development.

The "Asia Silicon Valley Development Plan" is the flagship programme of the "5+2 Innovative Industries Plan". It was approved by the Taiwanese government in September 2016 and is intended to connect Taiwan with high-tech R&D communities worldwide and to seize opportunities in next-generation industries. This development plan specifically focuses on promoting innovative R&D in the area of IoT, thereby building a comprehensive ecosystem for innovative start-ups.[11]

Under the "Advancing Forward-Looking Semiconductor Talent and R&D" initiative, Taiwan has established a three-pronged, multi-year national strategy for the semiconductor industry. The Taiwanese government seeks to advance the island's semiconductor sector in such areas as production, talent, technology, and resources. The objectives are to consolidate Taiwan's international strategic position and to expand upon the nation's existing advantages in the IT market.[12] In particular, to seize opportunities presented by the reordering of global supply chains in the post-COVID era, the government is bringing together the continued research and development of advanced technologies, equipment, and materials for high-end semiconductors. One objective of this programme is to enable Taiwan to produce a semiconductor chip with a process node of 1 nanometre or less by 2030. Another goal is to create an additional 10,000 semiconductor professionals annually to ensure a sufficient supply of quality talent for the semiconductor industry.

Finally, the government has poured considerable resources into the development of AI and related technologies as part of Taiwan President Tsai Ing-wen's push to transform Taiwan's economy for the new digital age. Multiple government ministries have introduced sweeping, multi-million-dollar AI-focused schemes, which involve the participation of industry, academia, and both publicly and privately funded research institutions. The government's "AI Action Plan", launched in January 2018 with a budget of NT$38 billion (S$1.9 billion), is intended to expand the island's existing pool of AI engineering talent, as well as maintain Taiwan's world-leading position in the semiconductor industry, and in general use AI to transform industry in Taiwan.

[11] "Asian Silicon Valley Development Plan", Executive Yuan, Taiwan, https://english.ey.gov.tw/News3/9E5540D592A5FECD/db883555-fbbd-4e8e-907f-5bb02c462344.

[12] "Advancing Forward-looking Semiconductor Talent and R&D", Department of Information Services, Executive Yuan, 21 May 2021, Taiwan, https://english.ey.gov.tw/News3/9E5540D592A5FECD/bf3b400e-e014-4e10-af21-48d987ed8b07.

Conclusions

Technonationalism is not without its challenges. The application of technonationalist strategies in many countries has experienced setbacks and failures, due, not the least, to overconfidence and subsequent overreach. Indonesia failed in aerospace, while Malaysia has struggled to build a self-reliant automobile industry. South Korea found it difficult to compete in the global personal computer business. China's top-down state-led development model has failed to permit China to break the "7-nanometre wall" in semiconductor production; as a result, the country relies heavily on foreign microchips and even chip-manufacturing technology. China's inability to manufacture high-end chips will in turn make it difficult for the country to truly dominate the 4IR.

Autarky in technology is an even more elusive thing, and enthusiasm and throwing money at a problem is no shortcut to success. In general, therefore, it is permissible to question whether the technonationalist approach is a wise strategy for economic development and industrialisation at the cutting-edge of technology — if not in every case, then at least in situations where a nation's aspirations far outstrip its capacities to commit sufficient resources and create large enough markets.

Nevertheless, the technonationalist model will continue to appeal to many states as a shortcut to technological and industrial development. It is likely to tantalise countries seeking to exploit the 4IR. The 4IR promises to be a particularly intense global competition, for whoever leads in such technological niches as AI will be well positioned to predominate not only in the global economy but in international security as well.

About the Author

Richard A. Bitzinger is a Visiting Research Fellow with the Military Transformations Programme at the S. Rajaratnam School of International Studies (RSIS), where his work has focused on security and defence issues relating to the Asia-Pacific region, including military modernisation and force transformation, regional defence industries and local armaments production, and weapons proliferation. He was previously a Senior Fellow at RSIS from 2006 to 2018, and he headed the Military Transformations Programme from 2012 to 2018. He has written several books, monographs, and book chapters, and his articles have appeared in such journals as *International Security, Orbis, China Quarterly, and Survival*. He is the author of *Arming Asia: Technonationalism and Its Impact on Local Defence Industries* (2017), and the editor of *Defence Industries in the 21st Century: A Comparative Analysis (2020) and Reshaping the Chinese Military: The PLA's Roles and Missions in the Xi Jinping Era* (2019). He has previously worked at the RAND Corporation, the Centre for Strategic and Budgetary Affairs, the Asia-Pacific Centre for Security Studies, and the US Central Intelligence Agency.

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