Chapter 7
The U.S.-China Tech War: A Dawn of New Geopolitics?

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In 2019 Donald Trump enacted first systematic sanctions against Huawei and ZTE – officially, to stop further expansion of Chinese technologies and standards for 5G telecommunication systems positioned by the White House as "insecure" and supporting Beijing's espionage capabilities. This step initialized process that was later labeled by some exerts as a "Technology War" (or shortly "The Tech War") – in association with the U.S.-China trade war that started in 2018 (Sun, 2019; Chang, 2020; Barkin, 2020; Danilin, 2020; Zhao, 2021). However, this new technology conflict may be rebranded as "Digital War" since it is focused on wide range of information and communication technologies (ICT): microelectronics, semiconductor manufacturing systems, telecommunication equipment, supercomputers, specialized software and internet solutions. An important separate accent is placed on digital technologies labeled by experts and media as emerging, disruptive, or transformative, like Artificial Intelligence (AI) and quantum computing that are seen as basic for the future markets and tech power.

Sharpened by rising political and security tensions, the Tech War enforced and reshaped ongoing changes in the U.S.-China relations (and with the West in general) with multiple global and regional (Asian and European) strategic implications. What is not less important, it seems that the Tech War marked new realm of the global politics – now seen also in Russia-West confrontation. Thus, understanding the Tech War, from its formal driving forces to political economy, is necessary for understanding not only U.S.-China relations, but also regional and global trends and future challenges.

The Economic Landscape of the Tech War

The fact that digital markets and information and communication technologies moved into the focus of a new economic conflict is both unsurprising and shockingly unexpected.

During last decades ICT evolved as key driving forces of global development, trade, and Post-Cold War globalization. Different OECD, UNCTAD and other studies

illustrate how ICT – and Internet in first place – drive GDP growth and qualitative changes in national economies by enhancing entrepreneurial activity, rise of labor productivity, supporting exports and other important economic and social processes (see, for example: UNCTAD, 2019; OECD, 2020). ICT are also important for the global trade and investments – outside of intensive use of digital technologies in financial sector and logistics. By different calculations, ICT are responsible for up to 12% of global exports in goods and approximately 11% in services – including more than 60% of the high-tech exports and about 20% of trade in knowledge-intensive services (OECD, 2020; National Science Board, 2020; The World Bank, 2021). Global electronic industry also played an important role in sharp rise of the Foreign Direct Investments (FDI) since 1990s.

These processes gained additional impetus in 2010s from the "smartphone revolution" and associate rise of the Internet – ICT-driven – global markets like e-commerce and social media, advancing the Digital Economy realm. By different calculations its size ranges from 4% ("narrow" definition – Internet markets with supportive ICT goods and services) and up to 25-30% (all ICT markets plus effects induced in other industries) of the global GDP (Barefoot et al., 2018; International Monetary Fund, 2018; UNCTAD, 2019).

Highly internationalized nature of the ICT markets and value chains was and still is promoted by strong global demand, differences in production costs, deepening specialization in production and research and development (R&D). All these factors are explained by a complex combination of the market forces and developmental efforts of different nation states to nurture prospective digital industries since 1970s. Modern production of ICT goods is geographically fragmented, but highly coordinated. ICT global value chains (GVC) are mostly concentrated in top-10 counties (United States, Japan, Republic of Korea, P.R.C., etc.), but different functions and centers of excellence are located almost everywhere, from Germany to Brazil, and from Singapore to Russia (UNCTAD, 2019). It is even more true for supportive businesses, not always integrated in corporate GVCs, like development of online games. Here we can see some unexpected locations like Belarus (Minsk High Technology Park).

ICT are also responsible for the important part of global innovations. If measured in most valuable patent families (registered in at least 2 of top-5 jurisdictions[1]) in

[1] U.S. Patent and Trademark Office, European Patent Office, Japan Patent Office, Korean Intellectual Property Office, and the National Intellectual Property Administration of People's Republic of China

2014-2017 globally ICT were responsible for 35,3% of all registered patents (OECD 2020). And this is not to mention wide use of different digital technologies in R&D, design, and other innovation-related activities. ICT and Internet businesses (also related to the non-digital industries like healthcare or education) are also key area of the global venture investments (Pitchbook, 2020; National Venture Capital Association, 2021; KPMG, 2021).

And in the long term, further rise of the ICT's role in the global economy is inevitable, especially considering Internet of Everything and AI as almost classic general purpose technology (Jovanovic and Rousseau, 2005; Bresnahan, 2010).

The role of the ICT is especially important when we analyze Chinese and American economies and bilateral economic relations.

In China, ICT supports more than 30% of the nation's export of goods (around 40% of the global ICT exports), making it an important source of revenues (National Science Board, 2020; World Bank, 2021). It is also a critical factor of internal development considering both ongoing digitalization of Chinese economy[2] and the fact that digital industries were and still are the most innovative sector of the P.R.C. economy. Quite predictably, China is trying to strengthen its potential in most advanced digital areas also considering its implications for traditional hard power.

In turn, the U.S.A. was always emphasizing ICT as one of its globally most competitive industries and important part of national economy (up to 10% or more considering both traditional ICT and internet markets with profound economic impact on other industries). America still has strong market positions (up to 50-100% of global sales) in some most technologically advanced areas, from operating systems to the most sophisticated electronic components (UNCTAD, 2019; Semiconductor Industry Association, 2020; OECD, 2020). U.S.A. also leads in digital venture activities, as well as in research and development efforts (National Science Board, 2020; National Venture Capital Association, 2021). The industry was always seen as strategic for both economic development and defense, as was well shown by activities of CoCom and the U.S.-Japan relations in 1980s (see below).

Importance of the ICT for both nations predefined dialectic nature of their digital interactions.

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[2] On different activities related to development and scaling-up of internet technologies in the P.R.C. see, for example, official web-page of the Chinese national program "Internet Plus" (English version of the web-site of the State Council of the People's Republic of China: https://english.www.gov.cn/2016special/internetplus/).

