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COMPETITION IN THE PRODUCTION OF ELECTRONIC MICROCHIPS (SEMICONDUCTORS) AS AN ISSUE IN US – CHINA RELATIONS

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Wars and battles throughout the 20th century were fought mostly over oil in resource-rich nations. Recently, the world's two biggest economies, China and the United States, clashed over electronic microchips, a crucial component of almost every modern electronic device. As we describe the semiconductor sector as an area of intensifying technological competition between the US and China, we look at each party's measures against their rival and examine what they did to minimise the side effects of these measures. We conclude that the confrontation in the semiconductor sector typifies the fight for economic and technical dominance that will shape global politics in the 21st century. We also predict that in this ongoing confrontation, Taiwan will shortly come to the centre stage.

Keywords: electronic chips; United States; People's Republic of China; Taiwan; sanctions; trade war.

КОНКУРЕНЦИЯ В ПРОИЗВОДСТВЕ ЭЛЕКТРОННЫХ МИКРОЧИПОВ (ПОЛУПРОВОДНИКОВ) КАК ПРОБЛЕМА АМЕРИКАНО-КИТАЙСКИХ ОТНОШЕНИЙ

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Одной из особенностей XX в. было стремление контролировать добычу нефти, что провоцировало войны и конфликты во многих регионах мира, богатых природными ресурсами. Однако в последнее время две крупнейшие экономики мира, Америка и Китай, оказались в состоянии борьбы за другой ценный ресурс – электронные чипы, лежащие в основе почти всех используемых электронных устройств. Рассматривается роль полупроводников в усилении технологической конкуренции между Америкой и Китаем, а также меры и контрмеры, предпринятые обеими странами для преодоления последствий этой конкуренции. Подчеркивается, что технологическое и экономическое превосходство, особенно передовая индустрия электронных микросхем, определят особенности XXI в. Делается вывод о том, что между Вашингтоном и Пекином развернется ожесточенная технологическая борьба. В таком случае Тайвань в ближайшее время станет ареной конфликта между КНР и США.

Ключевые слова: электронные микрочипы; Соединенные Штаты Америки; Китайская Народная Республика; Тайвань; санкции; торговая война.

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Historical background

Intense rivalry between the US and China for control of the semiconductor market has existed for some time, and it became even more heated when D. Trump was elected US President in 2017. It warrants a separate inquiry due to its high intensity, which might result in proxy warfare. Additionally, Chinese companies have made strides in the semiconductor sector and are already in competition with American firms, even though the majority of US economic sanctions are geared at slowing China's technical development. US-Chinese competition in the microchips industry has received little attention among Belarusian academics, and this study has consulted a variety of materials in Arabic, Russian, Chinese, and English. The goal is to explain how competition in the semiconductor business affects bilateral ties between the US and China and international issues. The following objectives were also addressed: reviewing the issue's history, providing an overview of the electronic chip market and its major players, evaluating the relative positions of Taiwan, the US, and China, assessing the US's ability to hold back China's technological development and its readiness to prevent Taiwan's annexation by force, and assessing China's capacity to respond to US sanctions related to microchips.

Numerous authors have recognised Taiwan's importance to the microchip industry, the US' readiness to defend Taiwan militarily, and its use of sanctions to reduce China's technical competitiveness. For instance, Shawqi Al-Rayes, a Syrian journalist, agrees with all three viewpoints and predicts that the microchip industry will become a key point of contention between Washington and Beijing[1]. The technological rivalry between China and the US has intensified, according to professor Najat Al-Saeed of Zayed University, and both countries have taken steps to transfer chip manufacturing inside their borders. She underlines Taiwan's importance to the global economy and its part in the conflict between the US and China, noting that disruptions in the electronic chip sector will have significant ramifications[2].

The prospect that the US would deploy its military to defend Taiwan is not entirely disregarded by Western academics. Given Taiwan's supremacy in the electronic chip business, J. Matney, president and CEO of "Rand Corporation", believes that Washington would battle for Taiwan as if it were an American state and outlines Washington's alternatives. Others, like professor S. D. Kaplan, believe that the US should take a lesson from China's experience rather than pinning all of its expectations on J. Biden's Chips and science act. In the same way that China's special economic zones in 1980 helped that country get over the limitations of its state-dominated governance structure, which discouraged foreign investment, S. D. Kaplan claims that special manufacturing innovation zones might catalyse entrepreneurial activity in the United States. She argues that subsidies are unproductive because they stifle innovation and competition by creating an uneven playing field. According to her, bureaucrats are not capable of allocating funds to the appropriate objectives, but the Chips and science act may force them to do so. Additionally, the US government lacks the resources necessary to carry out an industrial policy as defined by the Chips legislation. A one-time commitment from Washington would not accomplish as much to boost local manufacture of chips and other high-tech products as empowering markets and customers to drive innovation[3].

When it comes to the future of US-Chinese relations, the majority of Chinese scholars favour cooperation above opposition and conflict and warn that unchecked competition could thwart efforts to address shared threats facing humanity, as argued, for instance, by Mabel Lu Miao, co-founder and secretary general of the Centre for China and globalisation[4].

