

國立政治大學亞太研究英語碩士學位學程  
International Master's Program in Asia-Pacific  
Studies  
College of Social Sciences  
National Chengchi University

碩士論文  
Master's Thesis

未來技術與未來競爭：人工智能在中美關係中的  
作用  
Future Technology & Future Competition: the Role  
of Artificial Intelligence Development in US-Sino  
Relations

Student: 陳維倫 William Kristopher Bradford  
Advisor: 冷則剛 Tse-Kang Leng

中華民國 110年 7月  
July 2021

未來技術與未來競爭：人工智能在中美關係中的作用  
Future Technology & Future Competition: the Role of Artificial  
Intelligence Development in US-Sino Relations

研究生: Student: 陳維倫 William Kristopher Bradford

指導教授: Advisor: 冷則剛 Tse-Kang Leng

國立政治大學

亞太研究英語碩士學位學程

碩士論文

A Thesis

Submitted to International Master's Program in Asia-Pacific Studies

National Chengchi University

In partial fulfillment of the Requirement

For the degree of Master in China Studies

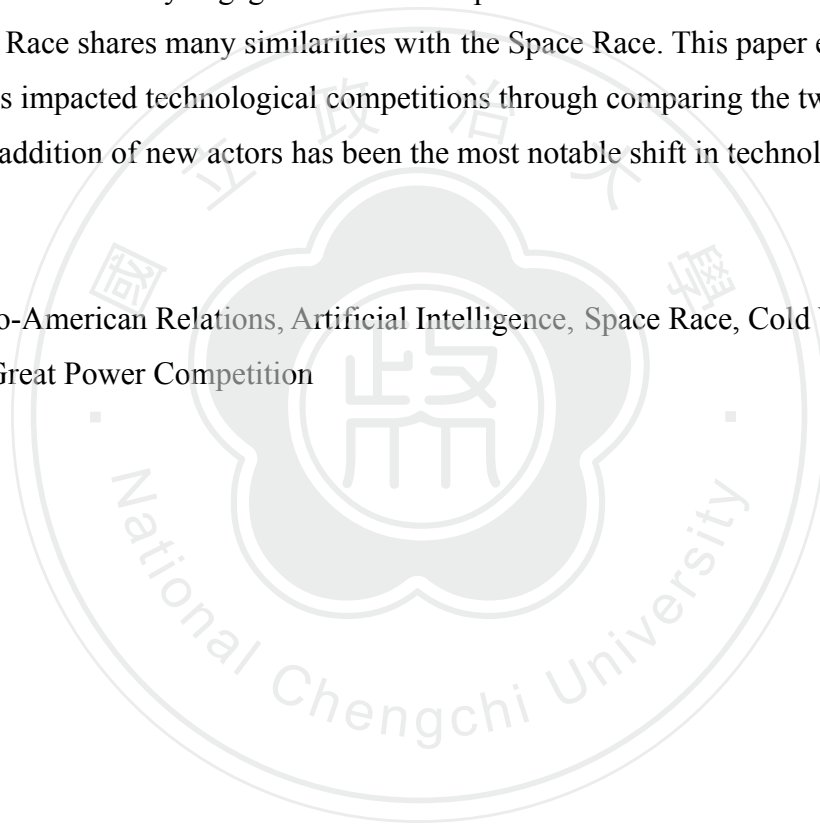
中華民國 110年 7月

July 2021

## Abstract

Technological competitions between great powers have been used in the past to test the ideological superiority of great powers, while also creating a non-military area of competition. While the Space Race is the most well-known of the technological competitions, the United States and China are currently engaged in a new competition: the Artificial Intelligence Race. The ongoing AI Race shares many similarities with the Space Race. This paper explores how globalization has impacted technological competitions through comparing the two competitions, finding that the addition of new actors has been the most notable shift in technological competition.