On one hand, China's ambitions are focused at re-mastering GVC architecture and redistribution of the global value add in the digital sector, while for the United States maintaining its technological dominance is critical for market power. Both nations are also aiming at future disruptive digital technologies and markets that are important for economic growth and global leadership.

On the other, even setting aside consumer electronic exports, China and the United States are closely intertwined in the digital area. Despite China is seen as an electronic powerhouse, it is still very dependent on key U.S. and other Western technologies, from high-performance chips and up to semiconductor manufacturing equipment. It is well illustrated by the sizeable P.R.C. imports of microelectronics (up to 60% of world's total) with only about 15% of the needed components produced in the Mainland China (mostly less sophisticated ones) (Semiconductor Industry Association, 2020; IC Insights, 2021; Xi, 2021; Thomas, 2021; Grimes and Du, 2022). Chinese companies also use Windows, Android, and other American software and only now seem to develop alternatives. For many American businesses, in turn, Chinese market is important (Apple, Microsoft and others) or even the biggest one (e.g., for Qualcomm or Texas Instruments). R&D and other innovation cooperation is important too – especially for giants like Google and Intel or Huawei and BOE Technology Group. For the U.S. companies, Chinese growing S&T sector is a new source of talents and other inputs by reasonable price, while for the P.R.C. advanced American competences and technologies are critical for development.

This digital dualism illustrates the Tech War dilemma.

Considering future markets and global leadership at stake, some kind of conflict over ICT markets seemed to be structurally inevitable. However, the Tech War as an ultimate form of it was not unavoidable or predictable. GVC in the digital area with all its flexibility were and still are structurally very interdependent, ICT markets are necessarily global, while production and innovation activities of both U.S.A. and China are increasingly interconnected. So, hypothetically in some "ideal futures" the two nations may have been complementary competitors ("coopetitors").

This is especially true since the U.S. technology sector is highly dynamic and flexible, whereas the Tech War itself doesn't support American innovation capacity (Gewirtz, 2019; Manuel and Hicks, 2020; Goodrich and Su, 2020). What is even worse, the Tech War may result in what the U.S. tries to prevent – i.e., rise of China as a global center of advanced electronics and digital innovation. Chinese "smart response" (investments in human capital, R&D, etc.) to the U.S. sanctions is already beefing up Chinese innovation, technological, and manufacturing capacities. And full technology blockade was always a

very problematic issue, while evading sanctions is rather a technical issue (also through informal import of competences like in case of P.R.C.'s «buying out» Taiwanese experts in microelectronics (Cheng, 2020)).

However, the problem is that the Tech War is not – and never was – purely economic phenomenon, but a highly securitized aspect of a new "Great Game" of the superpowers.

Casus Belli

The U.S. post-Cold War restrictions on trade and cooperation with the P.R.C. in different dual-use or strategic high-tech areas like aerospace were always present (Petland, 2011; Nelson, 2014). For the ICT a change in mode of bilateral relationships occurred since early 2010s. Several major reasons pushed the United States to a harder course toward China.

First of all, 2010s witnessed sharp rise of Chinese manufacturing and innovation capacity. The best illustration of changes that occurred was the rise of Huawei empire. The company developed competitive telecommunication equipment (including viable 5G standards), advanced Kirin chip design, and globally recognizable smartphone brand. P.R.C. digital prowess revealed itself also in booming patenting and publication activities in different areas related to the emerging technologies like AI (WIPO, 2019; Savage, 2020; Correia and Reyes, 2020).

A closely related factor was P.R.C. ambitious policies for digital development. As many other catching-up nations, Chinese elites accented so-called developmental state practices with strong neo-techno nationalist accents (Ostry and Nelson, 1995; Nakayama, 2012; Wade, 2018; Manning, 2019; Capri, 2020). Correlated with import substitution macro-strategy, neo-techno nationalism exploits specific conditions of the economic globalization (intensified FDI, trade, etc.) for strengthening national technological sovereignty in areas considered to be critical for long-term sustained economic growth and security. Among other instruments, this neo-techno nationalist/developmental focus resulted in the extensive use of practices considered by the Western nations as unfair (forced technology transfer in what may be called as "compulsory offset deals"; guarding some national "strategic" markets – including the Internet ones, excessive state support and protectionism, and more). The ICT as critically important sector was at the center of these efforts – with electronic industry and national telecomm standards among most known examples (Shim and Dong, 2016; Lee and Kwak, 2020; Capri, 2020). With time archaic XX-century-styled industrial policy instruments were supplemented with

advanced measures to support human capital, venture ecosystems, science parks, and other important elements of national innovation systems. Still, even then excessive public interventions were the case – from restrictions on foreign investments and up to different preferences to the state-owned enterprises or privately-owned "national champions". For many years sales on the fast-growing Chinese market were seen as an adequate compensation for these risks, while P.R.C. tech challenge was not seen as critical. But rise of the science and technology power and new ambitious goals of the Chinese leadership in 2010s changed minds of the Western decision makers. And especially it was true for the U.S.A. that anticipated rivalry between the two superpowers. As a trigger of change, one may mention "Made in China 2025" program adopted in 2015. The initiative was condemned by many American politicians and part of the expert community, and provoked some concerns on the U.S. business side. "Made in China 2025" even became part of the American agenda on negotiations to settle the U.S.-China trade dispute in 2019 (U.S. Chamber of Commerce, 2017; Laskai, 2018; U.S. Congress, 2019; Cafruny, 2019; Wei, 2019; Davis and Wei, 2019; Cory and Atkinson, 2020; Ding and Dafoe, 2021).

