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TECHNOLOGICAL RISE OF CHINA

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ABSTRACT

This paper reviews China's technological development. It shows that the success of China's technological policy came from both international cooperation at national and firm levels and state support measures. The country's innovation development model is based on the central role of the government. Using foreign technologies, investments, and expertise, China created its own technology companies, which transformed into global corporations. Through investments in research and development and talent cultivation, China narrowed the technology gap with many developed countries, including the United States. Despite existing tensions, in particular, in the technology sector, United States corporations are interested in strengthening cooperation with China due to its growing market. This type of cooperation will further improve China's competitiveness and accelerate its technological development.

Keywords: China, Technology, Innovations, Robotics, Research and Development.

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INTRODUCTION

The political and economic growth of China is one of the frequently discussed issues among experts. The historical transformation of China's policies, especially in terms of economy and technology, has led to significant achievements. China pays special attention to the development of innovations, utilizing tremendous resources and implementing a special support policy. China's government has played a key role in the country's technological rise. The country's transformation from a manufacturing powerhouse to a technology hub has intensified global competition, as innovations remain crucial for economic and political dominance. These changes have led to technology wars between the United States (US) and China, making innovation policies a developmental priority.

Hence, this paper aims to review China's technological policies and assess its progress in the development of innovations using statistical and comparative analysis. The paper showcases the early stages of China's technology development policy, which were mainly focused on cooperation with other countries. Later, following significant changes in China's foreign economic policy, the country began to attract international businesses, establish joint ventures, and capitalize on this opportunity as a key source of technology. Simultaneously, the country's government made substantial efforts to create local tech companies as an integral part of the operations of foreign businesses. Many of these companies transformed into technology giants and top global corporations. Utilizing data from the World Bank and the World Intellectual Property Organization (WIPO), the article demonstrates China's successful transformation into a technology hub. It's noteworthy that the country managed to narrow the technology gap with leading nations such as the United States, Germany, and Japan. Moreover, China transformed into one of the key markets for transnational corporations (TNCs) with production facilities in China. These TNCs, particularly those from the US, are interested in strengthening cooperation with China despite existing restrictions, thereby contributing to China's competitiveness. This will have long-lasting consequences for the global economy.

OVERVIEW OF CHINA'S TECHNOLOGICAL POLICY

Technology plays a key role in determining competitiveness at both the company and national levels. It improves productivity and contributes to the development of new products and services. Technological development depends on many factors, particularly human capital and investments in research and development (R&D). Governments play a pivotal role in the technological advancement of their businesses by providing different incentives and implementing policies to foster innovation. For instance, governments may offer tax breaks or directly fund the innovation activities of local businesses. Moreover, they can offer benefits to transnational corporations to attract their branches. These policies result in the transfer of technologies, knowledge, expertise, and skills, which have a positive impact on the local business environment. TNCs contribute to R&D and make local markets more competitive. The presence of international businesses can create local competitors and contribute to employment with high productivity.

China's experience shows that improving technological capacity requires the

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implementation of a broad range of measures. China relied on international trade, foreign direct investment, migration – especially foreign education of students and workers – international research collaboration, and integration into global value chains. External actors played a pivotal role in China's technological development and its rise. Historically, China has placed special emphasis on technology development through cooperation with foreign countries. In the 1950s, the former Soviet Union served as the primary source of technology for China. Following tensions between the two nations in the early 1960s, Western countries and Japan emerged as the main technology suppliers in heavy industry. With the initiation of the open-door policy, China began diversifying its technology transfer through the acquisition of turnkey plants and equipment, as well as disembodied technology encompassing licensing, technical consulting, technical services, and coproduction. In the 1980s, China reevaluated its policy and initiated reforms within its science and technology system. The country began relying on the acquisition of foreign technology as a primary strategy for technological sourcing. During the 1990s, the country introduced incentives for firms to establish R&D units. In 2006, China designated indigenous innovation as a strategic priority and started shifting its focus on innovation from externally acquiring knowledge to internally creating knowledge. The government encourages Chinese firms to invest in and acquire foreign technology companies abroad. Research institutions began establishing technology companies, often as independent incorporated entities. Many of these spin-off technology companies achieved significant success, prompting the government to incorporate large public R&D institutions as units within large business enterprises. For instance, Lenovo took over the management of the Institute of Computing Technology of the Chinese Academy of Science in 1995, approximately 10 years after Lenovo spun out from that Institute (Fu et al., 2016).

