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Knowledge is Power? Technology and Innovation in the Indo-Pacific

By Daniel Fiott | 17 September 2021

Ever since the 1970s, the Indo-Pacific region has steadily become home to increasing levels of technological output, innovation, and people. During this period China's economic opening, the United States' technological dominance, and the broader processes of generalised economic globalisation have contributed to the formation of high-tech global value chains. These value chains have supported new technologies such as the floppy disk, cell phones, microprocessors, and pocket calculators. More recently, the Indo-Pacific has become home to a range of sophisticated technologies in domains such as information and communication technology (ICT), artificial intelligence (AI), robotics, space and military technology. Today, the region is home to fast-paced economic growth and the bulk of the world's population – some 4.2 billion people. It is a region that is also marked by inequality and challenges to fundamental freedoms in certain countries.

The Indo-Pacific is also becoming more technologically and digitally interconnected. For example, the International Telecommunication Union (ITU) estimates that in 2020 the region enjoyed almost complete mobile cellular coverage – 96.1% of people are in reach of a 3G signal. Although countries such as China use technology for mass surveillance and political control, on the whole the Indo-Pacific is harnessing its interconnectivity to unlock innovation. Most projections indicate that this is likely to continue and grow in the decades ahead, although it will happen in a differentiated manner given the size and diversity of countries located in the Indo-Pacific. Nevertheless, the Indo-Pacific region will continue to be critical for global technological value chains, especially given its relative abundance in raw materials and vital production processes (eg, semiconductor design and fabrication).

Despite these trends, the technological rise of the Indo-Pacific comes with challenges such as resource security of supply, global regulation, surveillance and fundamental freedoms, and the China-US rivalry. As it charts its own strategy in the Indo-Pacific, all of these issues are of relevance to the European Union (EU). Technology and innovation trends in the Indo-Pacific are likely to affect how the EU boosts its technological sovereignty and innovation capacities. The technological standardisation and norms currently emanating from the Indo-Pacific, and the potential for scientific and research partnerships,

will increasingly inform the nature and extent of multilateralism in the region and the EU's ability to help shape it.