Another issue – also related to a proactive P.R.C. economic policy – was Chinese investment expansion on the Western markets, especially since 2008-2009 crisis. Among other assets, in focus were American and European established technology companies, including global leaders like American Broadcom Inc. or German Kuka Roboter. And it is important to mention that at least some of these strategic assets were targeted by the Chinese state-owned or state-related enterprises (CFIUS Scoreboard, 2018). In search for new business ideas, technologies, and "entry tickets" to the Western markets Chinese entities intensified investments in the U.S. venture sector – especially since 2015, with peak in 2017 (more than 400 deals and about $6.5bln invested) (Gonzales and Ohara, 2018; Ruehl et al., 2019). Despite the reason for this investment "invasion" were economic (also considering developmental logic), its possible strategic consequences challenged U.S. interests (Bradsher and Mozur. 2016; Bellinger et al., 2016).

Finally, traditional hard power and strategic considerations play a role. Here special concern of the U.S.A. was P.R.C. technology transfer from the civilian to the military sector, reformulated by Xi Jinping in a so-called Civilian-Military Fusion strategy (Besha, 2011; Lafferty, 2019; Bitzinger, 2021; Kania and Laskai, 2021). The new policy was neither totally unexpected, nor all-embracing or super effective. More than all, it was not something unseen, since Beijing simply tried to make a Chinese version of well-established U.S. practices of tech dialogue and cooperation between defense and civilian sectors. But

in a general context of bilateral relationship, it strengthened American suspicions against China, its digital companies, and became (at least officially) an important factor for the Tech War (Manuel and Hicks, 2020; U.S. Department of Defense, 2020).

Unsurprisingly, since the beginning of 2010s political elites in Washington, as well as defense and intelligence community paid more attention to the Chinese "Digital Challenge" outside of traditional dual-use and defense technologies. For example, in October 2012 the U.S. House Permanent Select Committee on Intelligence started investigation on potential security risks of Huawei and ZTE technologies.

But most visibly this new trend revealed itself in the evolution of activities of the Committee on Foreign Investment in the United States (CFIUS) (Bellinger et al. 2016; Bradsher and Mozur. 2016; CFIUS Scoreboard, 2018). During 2010s up to 16-20% of all CFIUS reviews were allegedly related to the Chinese acquisitions – with rising number of high-tech cases. Number of ICT-related deals abandoned because of the CFIUS position also rose since 2015-2016. Among most known were failed bids of Tsinghua Unigroup for Micron and for 15% stake of Western Digital, and GO Scale Capital for Lumileds. However, until the end of 2016 CFIUS mostly applied "soft" approach. It didn't overreacted and was able to stop unwanted deals just by signaling its position to the sides (e.g., communicating concerns or hinting on "expected" prohibition of a deal). Situation changed in December 2016. CFIUS recommended to reject, and President Barack Obama prohibited acquisition of the U.S. business of German Aixtron SE (semiconductor equipment manufacturer, also an important supplier for the U.S. military aerospace) by Fujian Grand Chip Investment, blocking the whole deal (Bellinger et al., 2016). It seemed to be a kind of landmark or symbolic decision indicating the changes occurred, especially since it was only third time in two decades when U.S. Government blocked Chinese acquisition.[3]

The winds changed in other areas too, revealing new U.S. technology containment policy – absent in high-level documents like National Security Strategies, but felt in de-facto agendas of key federal agencies and U.S. Congress (like Wolf Amendment, cutting NASA's cooperation with China since FY2012). It was also in line with general U.S. trade and investment policies clearly focused at reduction of China's economic and strategic influence, from the U.S.-India dialogue and up to negotiations on Transatlantic

[3] First one was in 1990 (bid for specialized aircraft parts producer MAMCO Manufacturing Inc.by state-owned CATIC), and the second in 2012 (construction of a wind farm near the U.S. Navy base by Ralls Corp.)

Trade and Investment (TTIP) and Trans-Pacific (TAP) Partnerships.[4]

So, when Donald Trump, a long-standing critic of Chinese policies, entered the White House, the stage for the technology war was already settled. Still, it was Trump who shaped the Tech War – presumably, also because he was less associated with the traditional political elites and thus not so constrained with established practices or international political "etiquette".

Political Economy of The Tech War: First Modern Conflict?

Political economy of the Tech War may be conceptualized using existing body of knowledge about sanctioning policy (see, for example: Kaempfer and Lowenberg, 2007; Hufbauer et al., 2008). There were at least three blocks of rationales and goals, reflecting both traditional practices – always present in the economic confrontation of superpowers, as well as the post-Cold War realities.

First of all, there are rationales and efforts that may be labelled as "realist". Following M. Mastanduno's framework, we may identify it as a combination of a "strategic embargo" (halting exports of defense or critical dual-use technologies) and "economic war" (restrictions on the transfer of technologies important for long-term rise of adversary's total capacity) (Mastanduno, 1985). From a formal point of view, a separate block of rationales is presented by the cyber-security challenges, a specific XXI-century concern. But it is still very "realist" in nature since it is linked to the hard power issues.

Second block relates to the values and human rights. Here we may find "punishment" and denouncements for alleged digital oppression against Uyghur minorities, as well as for general efforts to build Chinese Surveillance State (Barnes, 2021; Chan, 2021; CNBC, 2021). In both cases the rationales may be linked either to the Post-Cold War value-based policy concept, or with established "moral opposition to the repressions", that existed in the U.S. policies for decades (e.g., American sanctions for the U.S.S.R.'s Jewish immigration policies). It is worth noting that in Chinese own views this block is also seen as "realist", just disguising the "economic war" efforts.

Finally, there was a competitiveness rationale, mostly focused on stopping P.R.C. "unfair" trade and investment practices. Almost invisible in official statements and documents, as well as in the actual sanctions, it was and still is real and important. Once

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[4] See, for example Barack Obama's statement on Pacific trade agreement in his 2015 State of the Union Address: China wants to write the rules for the world's fastest-growing region. That would put our workers and our businesses at a disadvantage. Why would we let that happen? We should write those rules" (Obama, 2015).

again, depending on the point of view associated measures may be interpreted either as supporting "level playing field" on Chinese and global markets, or as preventing further rise of the Chinese tech companies - as competitors for the American ones and source of financial and digital power to the P.R.C.