China's policy to attract foreign companies and enhance its production capacity has proven successful. Apple, which commenced iPhone manufacturing in China in 2007, played a substantial role in driving innovation within the country. During that period, Chinese firms had limited capacity to produce the internal components of iPhones. China's contribution to production primarily encompassed labor and accounted for less than four percent of the value-added costs. As time progressed, Chinese workers and companies gained experience and expertise, leading to a significant shift in their collaboration with Apple. By 2018, Chinese firms were responsible for manufacturing numerous sophisticated components within iPhones, including acoustic parts, charging modules, and battery packs. The share of Chinese tech firms in the device's value-added costs exceeded 25%. China's ascent in both manufacturing and technology was anchored in industrial clusters, which were established with the assistance of foreign companies. China has greatly accelerated its industrial development by directly learning from foreign firms. It's important to note that, in China, innovation has emerged not only from universities and research labs but also through the learning process inherent in mass production itself, particularly in the capacity to manufacture products. The most important factor in China's burgeoning tech industries is its manufacturing ecosystem. Over the past two decades, China has developed an unparalleled production capacity for tech-intensive industries, with extensive government support playing a key role. This policy has been successful in nurturing China's giant technological companies. For instance, China is currently recognized as a solar superpower due to its

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solar panels being not only the most cost-effective on the market but also the most efficient. The significant reduction in solar costs over the past decade has been propelled by manufacturing innovations in China. It's worth noting that CATL, a Chinese company established in 2011, has become the largest battery manufacturer globally. The company collaborates with major car manufacturers such as BMW, Tesla, and Volkswagen (Wang, 2023). As of July 2023, CATL boasts a market capitalization of $135.27 billion, making it the world's 93rd most valuable company. Table 1 presents the market capitalization dynamics of CATL.

China developed various strategies to promote technological growth within its economy. In 2015, the country's government introduced its "Made in China 2025" strategy, aimed at achieving self-sufficiency in high-tech industries like telecommunications and artificial intelligence (AI). Additionally, authorities unveiled an economic plan called "dual circulation," with the intention of boosting both domestic and foreign demand for Chinese goods. Once again, the government played a pivotal role in the subsequent stages of China's technological transformation. To realize its objectives, the government utilized public-private partnerships, offered direct subsidies to private companies, and provided support for state-backed enterprises. China invested billions of to ensure it comes out ahead in the race for technological supremacy.

Table 1. *The market capitalization of the CATL, billion USD*

Year	Market capitalization
2018	$23.55
2019	$33.63
2020	$125.40
2021	$215.08
2022	$137.77
2023	$135.27

Source: https://companiesmarketcap.com/catl/marketcap/

In 2017, Beijing unveiled plans to become the global leader in artificial intelligence by 2030. It is anticipated that China will achieve this goal sooner, given that over the past decade, the country has invested at least $10 billion in quantum technology, approximately ten times the investment of the United States government. A primary focus for the Chinese government is attaining leadership in semiconductor manufacturing by 2030. Currently, it trails behind the United States and its aligned counterparts, Taiwan and South Korea. Nevertheless, Chinese companies command 85% of the processing of rare-earth minerals used in these chips and other critical electronics, providing a significant leverage point over their competitors. China may employ its control over rare-earth minerals as a political tool, leveraging technological development and the capacity to supply technological products abroad to gain a heightened political advantage. Many developing countries rely on Chinese-supplied infrastructure, and countries in Africa, where Huawei's components constitute about 70% of 4G networks, have been reluctant to criticize Chinese human rights violations. Similarly, Taiwan's preeminence in semiconductor manufacturing acts as a

robust deterrent against invasion, as China has limited interest in jeopardizing its primary source of microchips (Schmidt, 2023).