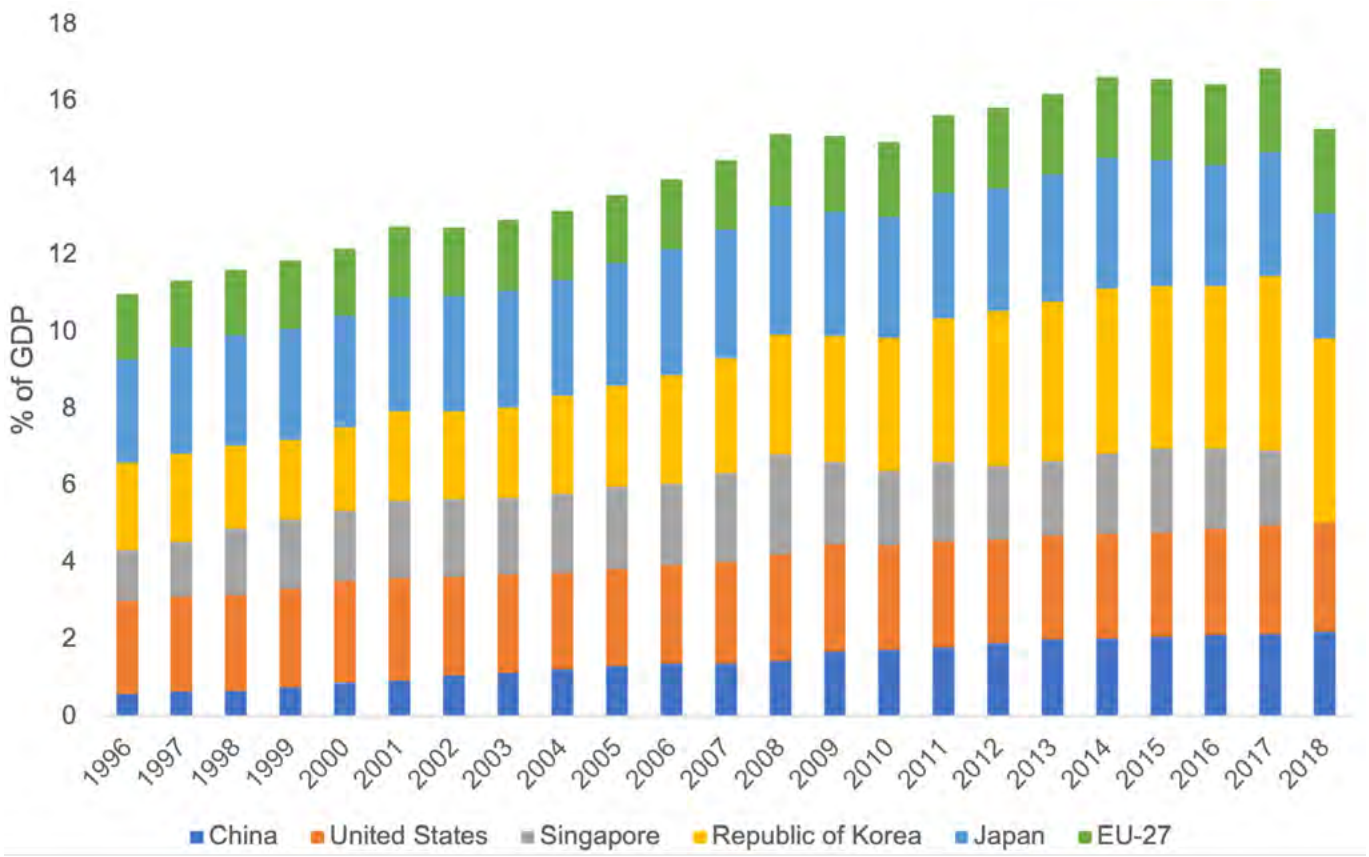
This policy brief analyses the technological and innovation trends underway in the Indo-Pacific out to 2030. It does so with the aim of informing the EU's own approach to technology and innovation partnerships in the Indo-Pacific region. The contribution looks at three trends: (1) technology and innovation investments; (2) high-technology exports; and (3) patents, intellectual property rights, and regulation.

Investments in R&D and skills

Technology and innovation in the Indo-Pacific region has been sustained by investments in research and development (R&D) and skills development. In a relatively short space of time, countries such as China, Singapore, and the Republic of Korea (ROK) have matched or even exceeded Western levels of R&D in terms of gross domestic product (GDP) investment. These investments have allowed Indo-Pacific countries to crowd in talent in high-technology R&D sectors. For example, as Figure 1 shows, in 1996 China dedicated only 0.56% of its overall GDP to R&D but by 2018 this had increased to 2.18%. Figure 2 shows that alongside this increase in R&D investment in China was a growth in the number of people engaged in R&D activities: In 1996, 438 people per million were engaged in R&D but by 2018 this increased to 1,307 people. Where the data was available, this trend has generally been replicated across the region.

There are exceptions to this rule, though. India, which invested an average of 0.7% of GDP in R&D over the 1996–2018 period, has experienced only a negligible increase in people engaged in R&D despite its population size – 152 people per million in 1996 and 252 per million in 2018. Indonesia has experienced a similar fate to India, with relatively low levels of investment and activities in R&D. Japan has witnessed a stable investment in R&D since 1996 of about 3.1%, and the number of people engaged