Most of these goals and rationales look very familiar. On one hand, we may see clear similarities between the Tech War and the Cold War – mostly because in both cases we may see confrontation between the superpowers and capacity-affecting measures. The economic war also gains some resemblance with other geopolitical conflicts of the last decades, including U.S. policies on Iran, North Korea, and Post-Crimea Russia. On the other hand, some clear parallels may be also drawn between the 2018-2021 situation and the U.S.-Japan conflict over semiconductor and electronics markets in late 1970s - early 1990s.

However, a more detailed analysis reveals that in reality the Tech War has rather eclectic nature with notable difference between these two structural conflicts of the XX century.

U.S.S.R. never considered commercial high-tech markets in general – and civilian digital technologies in particular – as factor enhancing its power or an important source of revenue for development. Despite there were attempts to rise Soviet commercial high-tech export to the West,[5] it never was top priority and had almost zero economic consequences. In its foreign economic policy, also in high-tech area, U.S.S.R. accented rather formation of an "alternative" trade and financial/investment system (See, for example, brilliant economic history compendium: (Khanin, 2008)). This situation was explained by both geopolitical and economic reasons. Any normal trade and investment relationships between the U.S.S.R. and capitalist economies during the Cold War were unrealistic. So was the scalable Soviet commercial high-tech exports and competition with the West. Soviet commercial high-tech sector was chronically underinvested and lacked dynamism due to the specifics of the socialistic economy and economic ideology accenting industrial supply (so-called "A-category goods") and defense sector. The only areas of the science and technology competition with the West were politically symbolic dual-use areas like space or high-energy physics with very small or none commercial potential.

On the contrary, Japan accented commercial sector. Since at least the middle of 1980s

[5] Sony's co-founder and Chairman Akio Morita was even asked to advise Soviet top industrial officials how to commercialize small TV sets on the capitalistic markets (Morita, 2014).

some experts and politicians speculated about possible role of Japanese digital and other high-tech prowess as factor of defense and security capacity and geopolitical influence (Vogel, 1989; Ishihara, 1991). But even the possibility of this power transmutation was challenging. And it is still questionable whether Japan in this period could and want to (considering its own national interests and available resources) reinstate its role in the global politics and international relations – not even saying about challenging U.S. hegemony. Interesting, but it seems that power and security implications of the semiconductor conflict were seen mostly on the American, not Japanese side. Part of the defense community interpreted possible U.S. dependence on the imported strategic electronic components as a risk in case of war, while different elite groups considered broader competitiveness issues as a challenge to the U.S. hegemony.[6]

Neo-techno nationalist challenge of China intertwined with rise of its regional and global strategic role looks different from both the U.S.S.R. and Japanese cases. So is the U.S. Tech War countermeasures that are neither CoCom[7]-styled technology sanctions, nor the analogue of the 1980s semiconductor conflict with Japan.

This eclectic nature of the Tech War is not accidental but reveals changes in global politics and economy induced by the digital transformation and reactions of the elites on this new realm.

In a world with growing importance of the high-tech sectors in global GDP, trade, and development, emerging and advanced technologies proved to be not only key source of competitiveness, but also a factor of building power architectures. Outside of defense/security issues and capacity building this also relates to the control over critical technologies and GVC elements as factor influencing capacity development of the third parties (as in case of halting ASML's EUV export to China). The market dominance affects (re)construction of power and leadership too: amid profits it also provides preferential access to the talents and raw data as critical competitiveness factors in the digital economy.

Despite most of these phenomena aren't new, in the realm of digitalizing economy they gain more importance – economic and (geo)political. In the latter case what makes difference is raising securitization and weaponization of digital (especially emerging)

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[6] Both these ideologies were reflected in the emergence of the SEMATECH consortia supported by the federal authorities in response to the Japanese semiconductor "invasion" " (see, for example: Charles, 1988).

[7] Coordinating Committee for Multilateral Export Controls. On history and basic activities of the CoCom see: (Office of Technology Assessment, 1979: 153-179).

technologies. Despite new technology developments – critical or other "game-changing" – were always securitized, in 2010s this process was reinforced by several factors. One was hype-styled "technology revolution" narratives – from the Industry 4.0 and up to speculations on the AI (Anton et al., 2006; Brynjolfsson and McAfee, 2016; Rifkin, 2014; Schwab, 2017). The other was the return of trade/investment conflicts and revised protectionism from a forgotten past of 1980s to perilous present and nascent future of the international relations– presumably, a consequence of imperfect national reactions on rising global competition (Evenett, 2019). Finally, there were some specific political and economic challenges, like American fears of losing markets and employment to the developing nations, or Chinese ideology of "catching up and surpass [the West]" ("ganchao") (Atkinson and Ezell, 2012; Gewirtz, 2019).

This tandem of traditional securitization and "revolutionary" concepts enhanced by other economic factors explains also the Tech War as a specific form of innovation conflict between the two superpowers. Both sides obviously see it as a zero-sum game rather than coopetition,[8] since future and global leadership are not tradable.

As a result, digital technologies and global markets are more and more interpreted not only as strategic resources for capacity formation or competitiveness, but also as factors of institutional and structural power[9] (Ding and Defoe, 2021). Here we may see almost H. Mackinder's ideology for the digital era ("who controls [digital technology] x, controls the world"). It is well illustrated by the confrontation over 5G, microelectronics, AI – and by efforts to localize "critical" tech infrastructure in both China and the U.S.A. as factor of "control" and tech sovereignty (see, for example, on the U.S. efforts: (Clark and Swanson, 2020; Rampton, 2020; The White House, 2022)). Not less important, this vision is shared by elite groups in other parts of the world. One can remember Russian President Vladimir Putin's speech in 2017, full of veiled criticism of the U.S. digital "monopolistic" ambitions, where he stated: "The one who will become a leader in this [AI] area will be the master of the world" (RIA Novosti, 2012). Alike sentiments are also felt in the E.U. – especially in European digital sovereignty concepts (for E.U. concepts see: (European Union, 2019; Hobbs, 2020; Komaitis and Sherman, 2021)).