**Keywords:** Sino-American Relations, Artificial Intelligence, Space Race, Cold War, Globalization, Great Power Competition



## 摘要

過去大國之間的技術競爭被用來檢驗大國的意識形態優勢，同時也創造了一個非軍事領域的競爭。雖然太空競賽是最著名的科技競賽，但美國和中國目前正在進行一項新的競賽：人工智能競賽。正在進行的 人工智能競賽 與 太空競賽 有許多相似之處。本文通過比較兩種競爭來探討全球化如何影響技術競爭，發現新參與者的加入是技術競爭中最顯著的轉變。

關鍵詞：中美關係、人工智能、太空競賽、冷戰、全球化、大國競爭



# Table of Contents

<b>Chapter 1. Introduction</b>	<b>1</b>
1.1 Methodology	3
1.2 Framework	5
1.3 Limitations of Research	8
1.4 Chapter Arrangement	8
<b>Chapter 2. Literature Review</b>	<b>10</b>
2.1 What is Artificial Intelligence?	10
2.2 Chinese AI Policies	16
2.3 US AI Policies	20
2.4 Limitations on the Chinese Hi-Tech Industry	23
2.5 From Cooperation to Competition	27
<b>Chapter 3. Past and Present Technological Competition</b>	<b>31</b>
3.1 The History of the Space Race	31
3.2 Soft Power Implications of the Space Race	34
3.3 Hard Power Implications of the Space Race	38
3.4 Comparing the Space Race and AI Race	40
<b>Chapter 4. Geopolitics and Globalization in the Sino-American AI Race</b>	<b>43</b>
4.1 The European Union and European Corporations in the AI Race	44
4.2 Taiwan- The Semiconductor Foundry of the World	47
<b>Chapter 5. Conclusion</b>	<b>56</b>
5.1 Recommendations for Future Research	58
5.2 In Conclusion	60
<b>Resources</b>	<b>62</b>

## Figures and Tables

**Figure 1: Gross Domestic Spending on R&D, China Power Team, “Is China Leading in Global Innovation?,” ChinaPower Project, January 28, 2021, fig. 2** 26

**Figure 2: US and Chinese AI Development SW Analysis** 58



## Chapter 1. Introduction

Technological innovations and advancements have been one of the primary driving forces of humanity. The impact of which is felt even more so today. Developments in the field of Artificial Intelligence (AI) could have drastic effects on international power systems, with both the United States and the People's Republic of China actively pursuing international dominance in this emerging field. Currently, there is an AI Race brewing between the United States, the current hegemonic power, and China, which is attempting to either gain equal footing with the United States as a second hegemonic power or replace the United States. The AI Race has started, and for the United States to keep its position as a global power, it must actively compete against China in this field. The goal of this research is to examine how the current push towards AI development in both the United States and China is playing into the larger hegemonic competition between the two powers. The research question explored in this paper is: how has globalization affected technological competition between great powers? This will be done through comparing the ongoing Sino-American AI Race to the Soviet-American Space Race in order to explore the changes and causes of the changes in technological competition. The hypothesis of this research is that globalization has introduced additional state and non-states actors into the competition, which are able to influence the policies and directions of development in the US and China. The IMF definition of globalization- which notes international trade and transactions, capital and investment movements, the dissemination of knowledge, and the migration and movement of people as the key defining factors of globalization- will be used in the pursuit of this analysis.<sup>1</sup>

---

<sup>1</sup> "Globalization: Threat or Opportunity?". International Monetary Fund. 12 April 2000.

This paper explores this topic through the lens of the realist theory of great power competition, which provides an overarching explanation of the current US-Sino relationship, as well as the competitive- and sometimes combative- relationship that the two nations currently have with one another. The paper uses a qualitative methodology, focusing on the time frame of 2012 to 2020 as the basis of research and analysis. This time frame was chosen as it was during this period that Chinese foreign policy shifted from the Keeping a Low Profile policy to Striving for Achievement under President Xi Jinping.<sup>2</sup> At the same time as this foreign policy shift, China began to emphasize the importance of developing their high-tech sectors, with an emphasis placed on the development of AI, which culminated with government investments, guidelines for development, and the increased presence of the importance of AI development in government publications and planning.<sup>3</sup> The relationship between the development of AI in China and the foreign policy goals in a statement made by the Chinese State Council in 2017, where it argued that:

Artificial intelligence is thought to be the strategic technology leading the future... ..  
China's national security and international competition situation are more complex, so we must look at the world, lay out the artificial intelligence development on the national

---

<sup>2</sup> Yan Xuetong, "From Keeping a Low Profile to Striving for Achievement," *The Chinese Journal of International Politics* 7, no. 2 (2014): pp. 153-184, <https://doi.org/https://doi.org/10.1093/cjip/pou027>.