Figure 1 – R&D Investments (% of overall GDP), 1996–2018

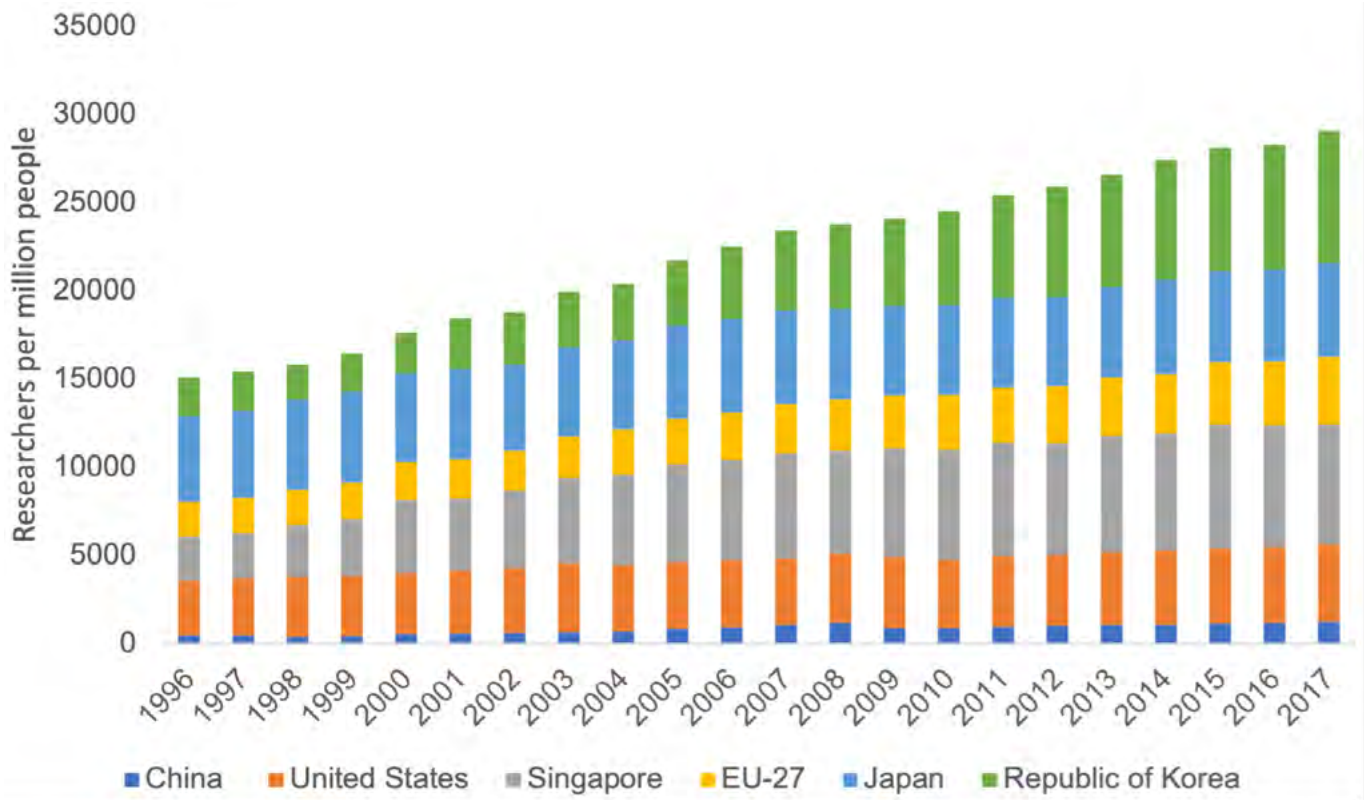


in R&D activities per million has not increased drastically since this time – 4,874 in 1996 compared to 5,331 in 2018. Singapore is the other outlier, but for a different reason. It has invested roughly 2% per year in R&D as a share of GDP since 1996, but it has seen a boom in the number of people per million engaged in R&D activities – 2,503 in 1996 and 6,802 in 2017.