The United States and China are strategic competitors. China's economic and political ascent is eroding the global position of the United States. The primary strategy to counteract China's rise is by competing in semiconductor manufacturing. The US policy's objective is to hinder China's access to critical technologies and limit its capacity to acquire innovations from Western nations. In August, the Biden administration enacted the CHIPS and Science Act, an industrial policy with a value of $52.7 billion, designed to enhance research, strengthen supply chain resilience, and rejuvenate semiconductor production within the United States. Subsequently, in October, the administration introduced the most comprehensive restrictions to date on China's chip manufacturing sector. This new set of restrictions restricts the sale of advanced chips to China, depriving China of the computing power required for large-scale artificial intelligence training. Moreover, these restrictions expand further to encompass industries supporting the semiconductor supply chain, thereby cutting off both US expertise and the components needed for the tools used in chip manufacturing. Following the US' announced policy on global restrictions and export control, China released the 20th Party Congress report, which identified the ongoing trade conflict with the US as the "economic main battlefield" and pledged to "achieve high-level technology self-strength and self-independence." In the perspective of leader Xi Jinping, China has no alternative but to transition from a market-based innovation system to a security-based national innovation plan. However, the semiconductor drive in China is likely to result in enduring economic distortions due to the shortcomings of China's management system. For instance, innovation incentives for local officials may perpetuate China's investment-led economic model, which has resulted in various issues, including corruption, local debt, and a real estate crisis. Additionally, nurturing national champions can diminish the global competitiveness of Chinese firms. Entrepreneurs might shift their focus away from innovation and research to maintaining their government connections and securing state support. Subsidies and policy loans tempt high-tech firms into soft budget constraints, ultimately leading to a decline in productivity and market competitiveness (Li, 2023).

Despite the efforts of the US government, there are cases where companies from China have successfully acquired important technologies from the US. For instance, Chipuller, a startup in China's southern tech hub Shenzhen, acquired what is known as chiplet technology (Silicon Valley startup zGlue's 28 patents in 2021). Chiplet technology is a cost-efficient method for packaging groups of small semiconductors to create a powerful integrated unit capable of driving various applications, from data centers to home gadgets. These chiplets, which can vary in size from that of a grain of sand to larger than a thumbnail, are combined through a process known as advanced packaging. This technology has gained increased acceptance within the global chip industry in recent years, as the cost of chip manufacturing escalates in the race to create transistors so tiny that they are measured in terms of atoms. China's expenditure on chip packaging equipment surged to $3.3 billion in 2021 from its previous peak of $1.7 billion in 2018, although it decreased to $2.3 billion in 2022 due to the chip market downturn. Since early 2021, research papers on chiplets have begun to appear, authored by researchers from the Chinese military People's

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Liberation Army (PLA) and the affiliated universities it oversees. Moreover, state-run and PLA-affiliated laboratories are exploring the utilization of chips produced through domestic chiplet technology. It's noteworthy that Huawei has been actively filing chiplet patents. The company published over 900 chiplet-related patent applications and grants last year in China, a significant increase from the 30 filed in 2017. Over the past two years, there have been more than a dozen announcements for new factories or expansions of existing ones from companies employing chiplet technology in manufacturing across China's tech sector. These announcements represent a total investment of over 40 billion yuan. US lawmakers have criticized and called for reforms in the Committee on Foreign Investment in the United States, a powerful Treasury-led committee that reviews transactions for potential threats to US security. This committee did not intervene in the mentioned deal (Reuters, 2023). Thus, China's technological policy encompasses a wide array of measures, with the state playing a pivotal role. China's policy also promotes international collaboration and the attraction of transnational corporations (TNCs), which has aided in the creation of industrial zones and establishment of technology hubs. In the wake of technology-based tensions with the US, China has increased its support for local firms. Nevertheless, the acquisition of foreign technologies and startups remains both a priority and a significant aspect of the country's technological development.

COMPARATIVE ANALYSIS OF CHINA'S TECHNOLOGICAL PROGRESS

Innovative leaders at both the corporate and national levels tend to invest heavily in research and development. In 2014, the United States, Japan, and Germany were the largest three rich economies and invested more than 2.7% of their GDP in research and development, which was about three times as much as most developing countries. Transition to a more innovative economy needs a commitment to research and investment spending as well. In 1991, China invested 0.7% of its GDP in research and development. This figure was notably lower than that of technological leaders. In fact, due to China's competitiveness being primarily rooted in the utilization of its extensive cheap labor force, domestic research and development as well as innovation were not considered crucial during that period. Another indicator of innovation efforts is the proportion of researchers within the population. In 1996, China had 443 researchers per million people. In comparison, the corresponding numbers for the United States, Japan, and Korea were 3,122, 4,947, and 2,211 per million, respectively (Wei et al., 2017). By 2020, there had been significant changes in research and development investments in China. In that year, the country's investment indicator stood at 2.4% of GDP (Figure 1). While China remains behind the global leaders, it is making rapid strides in catching up. Although it trails behind countries like Germany, Japan, the Republic of Korea, and the United States, it surpasses Russia, which has not demonstrated any notable progress in research and development expenditures. Notably, the Republic of Korea stands as a global leader, with its indicator surpassing 4.8% of GDP.