As an example of bold thinking, Zhuoran Li from the Johns Hopkins University, offered this comment regarding China's response to the US Chips and science act: "From the Chinese leader's perspective, China has no alternative but to move away from a market-based innovation system to security-based national innovation planning". He also cautions against putting security ahead of economic feasibility when making economic plans since it might cause market distortions in the long run. Chinese policymakers have continued the investment-led economic model, which is linked to several issues including cronyism, corruption, local debt, and the real estate crisis. Chinese businesses have been able to profiteer from innovation subsidies due to a lack of accountability. Zhuoran Li contends that Chinese companies' superior price-performance ratio results from their capacity to create high-quality goods at reduced costs. This business strategy depends on access to the

[1]*Al-Rayes Sh*. Will electronic chips draw international geopolitical features in the future? [Electronic resource]. URL: https://aawsat.com/home/article/3968191/%D9%87%D9%84-%D8%B3%D8%AA%D8%B1%D8%B3%D9%85-%D8%A7%D9%84%D8%B1%D9%82%D8%A7%D9%82%D8%A7%D8%AA-%D8%A7%D9%84%D8%A5%D9%84%D9%83%D8%AA%D8%B1%D9%88%D9%86%D9%8A%D8%A9-%D8%A7%D9%84%D9%85%D8%B9%D8%A7%D9%84%D9%85-%D8%A7%D9%84%D8%AC%D9%8A%D9%88%D8%B3%D9%8A%D8%A7%D8%B3%D9%8A%D8%A9-%D8%A7%D9%84%D8%AF%D9%88%D9%84%D9%8A%D8%A9-%D9%81%D9%8A-%D8%A7%D9%84%D9%85%D8%B3%D8%AA%D9%82%D8%A8%D9%84%D8%9F هل سترسم الرقاقات الإلكترونية المعالم الجيوسياسية الدولية في المستقبل؟ (date of access: 22.12.2022) (in Arab.).

[2]*Al-Saeed N.* Electronic chip race [Electronic resource]. URL: https://www.alarabiya.net/politics/2022/08/23/%D8%B3%D8%A8%D8%A7%D9%82-%D8%A7%D9%84%D8%B1%D9%82%D8%A7%D8%A6%D9%82-%D8%A7%D9%84%D8%A7%D9%84%D9%83%D8%AA%D8%B1%D9%88%D9%86%D9%8A%D8%A9سباق الرقائق الإلكترونية (date of access: 10.02.2023) (in Arab.).

[3]*Kaplan S. D.* How the US can win the chips war with China? [Electronic resource]. URL: https://thediplomat.com/2022/12/how-the-us-can-win-the-chips-war-with-china/ (date of access: 10.02.2023).

[4]*Mabel Lu Miao*. Three scenarios for future US – China relations: a view from Beijing [Electronic resource]. URL: https://www.ispionline.it/en/pubblicazione/three-scenarios-future-us-china-relations-view-beijing-26944 (date of access: 30.12.2022).

global value chain and the use of cutting-edge foreign technology. Zhuoran Li asserts that the US Chips and science act and the semiconductor ban are imitations of China's dubious methods[5].

According to numerous Russian researchers, including P. Aptekar, a Russian historian and journalist, the escalating competitiveness and evolving conflicts between China and the US, the world's two greatest economies and major world powers, present new problems as well as opportunities for Russia. The authors of the seminal Russian International Affairs Council report "Prospects for US foreign policy towards China: implications for Russia" underline how access to the most recent scientific and technological advancements has a significant impact on the balance of power in global politics and economics. Some American firms have been shifting their cutting-edge production from China to India due to the significant role that technology has played in the developing trade and economic dispute between the US and China.

Foreign pressure has not deterred China from pursuing technical leadership, and the report finds that this has potentially positive and negative implications for Russia. For instance, while a strategic alliance between China and Russia is a promising prospect, there are dangers due to Russia's economic, technical, and demographic asymmetries with China[6].

Electronics manufacturers and circuits

A microchip is a tiny silicon semiconductor crystal that carries out a particular function inside an integrated circuit. Silicon is widely used in microchip production because it is one of the ten most prevalent elements on Earth. Since silicon is a semiconductor, a material that lies in between insulators and conductors, its conductivity properties may be modified by the addition of impurities to permit the regulation of electric signals in a variety of electronic devices.

Silicon wafers are used to make microchips. On a single wafer, tens to hundreds of chips can fit. Wafers come in a multitude of sizes, ranging from 100 to 450 mm. It should be remembered that electrical chip dimensions are expressed in nanometers. Thus, when we refer to 7 nanometer and 10 nanometer central processing units (CPUs), we mean extremely tiny transistor measurements. Based on that, the more transistors can be packed onto a silicon wafer, increasing the bandwidth of electrical devices, the narrower the space between transistors.

The chip industry is split into two primary segments: fabless, which designs the chips, and foundries, which take designs and manufacture them in-house. With a 45 % market share, American businesses are leading the world in semiconductor design. The most well-known of them are "Qualcomm", "Broadcom", and "Nvidia". In contrast, Asia is responsible for 82.5 % of all chip manufacturing activities worldwide. For example, the Taiwanese company "TSMC" holds the top position with a 53.1 % share of the world market for electronic chips. The South Korean company "Samsung" is in second place, with a share of 17.1 %. Third on the list, with 7.3 % of the world market, is the Taiwanese "UMC". "SMIC", a Chinese manufacturer, is in fourth position with 5 % of the market[7].

Interestingly, it can take up to three months to produce a single chip, and it also demands a sizable budget and extremely advanced machinery. Therefore, it is challenging for one nation to control the entire production chain. Electronic chips are made in Taiwan, South Korea, and China utilising rare Earth metals from Australia and China, after being designed in the United States of America, as was already explained. The Dutch firm "ASML" manufactures the machinery.