This complex political economy of the Tech War, in turn, presumably represent new

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[8] Cooperation and competition among companies – see on the state of research on this phenomenon (Gernsheimer et al., 2021).

[9] A de-facto interpretation of digital tech as a form of structural and institutional power may be seen in the discussions on 5G. On classification and characteristics of different forms of power see (Barnett and Duvall, 2005).

step in *marketization* of geopolitics in the knowledgeable global economy. Amid growing importance of technological issues, we see how traditional *technological restrictionism* of the strategic embargoes and economic wars of the past is slowly evolving into the *innovation expansionism* (factor of market/innovation dominance and structural power). Setting aside regional technology blocks, data colonialism, and other possible outcomes, in a very dialectic manner this outward-oriented ideology also presupposes strong neo-techno nationalist sentiments as factor defending national technology sovereignty. And despite Russia-West confrontation may for some time reverse these transformations toward more traditional geopolitical strategies, it seems that the future of geopolitics will be much more intertwined with the digital technologies and generally high-tech. Considering its dynamism, role in GVCs, and renewed technology competitiveness, Asia will be at the heart of these new processes: as an epicenter of digital transformation, battleground in this new Great Game, and "living lab" or trend-setter of techno-geopolitics. This forms new challenges and risks for Japan and other Asian nations – but new opportunities as well.

References:

Anton, P.S., Silberglitt R. & Howell D.R. et al. (2006). *The Global Technology Revolution 2020, In-Depth Analyses. Bio/Nano/Materials/Information Trends, Drivers, Barriers, and Social Implications.* RAND Corporation, Document # MR-1307-NIC. Available at: http://www.rand.org/content/dam/rand/pubs/technical_reports/2006/RAND_TR303.pdf [Accessed: Nov. 1, 2021].

Atkinson, R.D. and Ezell, S.J. (2012). *Innovation Economics: The Race for Global Advantage.* New Haven, Yale University Press.

Barefoot K., Curtis D., Jolliff W., Nicholson J.R., Omohundro R. (2018). Defining and Measuring the Digital Economy. Working Paper, *The Bureau of Economic Analysis*, U.S. Department of Commerce. Available at: https://www.bea.gov/system/files/papers/WP2018-4.pdf [Accessed: Nov.14, 2021].

Barkin, N. (2020). Export controls and the US-China tech war. *MERICS China Monitor.* Available at: https://merics.org/en/report/export-controls-and-us-china-tech-war [Accessed: Oct.10, 2021].

Barnes J.E. (2021). U.S. Cracks Down on Firms Said to Aid China's Repression of Minorities. *The New York Times,* Dec. 16. Available at: https://www.nytimes.com/2021/12/16/us/politics/us-china-biotech-muslim-minorities.html [Accessed: Dec.21, 2021].

Barnett, M., & Duvall, R. (2005). Power in international politics. *International organization,* 59(1): 39-75. DOI: 10+10170S0020818305050010.

Bellinger III, J.B., Barker J.P., Blanchard C.A., Lee R.D., Reade C.E., Perkins N.L., Townsend N.L., McSorley T. (2016). Presidential Prohibition of Chinese Company Purchase of Semiconductor Firm Highlights Increased U.S. Government Scrutiny of Chinese Investments. *Arnold & Porter,* Dec. 21. Available at: https://www.arnoldporter.com/en/perspectives/publications/2016/12/presidential-prohibition-of-chinese [Accessed: Dec.21, 2021].

Besha, P. (2011) Civil-Military Integration in China: A Techno-Nationalist Approach to Development. *American Journal of Chinese Studies*, 18(2): 97-111.

Bitzinger, R.A. (2021). China's Shift from Civil-Military Integration to Military-Civil Fusion. *Asia Policy*, 16 (1): 5-24. DOI: 10.1353/asp.2021.0001.

Bradsher K., Mozur P. (2016) Political Backlash Grows in Washington to Chinese Takeovers. *The New York Times,* Feb. 16. Available at: https://www.nytimes.com/2016/02/18/business/dealbook/china-fairchild-semiconductor-bid-rejected.html [Accessed: Oct.20, 2021].

Bresnahan, T. (2010). General purpose technologies. In: *Handbooks in Economics*. Vol.2. / Hall B.H., Rosenberg N. (Eds.). North Holland: Elsevier. P. 761-791.

Brynjolfsson, E., McAfee, A. (2016). *The Second Machine Age.* N.Y.: W. W. Norton&Company.

Cafruny, A. W. (2019). Can the United States Contain China? *Russia In Global Affairs*, 17 (1): 100-122. DOI: 10.31278/1810-6374-2019-17-1-100-122.

Capri, A. (2020). Techno-nationalism: The US-China Tech Innovation Race. New Challenges for Markets, Business and Academia. *Hinrich Foundation Report.* Available at: https://research.hinrichfoundation.com/hubfs/White%20Paper%20PDFs/US-China%20innovation%20race%20(Alex%20Capri)/Hinrich%20Foundation%20-%20Techno-nationalism%20and%20the%20US-China%20tech%20innovation%20race%20-%20Alex%20Capri%20-%20August%202020.pdf [Accessed: Sept.15, 2021].

CFIUS Scoreboard (2018). *U.S.-China Transactions Jan.2014-September 2018.* Pillsbury Winthrop Shaw Pittman LLP. Available at: https://www.pillsburylaw.com/images/content/1/1/119897.pdf [Accessed: Oct.1, 2021].