Investments in R&D and skills have led to a boom in research in the region. As Figure 3 shows, although China is the world's largest producer of scientific and technical journal articles, a number of countries in the Indo-Pacific — with the notable exception of Japan — have witnessed an increase in their scientific output. This development is important because the publication of scientific knowledge is a good indicator of the production and application of R&D. Relatedly, the production of knowledge should also give rise to enhanced research collaboration in the Indo-Pacific, especially between those countries without significant barriers to freedom of expression and openness. Countries in South Asia are already investing in regional collaborative programmes to assist their researchers to plug into regional and international research networks. Such innovation networks are being supported by broader regulatory and market changes. ICT investments (worth $103.7 billion in 2018), reduced subscription and equipment costs, deregulation, the development of intellectual property rights (IPRs) regimes, and investments in submarine cables and satellite communications are the backbone of regional research and innovation networks in the Indo-Pacific.

Such developments are set to intensify up to 2030. The 14th Chinese five-year plan makes clear its target for scientific and technological self-reliance by 2025 and Beijing will invest more than 7% annually to meet this target. While China is assured raw materials, there are questions about whether it will have the skilled scientists and engineers needed to spearhead this effort. In the context of its 6th Science and Technology Basic Plan (2021–2025), Japan will also experience a demographic

Figure 2 – Researchers in R&D (per million people), 2000–2017

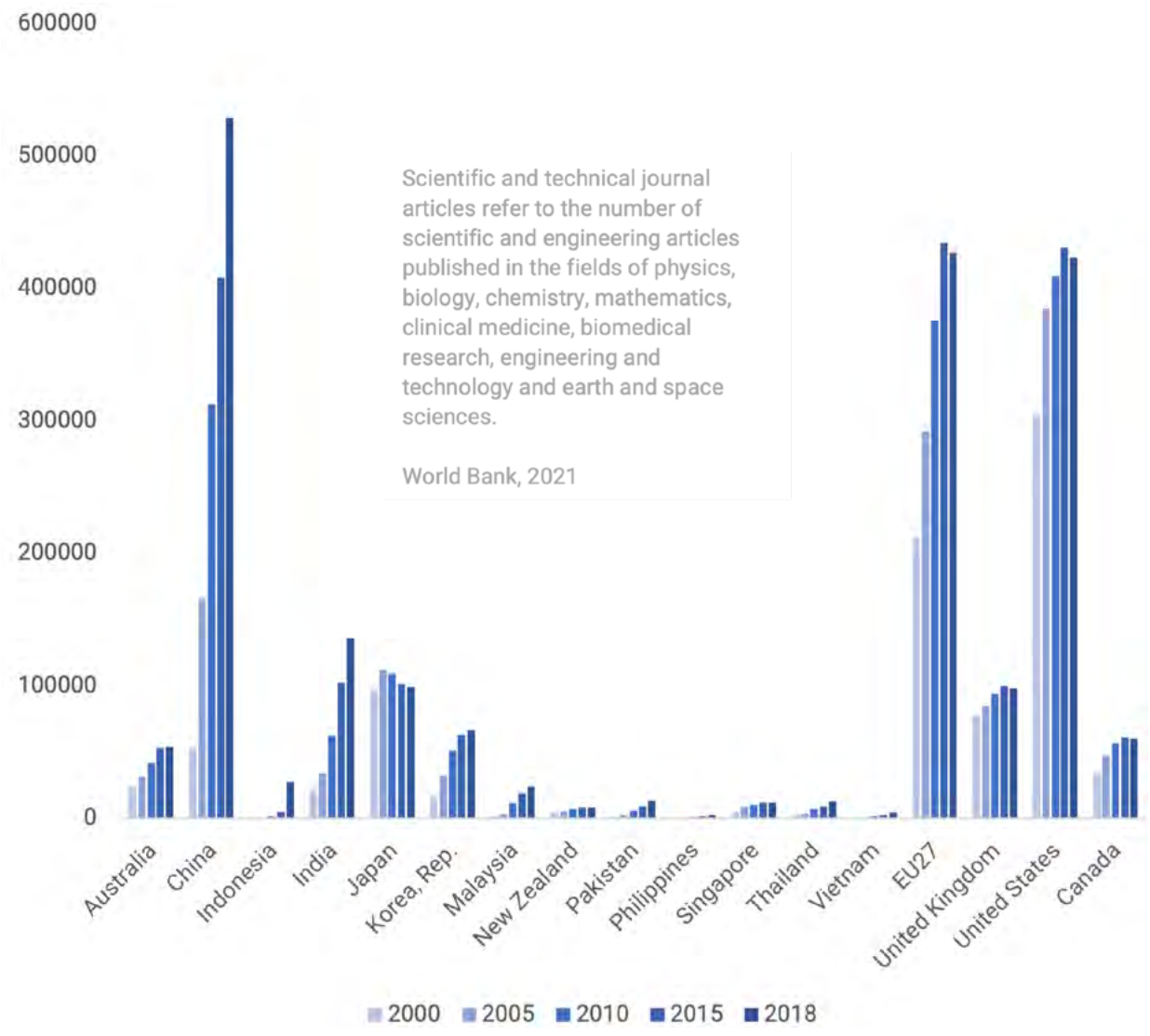


challenge but it does not have the luxury of a large-scale access to critical raw materials. Nevertheless, Japan has understood that its economic model rests on R&D. In the case of India, the 5th National Science, Technology and Innovation Policy calls for a different approach to historical pathways to boost public–private investment in R&D. The draft policy calls for incentives such as fiscal efficiency, the creation of a science and technology development bank, reducing the administrative burdens on researchers, etc.

High-technology interdependences

Another major trend in the Indo-Pacific is the growing importance of high-technology exports. Figure 4 shows the rate of change of high-technology exports as a share of overall manufactured exports. The largest exporters in this regard are Malaysia, Singapore, Vietnam, the ROK, and China, and in each case there can be said to exist steady increases of exports. The major exception is China but it still eclipses Canada, the EU27, the United Kingdom and the United States – both the EU and the US have experienced decreases in high-technology exports since 2008. Additionally, Thailand, Japan, and Indonesia have witnessed drops over the same period. Overall, Vietnam has witnessed the sharpest increase in high-technology exports through the production of electronics, integrated circuits, telephones, and broadcasting equipment.