Importantly, with 37 % of the world's reserves, the People's Republic of China is the country with the highest deposits of rare Earth minerals. These minerals are crucial components of electronic chips and other high-tech goods due to their special features. 17 different elements make up this group, including scandium, yttrium, lanthanum, and lanthanides (cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, and ytterbium and lutetium)[8].

For many years, the American company "Intel" led the world in the manufacture of microchips, but recently, Taiwanese "TSMC" and South Korean "Samsung" overtook it. US companies produced 30 % of the world's microchips in the 1990s. This percentage has now dropped to 12 %, with 53.1 % manufactured by Taiwan's "TSMC"[9].

[5]*Zhuoran Li*. The Future of the China – US chip war [Electronic resource]. URL: https://thediplomat.com/2023/03/the-future-of-the-china-us-chip-war/ (date of access: 11.02.2023).

[6]*Sokolshchik L.*, *Sokolshchik Yu.*, *Galimullin E.*, *Bondarenko A*. Prospects for US foreign policy towards China: implications for Russia [Electronic resource]. URL: https://russiancouncil.ru/papers/US-China-Report83.pdf (date of access: 11.04.2023) (in Russ.).

[7]*Awad A*. Electronic chip monopoly: China is "banned" from knowledge [Electronic resource]. URL: https://al-akhbar.com/Issues/328588 احتكار الشرائح الإلكترونية: الصّين «ممنوعة» من المعرفة (date of access: 20.12.2022) (in Arab.).

[8]*Saleema Labal S*. Rare metals are China's new weapon [Electronic resource]. URL: https://alqabas.com/article/672528 المعادن النادرة سلاح الصين الجديد (date of access: 21.12.2022) (in Arab.).

[9]*Al-Rayes Sh*. Will electronic chips draw international geopolitical features in the future? [Electronic resource]. URL: https://aawsat.com/home/article/3968191/%D9%87%D9%84-%D8%B3%D8%AA%D8%B1%D8%B3%D9%85-%D8%A7%D9%84%D8%B1%D9%82%D8%A7%D9%82%D8%A7%D8%AA-%D8%A7%D9%84%D8%A5%D9%84%D9%83%D8%AA%D8%B1%D9%88%D9%86%D9%8A%D8%A9-%D8%A7%D9%84%D9%85%D8%B9%D8%A7%D9%84%D9%85-%D8%A7%D9%84%D8%AC%D9%8A%D9%88%D8%B3%D9%8A%D8%A7%D8%B3%D9%8A%D8%A9-%D8%A7%D9%84%D8%AF%D9%88%D9%84%D9%8A%D8%A9-%D9%81%D9%8A-%D8%A7%D9%84%D9%85%D8%B3%D8%AA%D9%82%D8%A8%D9%84%D8%9F هل سترسم الرقاقات الإلكترونية المعالم الجيوسياسية الدولية في المستقبل؟ (date of access: 22.12.2022) (in Arab.).

Nevertheless, seven of the top ten global producers of electronic chips are based in the United States, including "Intel" and "Qualcomm". While America still produces a variety of chips, Taiwan is the only territory that manufactures the most recent generations of chips, including those that are used in iPhones. Taiwan has been far ahead of the other companies in this industry,particularly with the introduction of 3 nanometer chips[10].

The importance of Taiwan for the US and China

Taiwan is significant to the United States of America for a variety of reasons, including the manufacture of electronic chips. The recent crisis involving semiconductor chips has heightened tensions between China and the US over Taiwan.

The crisis was brought on by several factors.

First, the supply chain and the manufacturing microchips have suffered as a result of the trade war started by US sanctions on Chinese firms under the administrations of D. Trump and J. Biden.

Second, there was an imbalance in the demand for microchips during Covid-19. Due to preventative quarantine measures, automobile factories were shut down while the electronic industry was expanding. However, when the restrictions were scaled down and then lifted, the demand for automotive microchips increased faster than anticipated. As a result, the chip-producing firms were unable to meet the demand for chips.

Third, because of Covid-19, ports were shut down for several months.

The drought in Taiwan in 2021 was the fourth reason. It affected the production of high-purity water, needed to clean factories and the silicon alloys for microelectronic chips[11].

Due to Taiwan's important position in the world's manufacture of electronic chips, high-tech corporations in China and America, whose governments are already at odds with Taiwan, are forced to make tough decisions. Taiwan is a separatist area for China, which it seeks to reunify. There are two equally bad scenarios for the manufacture of electronic chips if China invades Taiwan: either China will seize control of the chip manufacturing facilities, or they will be destroyed in a conflict. The United States and its allies' comparative technical, military, and economic advantages would be diminished in the first scenario if China was able to prevent them from obtaining cutting-edge electronic chips. The second scenario would result in a sudden cessation of almost two-thirds of global shipments of microprocessors to industries that rely on them for production. Significantly, 80 % of auto manufacturers source their electrical microchips from Taiwan's "TSMC". To appreciate the significance of this problem, consider the 210 bln US dollars in losses the US auto sector suffered in 2021 as a result of the pandemic-induced production slowdown brought on by interruptions in the supply chains of the electronic chips used in automobiles[12].

This explains why China's efforts to seize this island by force and control the manufacture of electronic chips are causing the United States increasing alarm.