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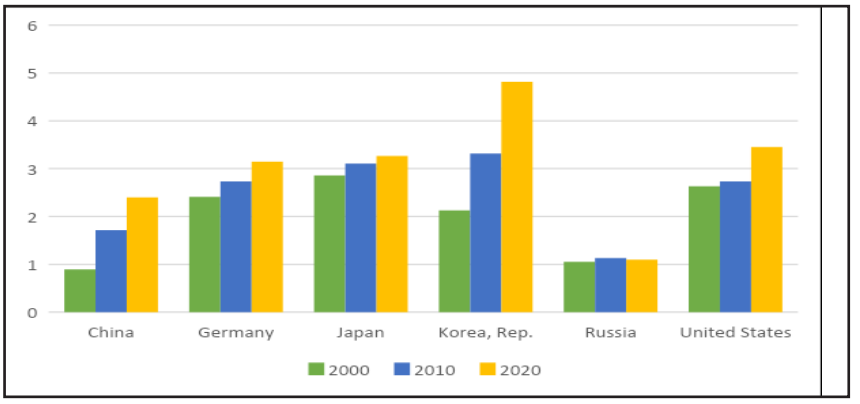
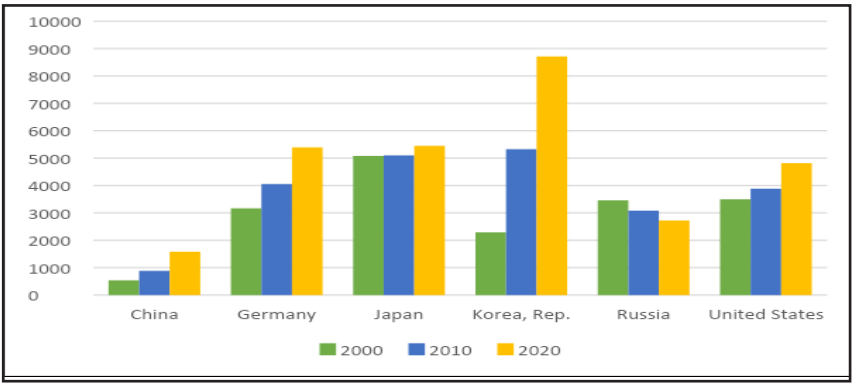
Figure 1. *Research and development expenditure (% of GDP)*



Source: Compiled by the author based on data from the World Bank (2023a).

The growth in the number of researchers reflects China's technological progress. In Figure 2, China lags behind all the countries presented. However, the details are crucial. The number of researchers engaged in R&D in China increased from 539 in 2000 to 1585 in 2020 (with 885 in 2010) per million people (as shown in Figure 2). Thus, during the reported period, the number of researchers increased by more than 2.9 times. In the same timeframe, the number of researchers increased by 1.7 times in Germany, by 1.07 times in Japan, by more than 3.8 times in the Republic of Korea, and by 1.38 times in the United States. Russia is the only country that experienced a reduction in the number of researchers in R&D. Furthermore, in comparison to the aforementioned 1996 data, China managed to narrow gaps with all developed countries except the Republic of Korea. For instance, in 1996, the number of researchers in the US was more than 7 times higher than in China. In 2020, this gap had narrowed to a little over three times. The difference between Japan and China decreased from nearly 11.2 times in 1996 to 3.4 times in 2020. However, this gap widened with the Republic of Korea from almost five times to 5.5 times. In 2020, Russia had a number of researchers 6.4 times higher than China. But in 2020, this gap had narrowed to 1.7 times. Hence, China has demonstrated significant progress in terms of the number of researchers.

Figure 2. *Researchers in R&D (per million people)*



Source: Compiled by the author based on data from the World Bank (2023b).

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In 2022, China ranked eleventh in the Global Innovation Index, marking one of the country's most significant achievements among 132 countries. Switzerland, the United States, and Sweden secured the top three spots in terms of innovation. The list of top 10 countries also included other Asian nations like the Republic of Korea (ranked 6th) and Singapore (ranked 7th). Back in 2015, China held the 29th position out of 141 countries, whereas the three most innovative countries were Switzerland, the United Kingdom, and Sweden.