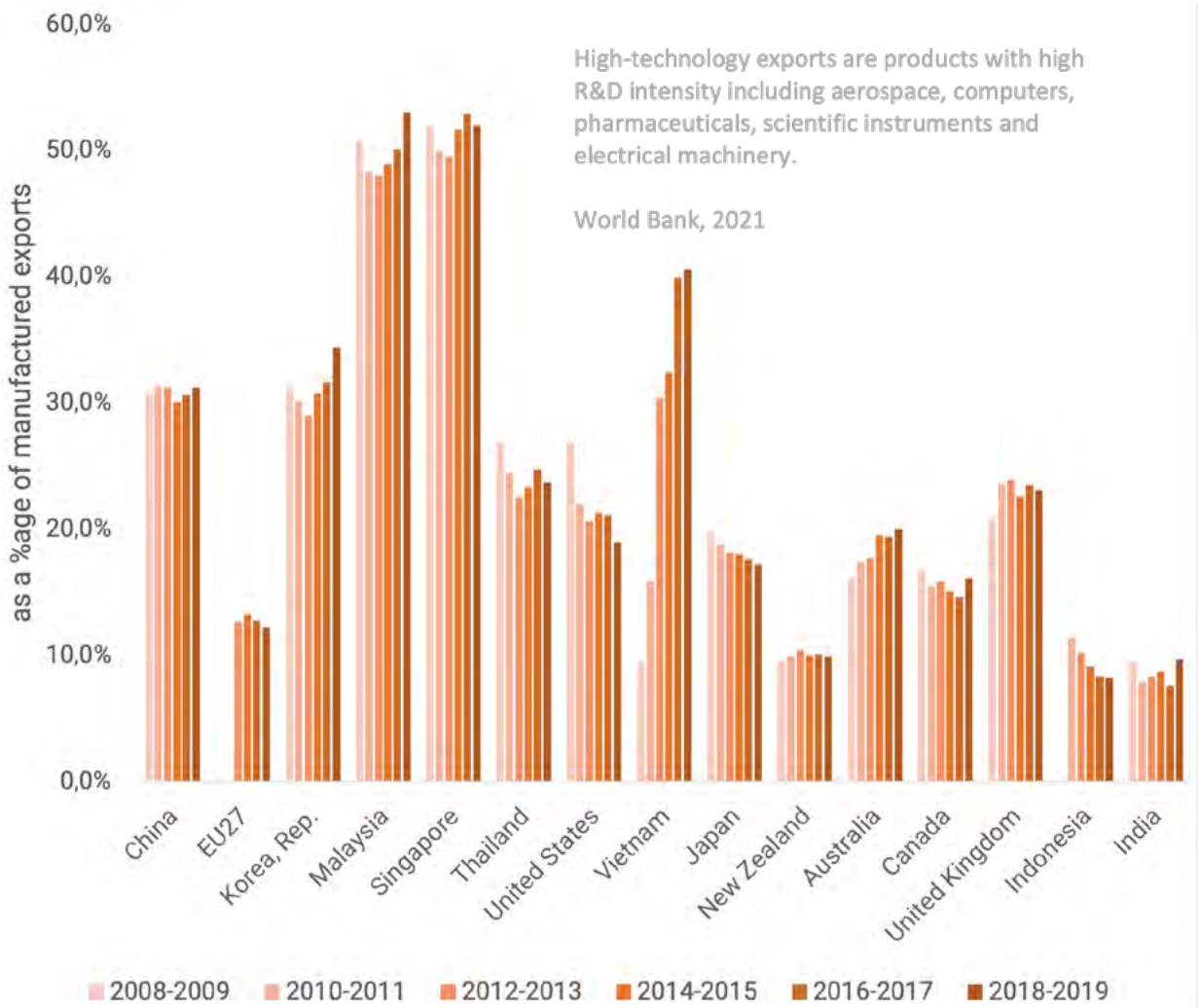
Figure 3 – Scientific and technical journal articles, 2000–2018



High-technology exports are important elements of the global value supply chain and they are good indicators of overall economic growth and competitiveness. High-technology goods cannot be produced without sufficient finances (capital formation), infrastructure (electricity), or skills (educated labour). Such exports also imply that any related IPRs have been sufficiently secured by the exporting state. What is more, the exportation of high-technology goods can enhance market openness and increase interdependence with importing nations. This can be positive as it creates efficient global supply chains, but it may create concerns in certain respects. For example, consider the security-related concerns attached to China's export of 5G technologies to the United States and Europe.

In the future, emerging technologies such as AI, automation, and robotics are likely to feature among the Indo-Pacific's high-technology exports. One index states that by 2030, China and developed states in Asia are likely to make the largest gains from investments in AI today. AI could help China potentially add $7 trillion to its economy, followed by $0.9 trillion in developed Asia, $3.7 trillion in the United States, and $2.5 trillion in Europe. A chief concern, however, is that China can use high-tech exports to the region to disseminate its technology and political norms, which are based on the idea that technology can be used for social and political surveillance and the control of freedom of expression. With high-tech exports also comes an opportunity to influence international regulation of the high-tech sector. This can be seen by Beijing's