The US position on curbing China's advancement in technology and the annexation of Taiwan

J. Matheny, president and chief executive officer of "Rand corporation", suggests three ways for America to overcome its dependence on these supplies in response to China's desire to annex Taiwan.

Given the fierce competition between China and the United States, the first answer is to boost manufacturing outside China, especially in the United States, to maintain supply chains while preventing China from accessing cutting-edge technology for the fabrication of electronic chips[13].

To do this, the US government has already started putting restrictions on the export of US technology to

[10] *Mahmoud K.* Nano. When the future of the world is in a chip [Electronic resource].URL: https://www.aljazeera.net/opinions/2022/8/19/%D8%A7%D9%84%D9%86%D8%A7%D9%86%D9%88-%D8%B9%D9%86%D8%AF%D9%85%D8%A7-%D9%8A%D8%B5%D8%A8%D8%AD-%D9%85%D8%B3%D8%AA%D9%82%D8%A8%D9%84-%D8%A7%D9%84%D8-%B9%D8%A7%D9%84%D9%85-%D9%81%D9%8Aالنانو.. عندما يصبح مستقبل العالم في شريحة (date of access: 23.12.2022) (in Arab.).

[11] Electronic chip war. The United States and China put the global industry in the crosshairs! [Electronic resource]. URL: https://followict.news/%D8%AD%D8%B1%D8%A8-%D8%A7%D9%84%D8%B1%D9%82%D8%A7%D8%A6%D9%82-%D8%A7%D9%84%D8%A5%D9%84%D9%83%D8%AA%D8%B1%D9%88%D9%86%D9%8A%D8%A9-%D8%A7%D9%84%D9%88%D9%84%D8%A7%D9%8A%D8%A7%D8%AA-%D8%A7%D9%84%D9%85/ حرب الرقائق الإلكترونية.. الولايات المتحدة والصين تضع الصناعة العالمية في مرمى النيران! (date of access: 24.12.2022) (in Arab.) ; The electronic chip crisis and the semiconductor crisis [Electronic resource]. URL: https://www.the8log.com/%D8%A3%D8%B2%D9%85%D8%A9-%D9%86%D9%82%D8%B5-%D8%A7%D9%84%D8%B1%D9%82%D8%A7%D8%A6%D9%82-%D9%88%D8%A3%D8%B4%D8%A8%D8%A7%D9%87-%D8%A7%D9%84%D9%85%D9%88%D8%B5%D9%84%D8%A7%D8%AA/ازمة الرقائق الالكترونية وازمة اشباه الموصلات (date of access: 24.12.2022) (in Arab.) ; Electronic chips – semiconductors: everything you need to know [Electronic resource]. URL: https://www.thra3.com/2022/11/chips-and-semiconductors.htmlالرقائق الإلكترونية - أشباه الموصلات : كل ما يجب عليك معرفته (date of access: 24.12.2022) (in Arab.).

[12] *Kaplan S. D.* How the US can win the chips war with China? [Electronic resource]. URL: https://thediplomat.com/2022/12/how-the-us-can-win-the-chips-war-with-china/ (date of access: 10.02.2023).

[13] Ibid.

China. President D. Trump initially ordered sanctions on China in 2018 after he accused Beijing of stealing American technology and intellectual property[14].

The Trump administration increased tariffs in 2019 on 200 bln US dollars worth of Chinese imports into the United States from 10 % to 25 %, starting what later became known as a trade war. China responded symmetrically by putting 25 % tariffs on about 50 % of American imports[15].

D. Trump also issued an executive order in 2019 that prohibited US businesses from utilising foreign telephone networks and equipment, ostensibly to prevent risks to US security. Additionally, the US has placed the Chinese telecom company "Huawei" on a blacklist, barring it from accessing components produced in the US. In the same vein, the US Department of commerce told US semiconductor makers in 2020 that they needed licences to export select technologies to China that it could use for military purposes[16].

Additionally, the Chips and science act was passed by the US Congress and signed by President J. Biden in August 2022 to limit China's technological capability to produce sophisticated electronic chips. The legislation offers around 280 bln US dollars in additional financing to advance local semiconductor research and production in the United States, with the main objective of competing with China[17].

Besides, in October 2022, the American Government issued export restrictions that mandated corporations to get licences before selling electronic chips to China. No matter where it was created, every chip made with US components or software was protected. Due to the restrictions, several Chinese semiconductor companies were unable to hire US citizens or permanent residents with green cards[18]. Many Chinese chip makers had difficulties as a result, according to Linghao Bao, an analyst with the policy research firm "Trivium China". Multiple CEOs of these firms hold US passports, have received their education in the US, and are residents of the US[19].

The United States encouraged chip makers to construct plants both inside and outside of its borders to make sure that its policy of limiting China's access to electronic chips was successful. For example, the "TSMC" started construction of a 12 bln US dollars factory in Arizona in 2021. This facility would be the company's second manufacturing site in the United States[20].

For its part, "Intel" stated in 2022 that it planned to invest over 33 bln euro (36 bln US dollars) to increase chip production in the European Union as it is striving to reduce its dependence on semiconductor imports. The investments made by "Intel" are part of a larger plan that will see the corporation spend up to 80 bln euro in Europe over the following ten years[21].