Chan V. (2021) U.S. to Add SenseTime to Investment Blacklist Ahead of IPO. *Bloomberg,* Dec.9. Available at: https://www.bloomberg.com/news/articles/2021-12-09/u-s-to-blacklist-sensetime-ahead-of-hong-kong-ipo-ft-reports [Accessed: Dec.11, 2021].

Chang, G.G. (2020). *The Great U.S.-China Tech War*. Encounter Books.

Charles D. (1988). Reformers Seek Broader Military Role in Economy. *Science*, 241 (4867): pp. 779-781. DOI: 10.1126/science.241.4867.779.

Cheng, T.-F. (2020). China Hires over 100 TSMC Engineers in Push for Chip Leadership, *Nikkei Asian Review,* August, 12. Available at: https://asia.nikkei.com/Business/China-tech/China-hires-over-100-TSMCengineers-in-push-for-chip-leadership [Accessed: Sept.13, 2022]

Clark, D., Swanson, A. (2020). T.S.M.C. Is Set to Build a U.S. Chip Facility, a Win for Trump. *The New York Times,* May 14. Available at: https://www.nytimes.com/2020/05/14/technology/trump-tsmc-us-chip-facility.html [Accessed: Sept. 18, 2021].

Correia, A., Reyes, I. (2020). *AI research and innovation: Europe paving its own way.* European Commission, R&I Paper Series, Working Paper 2020/15. Luxembourg: Publications Office of the European Union. DOI: 10.2777/264689.

CNBC (2021). U.S. adds 14 Chinese companies, to economic blacklist over Xinjiang. *CNBC,* Jul 10. Available at: https://www.cnbc.com/2021/07/10/us-adds-14-chinese-companies-to-economic-black-list-over-xinjiang.html [Accessed: Oct.16, 2021].

Cory, N., Atkinson, R.D. (2020). Why and How to Mount a Strong, Trilateral Response to China's Innovation Mercantilism. *Information Technology & Innovation Foundation*. Available at: itif.org/sites/default/files/2020-trilateral-china.pdf [Accessed: July 30, 2021].

Danilin, I.V. (2021). The U.S.-China Technological War: Digital Technologies as a New Factor of World Politics? *Russia in Global Affairs*, 19 (4): 78-96. DOI: 10.31278/1810-6374-2021-19-4-78-96.

Davis, B., Wei, L. (2019). China's Plan for Tech Dominance Is Advancing, Business Groups Say. *The Wall Street Journal,* Jan. 22. Available at: https://www.wsj.com/articles/u-s-business-groups-weigh-in-on-chinas-technology-push-11548153001 [Accessed: Sept. 30, 2021].

Ding, J., Dafoe, A. (2021). The Logic of Strategic Assets: From Oil to AI. *Security Studies*, 30(2): 182-212. DOI: 10.1080/09636412.2021.1915583.

European Union (2019). Expanding the EU 's Digital Sovereignty. *Official website of Germany's Presidency of the Council of the European Union*, 27 October. Available at: www.eu2020.de/eu2020-en/eu-digitalisation-technologysovereignty/2352828 [Accessed: July 30, 2021].

Evenett, S., J. (2019). Protectionism, State Discrimination, and International Business since the Onset of the Global Financial Crisis. *Journal of International Business Policy,* 2(1): 9–36. DOI:10.1057/s42214-019-00021-0.

Gernsheimer, O., Kanbach, D.K., Gast, J. (2021). Coopetition research - A systematic literature review on recent accomplishments and trajectories. *Industrial Marketing Management*, 96:113-134. DOI: 10.1016/j.indmarman.2021.05.001.

Gewirtz, J.B. (2019). China's Long March to Technological Supremacy. *Foreign Affairs*, 27 August. Available at: www.foreignaffairs.com/articles/china/2019-08-27/chinas-long-march-technological-supremacy [Accessed: July 30, 2021].

Gonzales, J., Ohara, F. (2019). Chinese venture investments in the United States, 2010–2017. *Thunderbird International Business Review,* 61 (2): 123-131. DOI: 10.1002/tie.22017.

Goodrich J., Su Z. (2020). The U.S. Should be Concerned with its Declining Share of Chip Manufacturing, Not the Tiny Fraction of U.S. Chips Made in China. *Semiconductor Industry Association,* July 10. Available at: https://www.semiconductors.org/the-largest-share-of-u-s-industry-fab-capacity-is-in-the-united-states-not-china-lets-keep-it-that-way/ [Accessed: Aug. 1, 2021].

Grimes, S., Du, D. (2022). China's emerging role in the global semiconductor value chain. *Telecommunications Policy*, 46 (2). DOI: 10.1016/j.telpol.2020.101959.

Hobbs, C. (ed.) (2020). Europe's Digital Sovereignty: From Rulemaker to Superpower in the Age of U.S.-China Rivalry. *The European Council on Foreign Relations*. Available at: www.ecfr.eu/page/-/europe_ digital_sovereignty_rulemaker_superpower_ age_us_china_rivalry.pdf [Accessed: July 30, 2021].

Hufbauer, C.G., Schott, J., Elliott, K.A. and Oegg, B. (2008). *Economic Sanctions Reconsidered*. 3rd Edition. Washington, DC: Peterson Institute for International Economics.

IC Insights (2021) China Forecast to Fall Far Short of its "Made in China 2025" Goals for ICs. *IC Insights Research Bulletin,* Jan. 06. Available at: https://www.icinsights.com/data/articles/documents/1330.pdf [Accessed: July 30, 2021].

International Monetary Fund (2018). Measuring The Digital Economy. *The IMF Staff Report*. Available at: https://www.imf.org/en/Publications/Policy-Papers/Issues/2018/04/03/022818-measuring-the-digital-economy [Accessed: Dec.12, 2021].

Ishihara, S. (1991). *The Japan That Can Say No: Why Japan Will Be First Among Equals.* New York: Simon & Schuster.