What factors have determined China's progress and its recent jump in innovation indices? Table 2 illustrates China's advancements in key indicators that have contributed to the country's technological rise. China has enhanced its positions in research and development, with an increased gross expenditure on R&D. The country's corporations are actively supporting its technological progress.

Table 2. *Global innovation ranking of China*

	2015	2022
Overall index	29	11
Research & development	21	8
Researchers, FTE/mn pop.	47	48
Gross expenditure on R&D, % GDP	17	13
QS university ranking, average score top 3	11	3
ICT access	77	61
ICT use	71	39
GERD performed by business, % of GDP	13	12
GERD financed by business, %	3	3
University/industry research collaboration	31	5
State of cluster development	23	2
GERD financed by abroad, %	89	77
High-tech imports less re-imports, % total trade	8	5
Research talent, % in businesses	na	15
Domestic resident patent app./bn PPP$ GDP (Patents by origin/bn PPP$ GDP for 2022)	1	1
Scientific & technical articles/bn PPP$ GDP	53	39
Citable documents H index	16	11
Growth rate of PPP$ GDP/worker, % (Labor productivity growth, % for 2022)	1	1
High-tech exports less re-exports, % total trade	1	4
Creative goods exports, % total trade	1	1

Source: Compiled by the author based on data from Cornell University, INSEAD, and WIPO (2015) and WIPO (2022).

In 2022, China ranked third in terms of global corporate R&D investors. During the same year, corporate R&D investments reached $93.8 billion. In the QS university ranking, China improved its position from 11th in 2015 to third in 2022. However, China was unable to enhance its position in terms of the number of researchers. Changes in ICT access and ICT use indicators indicate that China has also improved its technological infrastructure. In terms of university/industry research collaboration, China ranked second in 2022, a notable improvement from its 2015 position of 31st. China is also one of the leading countries in startup financing. In 2022, the country ranked 16th in terms of received venture capital and 31st in venture capital investors. China places special emphasis on the development of manufacturing, which it utilizes for testing innovations and

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technology. China's domestic industry remains highly diversified, ranking 2nd in 2022. The substantial level of diversification allows for increased high-tech manufacturing, in which the country ranked 14th in 2022.

Over the past decade, the number of high-tech enterprises in China has risen from less than 40,000 to 400,000. In 2022, investment in high-tech industries in China surged by 18.9% year on year. Through investments in education, research and development, China has cultivated a multitude of highly skilled and motivated professionals who are at the forefront of innovation (Xinhua, 2023). As a result, China has made significant progress in terms of innovation development, substantially enhancing its global position and emerging as a leader in various aspects. These positive changes will enhance China's global competitiveness and further escalate the rivalry between technology powers.

PERSPECTIVES OF CHINA'S TECHNOLOGICAL DEVELOPMENT

China's global ambitions necessitate new approaches to the management of technological sectors. Recently, the country restructured its Ministry of Science and Technology and established a potent Central Science and Technology Commission to ensure more direct oversight by the Chinese Communist Party over the ministry. This change acknowledges that competing in technology with the United States demands direct supervision from the highest echelons of the party. According to Chinese President Xi Jinping, the enhancement of integrated national strategies and strategic capabilities is pivotal to China's aspiration of becoming a global power. By 2049, China aims to emerge as a global leader in three strategic technologies: space, AI, and quantum communications and computing, which are regarded as China's "new or critical infrastructure." China plans to invest approximately $14.7 billion in AI in 2023, accounting for about 10% of global investment. By 2026, this figure is projected to reach around $26 billion. China demonstrated its quantum communications lead to the world in 2017 when Chinese scientists transmitted entangled photons from the world's inaugural quantum communication satellite, Micius, launched in 2016. The fusion of space, AI, quantum computing, and communications is propelling China into a significant technological powerhouse (Goswami, 2023).