The investment of up to 100 bln US dollars to construct up to eight electronic chip factories in Ohio, making it the largest production facility in the world, was announced by "Intel" CEO P. Gelsinger in 2022. In late 2022, work on the first two 30 bln US dollars facilities would start, and production would begin in 2025. The move is a part of "Intel's" effort to restore its market dominance in chip fabrication and lessen its reliance on Asian manufacturers[22].

The US investors were worried about how the export restrictions would affect the financial performance of semiconductor producers. "Nvidia", for instance, predicted that the limitations may cost it 400 mln US dollars in sales. US authorities anticipate similar limitations

[14] *Masson J*. Exclusive: Trump considers big "fine" over China intellectual property theft [Electronic resource]. URL: https://www.reuters.com/article/us-usa-trump-trade-exclusive-idUSKBN1F62SR (date of access: 27.12.2022).

[15] The trade war between China and America may even reach the shoe trade [Electronic resource]. URL: https://www.bbc.com/arabic/business-48334999 الحرب التجارية بين الصين وأمريكا قد تصل حتى إلى الأحذية (date of access: 27.12.2022) (in Arab.).

[16] Washington imposes restrictions on the sale of American technology to China [Electronic resource]. URL: https://www.skynewsarabia.com/world/1379198-%D9%88%D8%A7%D8%B4%D9%86%D8%B7%D9%86-%D8%AA%D9%81%D8%B1%D8%B6-%D9%82%D9%8A%D9%88%D8%AF%D8%A7-%D8%A8%D9%8A%D8%B9-%D8%A7%D9%84%D8%AA%D9%83%D9%86%D9%88%D9%84%D9%88%D8%AC%D9%8A%D8%A7-%D8%A7%D9%84%D8%A7%D9%94%D9%85%D9%8A%D8%B1%D9%83%D9%8A%D8%A9-%D9%84%D9%84%D8%B5%D9%8A%D9%86 واشنطن تفرض قيودا على بيع التكنولوجيا الأمريكية للصين (date of access: 27.12.2022) (in Arab.).

[17] The Chips and science act of 2022 [Electronic resource]. URL: https://www.nga.org/updates/the-chips-and-science-act-of-2022/ (date of access: 27.12.2022).

[18] Commerce implements new export controls on advanced computing and semiconductor manufacturing items to the People's Republic of China (PRC) [Electronic resource]. URL: https://www.bis.doc.gov/index.php/documents/about-bis/newsroom/press-releases/3158-2022-10-07-bis-press-release-advanced-computing-and-semiconductor-manufacturing-controls-final/file (date of access: 11.04.2023).

[19] *Suranjana Tewari*. US – China chip war: America is winning [Electronic resource]. URL: https://www.bbc.com/news/world-asia-pacific-64143602 (date of access: 27.12.2022).

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[21] *Shead S*. Intel commits $36 billion to make chips in Europe [Electronic resource]. URL: https://www.cnbc.com/2022/03/15/intel-commits-36-billion-to-making-chips-in-europe.html (date of access: 28.12.2022).

[22] Intel to invest up to $100 billion in Ohio chip plants [Electronic resource]. URL:https://www.cnbc.com/2022/01/21/intel-plans-20-billion-chip-manufacturing-site-in-ohio.html (date of access: 28.12.2022).

from other nations since unilateral action could be ineffective and potentially harmful to US businesses[23].

Notably, roughly 30 % of the profits of American semiconductor businesses come from China, yet the United States is ready to sacrifice them to keep China in check solely because China stands to lose more[24].

As previously indicated, US restrictions target manufacturers of electronic chips and also makers of the equipment for producing them, based mostly in Japan and the Netherlands.

According to P. Winink, CEO of "ASML Holding N. V.", a major Dutch manufacturer of such equipment, the Dutch government forbade its company from selling the most sophisticated printing machines to China starting in 2019 as a result of US pressure. P. Winink was responding to a media inquiry about whether the Dutch Government should restrict exports of chip-making equipment to China. Additionally, the UK-based computer chip manufacturer "Arm" said that it will no longer sell its most cutting-edge designs to China to comply with US and UK prohibitions[25]. "Alibaba", a giant tech company, was one of the Chinese businesses affected.

Because of the potential loss of significant and lucrative clients, the limitations make it difficult for the European and Japanese suppliers to accede to American pressure[26].

For example, any further limitations on exports "ASML" to China may harm commerce between the Netherlands and China. Already, "ASML", the world's only manufacturer of high-precision lithographic devices for microchip production, has been unable to obtain the Dutch Government's licence to export its most advanced extreme ultraviolet equipment to China, costing 160 mln euro (164 mln US dollars) per unit[27].

The extensive US network of allies, however, and the dollar's supremacy across the world enable Washington to impose its policies on other nations. This explains why Japan, the Netherlands, and others agreed to back the US Government's efforts to tighten restrictions on the transfer of sophisticated chip-making equipment to China[28].

J. Matheny's second recommendation for the US is to act swiftly to defend Taiwan militarily from China's threat of annexation[29].

Notably, President J. Biden acknowledged this possibility in 2022 when he was asked what the United States would do if China attacked Taiwan. In the event of a Chinese invasion, J. Biden emphasised, the US military would protect Taiwan[30].