Jovanovic, B., Rousseau, P.L. (2005). General purpose technologies. In: *Handbook of Economic Growth*, Vol. 1B / Aghion, P., Durlauf, S.N. (Eds.). Elsevier B.V. P. 1181-1224.

Kaempfer, W.H., Lowenberg, A.D. (2007). The Political Economy of Economic Sanctions. In: *Handbook of Defense Economics*, Vol. 2. / T. Sandler and K. Hartley (eds.).

Amsterdam: Elsevier, pp. 867-911. DOI: 10.1016/S1574-0013(06)02027-8.

Kania, E.B., Laskai, L. (2021). Myths and Realities of China's Military-Civil Fusion Strategy, *Center for a New American Security*. Available at: https://www.cnas.org/publications/reports/myths-and-realities-of-chinas-military-civil-fusion-strategy [Accessed: Nov. 11, 2021].

Khanin, G.I. (2008). *Ekonomicheskaya istoriya Rossii v noveishee vremya* [Economic History of Russia in Modern Times], Vol. 1. Novosibirsk: Novosibirsk State Technical University. (In Russ.).

Komaitis, K., Sherman, J. (2021). US and EU tech strategy aren't as aligned as you think. *The Brookings Institution.* Available at: https://www.brookings.edu/techstream/us-and-eu-tech-strategy-arent-as-aligned-as-you-think/ [Accessed: Oct.30, 2021].

KPMG (2021) Venture Pulse Q4. *KPMG Private Enterprise.* Available at: https://assets.kpmg/content/dam/kpmg/xx/pdf/2021/01/venture-pulse-q4-2020-report-asia.pdf [Accessed: Nov.12, 2021].

Lafferty, B. (2019). Civil-Military Integration and PLA Reforms. In: *Chairman Xi Remakes the PLA* / Phillip C. Saunders, Arthur S. Ding, Andrew Scobell, Andrew N.D. Yang, and Joel Wuthnow (Eds.). National Defense University Press. Pp.: 627-660. Available at: https://ndupress.ndu.edu/Portals/68/Documents/Books/Chairman-Xi/Chairman-Xi.pdf [Accessed: Nov. 5, 2021].

Laskai, L. (2018). Why Does Everyone Hate Made in China 2025? *Council on Foreign Relations,* March 28. Available at: https://www.cfr.org/blog/why-does-everyone-hate-made-china-2025 [Accessed: Nov.10, 2021].

Lee, H.; Kwak, J. (2020). The Changing Patterns of China's International Standardization in ICT under Techno-nationalism: A Reflection through 5G Standardization. *International Journal of Information Management*, 54. DOI: 10.1016/j.ijinfomgt.2020.102145.

Manning, R. (2019). Techno-Nationalism vs. the Fourth Industrial Revolution. *Global Asia,* 14(1). Available at: https://www.globalasia.org/v14no1/cover/techno-nationalism-vs-the-fourthindustrial-revolution_robert-a-manning [Accessed: July 7, 2021].

Manuel, A., Hicks, K. (2020). Can China's Military Win the Tech War? *Foreign Affairs*, 29 July [online]. Available at: https://www.foreignaffairs.com/articles/united-states/2020-07-29/can-chinas-military-win-tech-war [Accessed: Aug. 7, 2021].

Mastanduno, M. (1985). Strategies of Economic Containment: U.S. Trade Relations with the Soviet Union. *World Politics*, 37(4): 503-531.

Morita, A., Reingold, E.M., Shimomura, M. (1986). *Made in Japan.* N.Y.: E. P. Dutton

Nakayama, S. (2012). Techno-Nationalism versus Techno-Globalism. *East Asian Science,*

Technology and Society, 6 (1): 9–15. DOI: 10.1215/18752160-1504708.
National Science Board (2020). *The State of U.S. Science and Engineering 2020. Science & Engineering Indicators*. NSB-2020-1. Alexandria, VA.
National Venture Capital Association (2021). *NVCA Yearbook 2021*. Available at:https://nvca.org/wp-content/uploads/2021/08/NVCA-2021-Yearbook.pdf [Accessed: Nov.01, 2021].
Nelson, C. (2014). U.S. Space Industry Deep Dive Assessment: Impact of U.S. Export Controls on the Space Industrial Base. *U.S. Department of Commerce, Bureau of Industry and Security, Office of Technology Evaluation.* Technical Report. DOI: 10.13140/RG.2.2.16632.47368.
Obama, B. (2015). *Remarks by the President in State of the Union Address.* January 20, 2015. U.S. Capitol. Washington, D.C. https://obamawhitehouse.archives.gov/the-press-office/2015/01/20/remarks-president-state-union-address-January-20-2015 [Accessed: Oct.27, 2021].
OECD (2020). *OECD Digital Economy Outlook 2020.* Paris: OECD Publishing. DOI: 10.1787/bb167041-en.
Office of Technology Assessment (1979). *Technology and East-West Trade.* OTA Report. NTIS order #PB83-234955. Washington, D.C.: U.S. Government Printing Office.
Ostry, S., Nelson, R.R. (1995). *Technonationalism and techno-globalism.* Wash., D.C.: The Brookings Institution.
Petland, W. (2011). Congress Bans Scientific Collaboration with China, Cites High Espionage Risks. *Forbes,* May 7. Available at: https://www.forbes.com/sites/williampentland/2011/05/07/congress-bans-scientific-collaboration-with-china-cites-high-espionage-risks/?sh=1c83934d4562 [Accessed: Nov. 25, 2021].
Pitchbook (2020). *European Venture Report. 2020 Annual Report*. Available at: https://files.pitchbook.com/website/files/pdf/2020_Annual_European_Venture_Report.pdf [Accessed: Oct.25, 2021].
Rampton, R. (2020). Trump Gives Medical Stockpile A 'Kodak Moment' With New Loan To Make Drugs. *NPR*, July 28. Available at: https://www.npr.org/sections/coronavirus-live-updates/2020/07/28/896209016/trump-gives-medical-stockpile-a-kodak-moment-with-new-loan-to-make-drugs [Accessed: Aug.25, 2021].
RIA Novosti (2017). Putin: lider v sfere iskusstvennogo intellekta stanet vlastelinom mira [Putin: the leader in the field of artificial intelligence will become the master of the world]", *RIA Novosti,* September 1, Available at: https://ria.ru/20170901/1501566046.html [Accessed: Nov.25, 2021]. [In Russ.]