The US technology companies are interested in strengthening cooperation with China despite the existing tensions between the two countries. In 2023, Bill Gates, the co-founder of the US tech giant Microsoft; Elon Musk, co-founder of the electric vehicle front-runner Tesla; Intel CEO Pat Gelsinger; Tim Cook, CEO of Apple; and Cristiano Amon, CEO of Qualcomm, visited China, where they held meetings with Chinese government officials, including Xi Jinping. As the Chinese market becomes less accessible, these visits aim to maintain the positions of these companies. The US technology companies still rely crucially on China for a significant portion of their sales, as 17 of the top 100 global companies in terms of sales in China during the most recent fiscal year were US tech-related companies. Apple was the global company with the highest sales in China in 2022, amounting to nearly $70 billion. Greater China remains Apple's second-largest source of revenue, following its home market. Apple's greater China revenue surged by 43% to $74.2 billion in fiscal year 2022 from $51.9 billion in fiscal year 2018. Qualcomm, a major US chip company, depends on

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China for over 60% of its sales. In 2022, Tesla earned 22% of its total sales in China, up from 8% in 2018. Eight of the companies most dependent on China for sales were in the semiconductor sector – the area where the conflict between the US and China has been most severe. LinkedIn, Amazon.com, and Airbnb are experiencing lower revenue growth and planning to close their businesses in China. The US chip and semiconductor manufacturing companies are experiencing a significant reduction in revenues following the US tech restrictions. For instance, the US-based chip-equipment company Lam Research expects annual sales in 2023 to fall by $2 to $2.5 billion due to US restrictions. The US and some other Western nations have also moved to ban the use of Huawei and ZTE 5G equipment in their communications infrastructure. Experts predict a gradual decline in the US tech industry's dependence on China as many companies, including Apple and Google, are looking to move parts of their supply chains away from China and into other Asian countries (Tanaka and Li, 2023).

Another important direction in which China puts substantial effort is the development of robotics. The benefits of robot adoption in manufacturing include safety, speed, consistency, perfection, and higher levels of productivity, which can improve the competitiveness of firms. Robotic automation also helps create jobs in manufacturing, particularly in engineering, robot manufacturing, and systems integration (Universal Robots, 2022). However, robots can have displacement effects, and industrial robots may negatively impact jobs and wages. The impact of robots varies by region and industry. Estimates show that for every robot added per 1,000 workers in the US, wages decline by 0.42%, and the employment-to-population ratio goes down by 0.2 percentage points. Moreover, adding one more robot in a commuting zone (geographic areas used for economic analysis) reduces employment by six workers in that area (Brown, 2020). However, robotization and automation are among the key trends in the global economy. According to the 2022 McKinsey Global Industrial Robotics Survey, automated systems will account for 25% of capital spending over the next five years. Industrial-company executives expect to see benefits in output quality, efficiency, and uptime. It is worth noting that primary challenges to robot adoption include the capital cost of robots and companies' general lack of experience with automation (McKinsey & Company, 2023).

Annual sales of robots in China have risen dramatically. In 2000, sales amounted to a mere 380 units (0.4% of the world total). China's share rose to 3.7% of annual global sales in 2005 and 12.4% in 2010. In 2016, sales further rose to 87,000 units, accounting for about 30% of the global market's 294,000 units. China became the country with the largest operational robot stock in 2016, with 339,970 operational units (19% of the world's total). The top industries in China for robot adoption are automotive (accounting for 44.5% of all manufacturing robots), electronics (24.7%), metals (13.9%), plastics and chemicals (11.5%), and food and beverages (2.9%). In 2012, China produced about 5,800 robots. By 2017, the number of robots produced in China annually had risen more than 20-fold to 131,000. Local (non-foreign) firms manufactured almost 30% of robots. In 2005, the number of robotic firms in China amounted to 221, which increased to 6,478 by the end of 2015 (Cheng et al., 2019).

The industrial robotics market in China achieved robust growth, setting a new record of 243,300 installations in 2021 – a rise of 44% compared to the

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previous year. Growth is evident across all industries, with the electrical and electronics sector being the dominant one, experiencing a 30% increase to reach 81,600 installations. The automotive industry also displayed a strong recovery, primarily driven by electric vehicle manufacturing in China. It saw an 89% rise in 2021 with 50,700 installations (International Federation of Robotics, 2023a).

China's massive investment in industrial robotics has elevated the country to a top ranking in robot density, surpassing the United States for the first time. The ratio of operational industrial robots to the number of workers reached 322 units per 10,000 employees in the manufacturing industry. Presently, China holds the fifth position. The world's top five most automated countries in manufacturing are South Korea, Singapore, Japan, Germany, and China. The Republic of Korea achieved an all-time high of 1,000 industrial robots per 10,000 employees in 2021. This figure is more than three times the number reached in China and positions the country as the global leader (International Federation of Robotics, 2023b).