The first and second choices, in J. Matheny's opinion, are problematic because they ignore the time constraint. Taiwan needed at least ten years to become competitive in the semiconductor sector, and over 40 years of global leadership to get to where it is now. The US would require decades and huge expenditures before it could satisfy its local chip demand if it brought chip manufacturing within its borders. Additionally, it would be challenging to replicate some of the Taiwanese firms' distinctive advantages overseas. For example, to support the company's round-the-clock operations, the engineers of R&D division of "TSMC" work three shifts. If the US decides to defend Taiwan, time will also be an issue. The chip plants may be destroyed by China if it invaded before the US could respond, which would put the global manufacturing sector under extreme pressure[31].

The third option for the United States of America is to make China's invasion of Taiwan very costly by giving Taiwan the ability to defend itself and supplying it with a variety of systems, including the high-mobility missile

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[25]Electronic chips are the focus of a war between China and America, so what are their dimensions? [Electronic resource]. URL: https://www.alanba.com.kw/BBCNews/14343 الرقائق الإلكترونية محور حرب بين الصين وأمريكا فما أبعادها؟ (date of access: 29.12.2022) (in Arab.).

[26]American electronic chips: new restrictions on China [Electronic resource]. URL: https://aawsat.com/home/article/3923691/%D9%87%D8%A7%D9%84-%D8%A8%D8%B1%D8%A7%D9%86%D8%AF%D8%B2/%D8%A7%D9%84%D8%B1%D9%82%D8%A7%D8%A6%D9%82-%D8%A7%D9%84%D8%A5%D9%84%D9%83%D8%AA%D8%B1%D9%88%D9%86%D9%8A%D8%A9-%D8%A7%D9%84%D8%A3%D9%85%D9%8A%D8%B1%D9%83%D9%8A%D8%A9-%D9%82%D9%8A%D9%88%D8%AF-%D8%AC%D8%AF%D9%8A%D8%AF%D8%A9-%D8%B9%D9%84%D9%89-%D8%A7%D9%84%D8%B5%D9%8A%D9%86الرقائق الإلكترونية الأميركية قيود جديدة على الصين (date of access: 29.12.2022) (in Arab.).

[27]*Deutsch J., Martin E., King I., Wu D*. US wants Dutch supplier to stop selling chipmaking gear to China [Electronic resource]. URL: https://www.bloomberg.com/news/articles/2022-07-05/us-pushing-for-asml-to-stop-selling-key-chipmaking-gear-to-china (date of access: 12.04.2023).

[28]American electronic chips: new restrictions on China [Electronic resource]. URL: https://aawsat.com/home/article/3923691/%D9%87%D8%A7%D9%84-%D8%A8%D8%B1%D8%A7%D9%86%D8%AF%D8%B2/%D8%A7%D9%84%D8%B1%D9%82%D8%A7%D8%A6%D9%82-%D8%A7%D9%84%D8%A5%D9%84%D9%83%D8%AA%D8%B1%D9%88%D9%86%D9%8A%D8%A9-%D8%A7%D9%84%D8%A3%D9%85%D9%8A%D8%B1%D9%83%D9%8A%D8%A9-%D9%82%D9%8A%D9%88%D8%AF-%D8%AC%D8%AF%D9%8A%D8%AF%D8%A9-%D8%B9%D9%84%D9%89-%D8%A7%D9%84%D8%B5%D9%8A%D9%86الرقائق الإلكترونية الأميركية قيود جديدة على الصين (date of access: 29.12.2022) (in Arab.).

[29]*Kaplan S. D.* How the US can win the chips war with China? [Electronic resource]. URL: https://thediplomat.com/2022/12/how-the-us-can-win-the-chips-war-with-china/ (date of access: 10.02.2023).

[30]*Brunnstrom D.*, *Hunnicutt T.* Biden says US forces would defend Taiwan in the event of a Chinese invasion [Electronic resource]. URL: https://www.reuters.com/world/biden-says-us-forces-would-defend-taiwan-event-chinese-invasion-2022-09-18/ (date of access: 30.12.2022).

[31]*Kaplan S. D.* How the US can win the chips war with China? [Electronic resource]. URL: https://thediplomat.com/2022/12/how-the-us-can-win-the-chips-war-with-china/ (date of access: 10.02.2023).

system (HIMARS), drones, anti-tank missiles, and naval mines that can carry out tasks at a relatively low cost. This is sufficient for Taiwan to construct the so-called porcupine defence. The idea is for a small nation to shield itself from a larger one, much like Ukraine does against Russia so that the small nation can rely on numerous smaller, lighter, and more potent systems in the face of powerful armies while decreasing its demand for conventional weapons like tanks and combat aircraft[32].

We believe that the third option would be the most likely course of action for Washington in the case of a Chinese invasion of Taiwan. The 2022 Taiwan policy act testifies to this, as seen from its language of regional stability, deterrence, and harsh sanctions for China[33].

China's policy to counter US microchip-related sanctions

As part of the response to US sanctions, Premier Li Keqiang and his cabinet unveiled Beijing's "Made in China – 2025" strategy in May 2015, emphasising the microchip industry's self-sufficiency, decreased reliance on the United States, consolidation of China's leadership, and concentration of both design and production in Chinese territory[34].

Zhao Lijian, a spokesperson for the Chinese Ministry of Foreign Affairs, condemned the US sanctions as technical terrorism, abuse of state power, coercive diplomacy, and abuse of technology hegemony by the US. "They urge all nations to transition as quickly as they can to technological independence and self-reliance while reminding them of the dangers of technological dependence", – said Zhao Lijan.

At the WTO, China also contested the US' broad export restrictions. However, the resolution of WTO disputes might take years.