Figure 4 – High-technology exports, 2000–2018



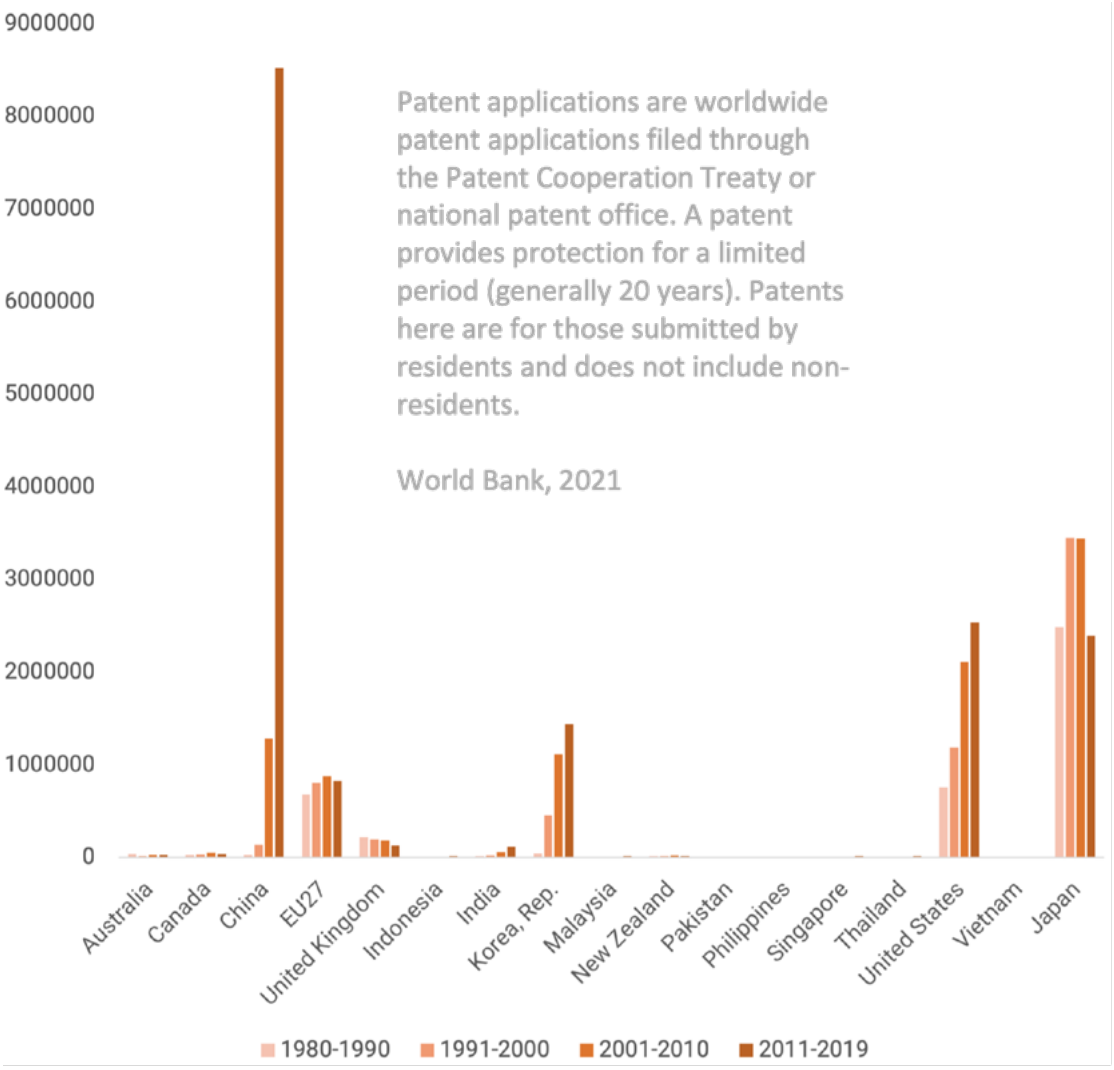
growing interest in fora such as the ITU, the United Nations Industrial Development Organisation, the World Intellectual Property Organisation, and the International Labour Organisation.

In addition to technology dissemination and norms, China also occupies a relatively advantageous position in global high-tech value chains. Beijing sits on approximately 80% of the global supply of rare earth elements, which are critical for the production of electrical power systems and magnets and, in turn, are used in the production of anything from smart phones to jet fighters. Even the manufacture of high-tech enablers such as semiconductors rely on China, the ROK, and Taiwan – 60% of total global fabrication of semiconductors occurs in Taiwan, and 53% are assembled there too. Despite steps by the US and Europe to lower their dependence on critical supplies and technologies from China, trade diversification will be challenging although it does offer Western countries an opportunity to enhance technological and economic ties with other Indo-Pacific states.