The global rise of China's car industry is a direct result of its successful technological policy. For example, China has significantly increased the sales of its homegrown passenger car brands. Local brands captured 54% of China's wholesale car market in the first six months of 2023, up from 48% a year earlier. This marks the second consecutive time that local brands have surpassed foreign ones on a half-year basis. Wholesale figures include vehicle exports. China's automotive revolution is being propelled by its commanding lead in battery-powered and plug-in hybrid cars. Led by BYD, nine local manufacturers were among China's top 10 bestselling electric vehicle makers in June. Tesla was the only foreign carmaker on the list. Backed by billionaire investor Warren Buffett, BYD ceased producing cars powered solely by gasoline in March of the previous year. The company sold over 1.2 million electric vehicles and plug-in hybrids in China during the first six months of 2023, which is almost double the number from a year earlier. More than half of these were plug-ins. Chinese carmakers are also expanding globally. The country surpassed Japan in the first quarter of 2023 as the largest exporter of vehicles, although about three-quarters of the 1.1 million autos shipped abroad were internal combustion engine models. BYD and state-owned SAIC have announced plans to establish plants in Europe, Asia, and Latin America (Kubota, 2023).

Given China's manufacturing and technological capacities, it will be challenging to compete with China, whose position in the global market will strengthen. Estimates show robust evidence of the displacement effect of China's exports. A 10% increase in China's bilateral exports, on average, leads to approximately a 3.2% reduction, or an average decrease of US$223,030, in the bilateral exports of a competing product by other countries to third markets (Pham et al., 2022). Therefore, technological self-sufficiency is a priority for China's policy. To achieve its goal of becoming a leading technology power, China will increase support measures for its local businesses and further develop its innovation ecosystem. It is worth mentioning that bilateral cooperation is of mutual interest to both China and foreign technology companies. China will leverage this collaboration to catch up with its competitors and achieve its ambitious goals of technological supremacy.

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CONCLUSION

The technological rise of China is the result of successful international cooperation combined with internal efforts to support manufacturing and innovation. Developed countries and foreign companies have played a key role and continue to contribute to China's ascent as a technological power. High levels of expenditure on research and development and talent cultivation have transformed China into one of the leading countries in terms of innovation development. In 2022, China ranked eleventh in the Global Innovation Index, and the country is a global leader in many sub-indices. For instance, China excels in terms of patent applications, labor productivity, and exports of creative goods. Its universities have made significant progress in terms of QS ranking, which bodes well for the accelerated development of innovations. It's important to mention that China has created corporations that dominate global markets. For example, CATL is a key battery manufacturer, and in terms of car manufacturing, China has begun to outperform many traditional leaders, such as Japan.

Technology development is a key priority for China's authorities. The country's innovation development model is centered around the government's pivotal role. Recognizing the significance of global technological and economic competition, the government implements special programs aimed at achieving self-sufficiency in terms of new technologies and innovations. These developments are poised to play a crucial role in the country's future economic growth.

China quickly catches up with its main competitors, such as the United States, which will intensify global competition for markets. It is worth noting that the US and other Western corporations are interested in maintaining and enhancing cooperation with China, relying on China's market as one of the key revenue sources. Sustaining this cooperation will further bolster China's competitiveness and strengthen its position in the global markets. China's experience in implementing technological policies remains valuable for many developing countries.

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REFERENCES

Brown, Sara (2020). A new study measures the actual impact of robots on jobs. It's significant. Retrieved from https://mitsloan.mit.edu/ideas-made-to-matter/a-new-study-measures-actual-impact-robots-jobs-its-significant. Accessed: 17.05.2023.

Cheng, Hong, Ruixue Jia, Dandan Li and Hongbin Li (2019). "The rise of robots in China". *Journal of Economic Perspectives*, 33(2): 71–88.

Cornell University, INSEAD, WIPO (2015). The Global Innovation Index 2015: Effective Innovation Policies for Development. Fontainebleau, Ithaca, and Geneva.

Fu, Xiaolan, Woo Wing Thye and Jun Hou (2016). "Technological innovation policy in China: the lessons, and the necessary changes ahead". *Economic Change and Restructuring*, No. 49: 139–157. Doi: 10.1007/s10644-016-9186-x.