Despite the restrictions, China has made impressive strides in the semiconductor sector. By copying a Taiwanese design by "TSMC", the Chinese company "SMIC" began producing 7 nanometer chips in July 2021. As a consequence, China was able to get around US restrictions on its access to the cutting-edge technology required to make advanced semiconductors[35].

Additionally, "SMIC" disclosed intentions to use government money to build a 2.35 bln US dollars semiconductor plant in Shenzhen. The facility began operationsin 2022. China's goal of constructing 31 more plants by 2024 is progressing.

Despite its remarkable successes, China still faces several formidable obstacles, most of which are connected to technological expertise, basic research, and US sanctions. Additionally, the fabrication of electronic chips requires large outlays of capital, extensive expertise and extreme accuracy. It is also quite expensive in terms of plant and equipment. For factories to repay their investments, they must operate around the clock. The amount of time required to finish a batch determines whether a plant succeeds or fails. Sometimes it takes years to create high-quality chips[36].

In reality, China is more than capable of making significant advancements in the semiconductor sector. For instance, it does not need to learn how to create 10 nanometer circuits as it did in 2021 before switching from 14 nanometer to 7 nanometer chips. However, other countries are gearing up to develop 2 nanometer or 1 nanometer chips while China seeks to produce a 5 nanometer chip. Time, knowledge, research, capital, and US sanctions all have an impact. According to experts, China is unable to produce a 5 nanometer chip because US sanctions prevent it from purchasing a EUV lithography machine from the Dutch firm "ASML". Additionally, the United States has imposed restrictions on "SMIC", preventing foreign businesses from purchasing chips made by this company that is 14 nanometer or larger[37].

[32] *Kaplan S. D.* How the US can win the chips war with China? [Electronic resource]. URL: https://thediplomat.com/2022/12/how-the-us-can-win-the-chips-war-with-china/ (date of access: 10.02.2023).

[33] Taiwan policy act – summary [Electronic resource]. URL: https://foreignaffairs.house.gov/wp-content/uploads/2022/09/Taiwan-Policy-Act-One-Pager-Summary.pdf (date of access: 30.12.2022).

[34] Notice of the State Council on printing and disturbing "Made in China – 2025" [Electronic resource]. URL: https://perma.cc/9PA3-WYBA (date of access: 02.01.2023).

[35] China manages to bypass US sanctions on electronic chips [Electronic resource]. URL: http://www.igli5.com/2022/07/blog-post_856.html#:~:text=%D9%81%D9%81%D9%8A%20%D8%AA%D8%B7%D9%88%D8%B1%20%D9%85%D9%81%D8%A7%D8%AC%D8%A6%20%D9%86%D8%AC%D8%AD%20%D9%85%D8%B5%D9%86%D8%B9,%D9%87%D9%86%D8%AF%D8%B3%D8%A9%20%D8%B9%D9%83%D8%B3%D9%8A%D8%A9%20%D9%88%D8%AA%D9%82%D9%84%D9%8A%D8%AF%20%D8%AA%D8%B5%D9%85%D9%8A%D9%85%20%D8%B4%D8%B1%D9%8A%D8%AD%D8%A9الصين تنجح في التحايل على العقوبات الأمريكية في مجال الشرائح الإلكترونية بطريقة ملتوية (date of access: 03.01.2023) (in Arab.).

[36] *Al-Rayes Sh.* Will electronic chips draw international geopolitical features in the future? [Electronic resource]. URL: https://aawsat.com/home/article/3968191/%D9%87%D9%84-%D8%B3%D8%AA%D8%B1%D8%B3%D9%85-%D8%A7%D9%84%D8%B1%D9%82%D8%A7%D9%82%D8%A7%D8%AA-%D8%A7%D9%84%D8%A5%D9%84%D9%83%D8%AA%D8%B1%D9%88%D9%86%D9%8A%D8%A9-%D8%A7%D9%84%D9%85%D8%B9%D8%A7%D9%84%D9%85-%D8%A7%D9%84%D8%AC%D9%8A%D9%88%D8%B3%D9%8A%D8%A7%D8%B3%D9%8A%D8%A9- %D8%A7%D9%84%D8%AF%D9%88%D9%84%D9%8A%D8%A9-%D9%81%D9%8A-%D8%A7%D9%84%D9%85%D8%B3%D8%AA%D9%82%D8%A8%D9%84%D8%9F هل سترسم الرقاقات الإلكترونية المعالم الجيوسياسية الدولية في المستقبل؟ (date of access: 22.12.2022) (in Arab.) ; *Masson J.* Exclusive: Trump considers big "fine" over China intellectual property theft [Electronic resource]. URL: https://www.reuters.com/article/us-usa-trump-trade-exclusive-idUSKBN1F62SR (date of access: 27.12.2022).

[37] *Awad A.* Why can't China produce advanced electronic chips? [Electronic resource]. URL: https://al-akhbar.com/Technology/304089#:~:text=%D9%88%D8%A7%D9%82%D8%B9%D9%8A%D8%A7%D9%8B%D8%8C%20%D9%8A%D9%85%D9%83%D9%86%20%D9%84%D9%84%D8%B5%D9%8A%D9%86%20%D8%A3%D9%86%20%D8%AA%D9%82%D9%81%D8%B2,%D8%A7%D9%84%D8%AF%D9%88%D9%84%20%D8%A7%D9%84%D9%85%D9%86%D8%AA%D8%AC%D8%A9%20%D9%84%D8%B1%D9%82%D8%A7%D9%82%D8%A9%20%D8%A7%D9%84%D9%805%20%D9%86%D8%A7%D9%86%D9%88%D9%85%D8%AA%D8%B1 لم لا تستطيع الصين إنتاج شرائح إلكترونية متطورة؟(date of access: 04.01.2023) (in Arab.).