Patents and the protection of knowledge

The third major trend of the Indo-Pacific's sustained rise in technology and innovation relates to the protection of IPRs. Figure 5 shows that China already is by far the world's largest domestic patent applicant and this has only increased since 2010. The only other country in the region with sizeable patent applications is Japan, which has since 1980 actually witnessed a decline in overall patents. Since

Figure 5 – Patent applications (resident), 1980–2019



1980, Japan has filed more patent applications than the United States but the US has witnessed an overall increase in patent applications. The ROK is the third highest ranking state in the Indo-Pacific with regard to patent applications. What is an additional point to keep in mind is the technological sector or domain in which these patents are held. The ITU makes clear that China, Japan, and the ROK are leaders when it comes to patents in AI and these same countries are making strides in cloud services and computing – the region as a whole could more than double in 2025 to $300 billion.

Patents are important features of technological and innovation power. Patents are a way to control the diffusion and proliferation of technology, and for this reason they give a state the ability to ensure its own technological sovereignty and impose technology and research costs on adversaries. The control of patents need not lead to conflict, though. For example, India and Japan have co-operated on creating a pilot Patent Prosecution Highway (PPH), which is a bilateral agreement designed to speed up applications, raise awareness for IPRs, and exchange information on ITC infrastructure. However, overall only seven Indo-Pacific countries – Australia, Canada, Japan, the ROK, New Zealand, Singapore, and the US – have joined the Global PPH initiative and this notably leaves out China.

Yet we should be cautious about China's vast investment in patent applications and whether it can translate into giving Beijing unparalleled control over the use and dissemination of technologies. First, it is unclear what domestic patents are being granted for in China – small modifications to existing technologies or new technologies. Second, China grants patents in different ways to Japan, the US, or Europe. Third, patents will only confer political and commercial power if they are globally recognised and China still struggles to have domestic patents recognised in the US, Japan, and Germany .Even with these caveats in mind, having control of patents means that a country can enhance its options in the global technology value chain by diversifying goods and processes.

The consequences and burdens of technological mastery

In looking at some of the major technology and innovation trends associated with the Indo-Pacific out to 2030, this policy brief has looked at three trends: (1) technology and innovation investments; (2) high-technology exports; and (3) patents and intellectual property rights. Overall, the brief has shown how technology and innovation trends in the Indo-Pacific are not homogenous but many countries are actively seeking to boost their R&D standing through investments, partnerships, exports and regulation. The EU's engagement with the region will inevitably have to take into consideration the technological and innovation intricacies of individual countries and avoid a one-size-fits-all approach. It is necessary for the EU to recognise that technology and innovation are a fundamental basis for any discussion about multilateralism in the Indo-Pacific region. There is scope to invest in technology and innovation partnerships in the Indo-Pacific, while also promoting the EU's own technological sovereignty.

There are some specific points that should also be on the EU's agenda as it engages with the Indo-Pacific region. First, digital connectivity will persist in the region and overall this should enable ample opportunities for research and innovation partnerships and collaboration – this means having to invest in the EU's science diplomacy. Second, China's export of technology norms and its thirst to shape international technology regulations is a major challenge for the EU and multilateralism in the Indo-Pacific. The promotion and acceptance of authoritarian technology norms in the Indo-Pacific could undermine cohesion and security. The EU needs to work with partners to promote responsible technology use in the region. Third, without an efficient renewable energy transition in the Indo-Pacific technology and innovation are likely to be adversely affected. Thus, the EU cannot neglect the importance of its climate diplomacy in pushing for a more multilateral approach to the development of energy supply in the Indo-Pacific.

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