Goswami, Namrata (2023). China prioritizes 3 strategic technologies in its great power competition. Retrieved from https://thediplomat.com/2023/04/china-prioritizes-3-strategic-technologies-in-its-great-power-competition/. Accessed: 22.04.2023.

International Federation of Robotics (2023a). China's robot installations grew by 44 percent. Retrieved from https://ifr.org/news/china-robot-installations-grew-by-44-percent. Accessed: 15.06.2023.

International Federation of Robotics (2023b). China overtakes the USA in robot density. Retrieved from https://ifr.org/news/china-overtakes-usa-in-robot-density. Accessed: 15.06.2023.

Kubota, Yoko (2023). In China, the era of Western carmakers is over. Retrieved from https://www.wsj.com/articles/rise-of-chinas-ev-makers-puts-end-to-wests-local-dominance-775d0811. Accessed: 10.07.2023.

Li, Zhuoran (2023). The Future of the China-US Chip War. Retrieved from https://thediplomat.com/2023/03/the-future-of-the-china-us-chip-war/. Accessed: 02.03.2023.

McKinsey & Company (2023). Unlocking the industrial potential of robotics and automation. Retrieved from https://www.mckinsey.com/industries/industrials-and-electronics/our-insights/unlocking-the-industrial-potential-of-robotics-and-automation. Accessed: 07.04.2023.

Pham, Cong S., Mary E. Lovely, Xuan Nguyen and Chi-Chur Chao (2022). "Impact of China on trade in electronic products". *Economics of Transition and Institutional Change*, 30(2): 357-372.

Reuters (2023). Chip wars: How 'chiplets' are emerging as a core part of China's tech strategy. Retrieved from https://www.reuters.com/technology/chip-wars-how-chiplets-are-emerging-core-part-chinas-tech-strategy-2023-07-13/. Accessed on 14.07.2023.

Eurasian Research Journal
Summer 2023
Vol. 5, No. 3.

Schmidt, Eric (2023). Innovation power. Why technology will define the future of geopolitics. Retrieved from https://www.foreignaffairs.com/united-states/eric-schmidt-innovation-power-technology-geopolitics. Accessed: 01.03.2023.

Tanaka, Akito and Grace Li (2023). U.S. big tech won't shake its China addiction. Retrieved from https://asia.nikkei.com/Spotlight/The-Big-Story/U.S.-big-tech-won-t-shake-its-China-addiction. Accessed: 12.07.2023.

Universal Robots (2022). Impact of robotics in manufacturing. Retrieved from https://www.universal-robots.com/in/blog/impact-of-robotics/. Accessed: 10.05.2023.

Wang, Dan (2023). China's hidden tech revolution. How Beijing threatens U.S. dominance. Retrieved from https://www.foreignaffairs.com/china/chinas-hidden-tech-revolution-how-beijing-threatens-us-dominance-dan-wang?check_logged_in=1&utm_medium=promo_email&utm_source=lo_flows&utm_campaign=registered_user_welcome&utm_term=email_1&utm_content=20230303. Accessed: 01.03.2023.

Wei, Shang-Jin, Xie Zhuan, and Xiaobo Zhang (2017). "From "Made in China" to "Innovated in China": Necessity, prospect, and challenges". *Journal of Economic Perspectives*, 31(1): 49–70.

WIPO (2022). Global Innovation Index 2022: What is the future of innovation-driven growth? Geneva: WIPO. Doi: 10.34667/tind.46596.

World Bank (2023a). Research and development expenditure (% of GDP) - China, Germany, Japan, Korea, Rep., Russian Federation, United States. Retrieved from https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=CN-DE-JP-KR-RU-US. Accessed: 10.06.2023.

World Bank (2023b). Researchers in R&D (per million people) - China, Germany, Japan, Korea, Rep., Russian Federation, United States. Retrieved from https://data.worldbank.org/indicator/SP.POP.SCIE.RD.P6?locations=CN-DE-JP-KR-RU-US. Accessed: 10.06.2023.

Xinhua (2023). Column: Secret to China's rapid rise in innovation prowess. Retrieved from https://english.news.cn/20230313/4c33c0d5f4ea4f16bb075605f9d587d9/c.html. Accessed: 14.03.2023.