Chinese businesses have been impacted by the sanctions. For example, after the United States tightened its export controls against China's tech industry, "Apple" stopped plans to utilise memory chips from one of the country's leading producers in 2022. "Apple" had earlier this year planned to purchase 128-layer 3D NAND flash memory chips from Yangtze memory technologies "YMTC" for use in the iPhones offered in the Chinese market, with the possibility of sourcing up to 40 % of the chips for all of its iPhones[38].

Linghao Bao, a Trivium China expert, cites "Huawei" as an illustration of how sanctions may be effective. This communications giant was once the world's second-largest smartphone manufacturer in the world after Samsung. Now it is "essentially dead"[39].

The Chinese Communist party's 20th national congress in October 2022 called for the establishment of a national industrial information technology system. The founder, chairman, and president of chip design company "Loongson technology corporation", Hu Weiwu, says that the absence of one is like "farming on other people's land: we do not have control".

Measures and countermeasures from the United States and China may show that the parties favour "risking and de-coupling" over "de-risking and coupling". Three possibilities for future relations between China and the US are presented by Mabel Lu Miao, co-founder, vice president, and secretary general of the Centre for China and globalisation.

In the first scenario, despite some animosity, China and the US will cooperate. While still competing geopolitically and economically, they will not decouple.

In the second scenario, there would be some partial decoupling: both parties will cut back on their joint research and development efforts in science and technology areas like 5G communications. Despite certain advantages of this result, such as reduced dangers to national security, it will delay progress in science and innovation. The divisions will eventually affect both parties and the rest of the globe.

When the parties totally "decouple" in the third scenario, other countries will have to choose between two camps, There is a chance that a new, dangerous Cold War may start and turn into a "hot" conflict. The world's divides will squander a lot of resources and obstruct the possibility of lasting peace and prosperity. Increased fragmentation in a multipolar world will harm chances for sustainable development[40].

According to Mabel Lu Miao, China and the US will move to a form of partial decoupling as they compare the three scenarios. Deep economic ties will keep them from complete decoupling, while other countries will have to choose a side. Ultimately, a multitude of camps will emerge.

Conclusions

Throughout the 20th century, the US-led West sought to control the oil supply under the guise of human rights, freedom, and democracy, all used as pretexts for waging wars and staging coups. Today, a fierce technological struggle is unravelling under the same pretences between America and China, and it will determine the distribution of power and influence for decades. In the previous five decades, geopolitics revolved around oil. In the 21st century, technological and economic superiority is at the centre. In the electronic chip industry, control over design and production determines who will set the course for the 21st century.

China has largely succeeded in becoming self-sufficient in the production of electronic chips, but this sparked technological competition with the US, which has attempted to halt China's development by imposing sanctions and creating geopolitical issues by putting pressure over Taiwan, human rights, and other issues. This containment policy has only partially succeeded in limiting China's access to technology. Still, Washington will continue to subvert China's growth as a major power, which it perceives as a risk to American hegemony. China will not remain silent and will work to lessen the effects of the sanctions. It may not be technologically more advanced than the US yet, but it is moving forward by drawing talent to its high-tech sectors.

China has astounded the globe with its 5G technology as well as the economic miracle of its openness policy since 1978, which has helped it go from a poor developing country to the second-largest economy in the world in less than 40 years. It may once more surprise everyone. But to do so, it must not only make significant investments in scientific research, but also reduce the room for the US to use complicated problems like minority rights, human rights, and freedoms, or the peaceful resolution of border conflicts as justification for assaults on it.

Because both countries have nuclear weapons, the likelihood of a full-scale conflict between them is minimal. However, shortly, proxy conflicts seem more probable. Despite its relative decline, the United States

[38] *Hardwick T*. Apple freezes plan to buy memory chips from China's YMTC after US imposes export controls [Electronic resource]. URL: https://www.macrumors.com/2022/10/17/apple-freezes-plan-buy-chips-ymtc/ (date of access: 05.01.2023).

[39] *Shead S*. Intel commits $36 billion to make chips in Europe [Electronic resource]. URL: https://www.cnbc.com/2022/03/15/intel-commits-36-billion-to-making-chips-in-europe.html (date of access: 28.12.2022).

[40] *Zhuoran Li*. The future of the China – US chip war [Electronic resource]. URL: https://thediplomat.com/2023/03/the-future-of-the-china-us-chip-war/ (date of access: 11.02.2023).

will not cede ground to Russia or China in regions it sees as crucial to its interests, such as the Middle East or Southeast Asia. To dissuade China and lessen global dependency on Chinese producers, it will work to improve the economic and military capacities of other Asian nations, including the Philippines, India, Taiwan, and Japan. From our vantage point, a Chinese-American battle might soon be centred on Taiwan.The best course of action to avert a catastrophe would be for both parties to transform antagonism into mutual acceptance. Beijing should continue to behave in its ascent as a peaceful nation that promotes global security and stability both inside and beyond its borders, just as Washington should recognise that the world order is dynamic and not perceive China's development as its intention to replace America's position.

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