Rifkin, J. (2014). *Zero Marginal Cost Society.* New York, Palgrave MacMillan.

Rogers M., Dutch C.A. (2012). Investigative Report on the U.S. National Security Issues Posed by Chinese Telecommunications Companies Huawei and ZTE. *U.S. House of Representatives.* 112th Congress. Available at: accessed:https://stacks.stanford.edu/file/druid:rm226yb7473/Huawei-ZTE%20Investigative%20Report%20%28FINAL%29.pdf [Accessed: Sept.15, 2021].

Ruehl, M., Kynge, J., and Kruppa, M. (2019). Chinese venture capital investment in US falls to four year low. *Financial Times,* October 2. Available at: https://www.ft.com/content/440fecb8-e4cd11e9-b112-9624ec9edc59 [Accessed: Aug.25, 2021].

Savage N. (2020). Learning the algorithms of power. *Nature,* 588 (Supplement): S102-S104. DOI: 10.1038/d41586-020-03409-8.

Schwab, K., 2017. *The fourth industrial revolution.* New York, Currency Books.

Semiconductor Industry Association (2020). *State Of The U.S. Semiconductor Industry*. Available at: www.semiconductors.org/wp-content/uploads/2020/06/2020-SIA-State-of-the-Industry-Report.pdf [Accessed: Sept. 30, 2021].

Shim, Y., Dong, H. S. (2016). Neo-Techno Nationalism: The Case of China's Handset Industry. *Telecommunications Policy,* 40 (2–3): 197–209. DOI: 10.1016/j.telpol.2015.09.006.

Sun, H., 2019. U.S.-China Tech War: Impacts and Prospects. *China Quarterly of International Strategic Studies*, 5(2): 197–212. DOI: 10.1142/S237774001950012X.

The White House (2022). *Biden-Harris Administration Bringing Semiconductor Manufacturing Back to America*. Fact Sheet, Jan.21, Available at: https://www.whitehouse.gov/briefing-room/statements-releases/2022/01/21/fact-sheet-biden-harris-administration-bringing-semiconductor-manufacturing-back-to-america-2/ [Accessed: Sept.19, 2021].

The World Bank (2021). *ICT goods exports (% of total goods exports).* Available at: https://data.worldbank.org/indicator/TX.VAL.ICTG.ZS.UN [Accessed: Aug.3, 2021].

Thomas C.A. (2021). Lagging But Motivated: The State of China's Semiconductor Industry. *Brookings Institution,* January 7. Available at: https://www.brookings.edu/techstream/lagging-but-motivated-the-state-of-chinas-semiconductor-industry/ [Accessed: Aug.3, 2021].

U.S. Chamber of Commerce (2017). *Made in China 2025: Global Ambitions Built on Local Protections.* Available at: https://www.uschamber.com/assets/documents/final_made_in_china_2025_report_full.pdf [Accessed: Sept.10, 2021].

U.S. Congress (2019) *Made in China 2025 and the Future of American Industry*. U.S.

Congress. Hearing before the Senate Small Business and Entrepreneurship Committee. February 27, 2019. Available at: https://www.sbc.senate.gov/public/index.cfm/2019/2/made-in-china-2025-and-the-future-of-american-industry [Accessed: Oct.10, 2021].

U.S. Department of Defense (2020). *Military and Security Developments Involving the People's Republic of China 2020.* Annual Report to Congress. Available at: media.defense.gov/2020/Sep/01/2002488689/-1/-1/1/2020-DODChina-military-power-report-final.pdf [Accessed: Oct. 30, 2021].

UNCTAD (2019). *Digital Economy Report 2019.* New York, United Nations Publications. Available at: https://unctad.org/system/files/official-document/der2019_en.pdf [Accessed: Aug.1, 2021].

Vogel, S.K. (1989). Japanese High Technology, Politics, and Power. Berkeley. *Roundtable on the International Economy.* Research Paper #2. University of California, Berkeley. Available at: ageconsearch.umn.edu/record/292939/files/ucb-0002.PDF [Accessed: July 30, 2021].

Wade, R.H. (2018). The Developmental State: Dead or Alive? *Development and Change*, 49 (2): 518–546. DOI: 10.1111/dech.12381.

Wei, L. (2019). Beijing Drops Contentious 'Made in China 2025' Slogan, but Policy Remains. *The Wall Street Journal,* March 5. Available at: https://www.wsj.com/articles/china-drops-a-policy-the-u-s-dislikes-at-least-in-name-11551795370 [Accessed: Aug. 12, 2021].

WIPO (2019). *WIPO Technology Trends 2019. Artificial Intelligence.* World Intellectual Property Organization. Geneva: WIPO. 154 p. Available at: https://www.wipo.int/edocs/pubdocs/en/wipo_pub_1055.pdf [Accessed: Aug. 18, 2020].

Xi, C. (2021) Chip Wars And Decoupling: China And The US's Semiconductor Plays. *AsiaGlobal Online (AGO)*, June 3. Available at: https://www.asiaglobalonline.hku.hk/chip-wars-and-decoupling-china-and-uss-semiconductor-plays [Accessed: Aug. 21, 2021].

Zhao, J. (2021). The Political Economy of the U.S.-China Technology War. *Monthly Review,* 73 (3). Available at: https://monthlyreview.org/2021/07/01/the-political-economy-of-the-u-s-china-technology-war/ [Accessed: Oct. 22, 2021].