<sup>3</sup> Mozur, Paul. "Beijing Wants A.I. to Be Made in China by 2030." *The New York Times*. The New York Times, July 20, 2017. <https://www.nytimes.com/2017/07/20/business/china-artificial-intelligence.html>; Knight, Will. "The West Should Stop Worrying about China's AI Revolution." *MIT Technology Review*. MIT Technology Review, October 20, 2017. <https://www.technologyreview.com/s/609038/chinas-ai-awakening/>; Triolo, Paul, Elsa Kania, and Graham Webster. "Translation: Chinese Government Outlines AI Ambitions through 2020." *New America*, January 26, 2018. <https://www.newamerica.org/cybersecurity-initiative/digichina/blog/translation-chinese-government-outlines-ai-ambitions-through-2020/>; Lee, Kai-Fu, and Paul Triolo. "China's Artificial Intelligence Revolution: Understanding Beijing's Structural Advantages." *Eurasia Group*, December 2017. [https://www.eurasiagroup.net/files/upload/China\\_Embraces\\_AI.pdf](https://www.eurasiagroup.net/files/upload/China_Embraces_AI.pdf); "Beijing AI Principles." *Beijing AI Principles*, 2018. <https://www.baai.ac.cn/blog/beijing-ai-principles>.



strategic level, and firmly grasp the strategic initiative of international competition during the new stage of artificial intelligence development.<sup>4</sup>

This declaration was a key event in the creation of AI as a realm of international great power competition between the United States and China, which showed the goals that China hopes to achieve through the development of AI. In response to this policy development, the United States has begun to develop its own AI policies and goals, which cite China as their key competitor in the field.<sup>5</sup> Thus, the field has been set for technological competition between the two nations.

This paper examines these domestic and foreign policy shifts in both the United States and China in this timeframe concerning the development of competition between the two nations, as well as the development of AI policies. It also compares the current technological competition between the two nations to the Space Race, which pitted the technological might of the Soviet Union and the United States to compare and contrast the current technological competition between competing great powers to a previous technological competition. This will provide historical context to the current competition, as well as provides a historical counterpart.

## 1.1 Methodology

This study will be interpretivist in nature, as such the majority of the methods used to examine the topic at hand will be qualitative. Due to the wide-ranging nature of the analysis that will be employed, a variety of research methods will likely be employed. The most vital of these will be that of engaging with the literature available on the topic of technological innovation in

---

<sup>4</sup> “China's New Generation of Artificial Intelligence Development Plan.” FLIA. Chinese State Council, July 31, 2017. <https://flia.org/notice-state-council-issuing-new-generation-artificial-intelligence-development-plan/>.

<sup>5</sup> Executive Order No. 13,859, 84 C.F.R. 3967 (2019); “NIST Requests Information on Artificial Intelligence Technical Standards and Tools”. May 8, 2019. <https://www.nist.gov/news-events/news/2019/05/nist-requests-information-artificial-intelligence-technical-standards-and->

the four aforementioned fields. At the same time, to better understand the push towards technological innovation as a part of China's plans to compete with the United States as a rising global hegemonic power, an in-depth reading of the relevant literature from Chinese and American foreign policy experts will be required. This will range from general foreign policy goals and strategies to the more recent shift towards a Striving For Achievement policy in 2012. As such, I will focus on the foreign policy shifts from 2012 to 2020. This will have a more specific interest in the transition of the foreign policy goals of China from former President Hu Jintao to President Xi Jinping. The focus on the foreign policy strategies of the United States will be on the second term of President Obama and the changes made during the administration of President Trump. While the research will be a mostly qualitative endeavor, there will be a quantitative aspect as well. This will be done to chart the economic growth of China and the United States, the investments made into the high-tech industries of both countries, and the development of companies working in these fields.

Data collection for the thesis will include the examination of first-hand and second-hand sources regarding AI development and foreign policy changes within China and the United States. In terms of first-hand documents, the focus will be on government policy white papers, official statements, and policy proposals in the two nations. Major Chinese government documents that will be examined will include the Made in China 2025 platform, Beijing AI Principles, research and development funding proposals from the Chinese National Congress, recent Five-Year Plans, and official statements made by the Ministry of Science and Technology and the Chinese State Council. From the United States, Executive Orders on AI development, foreign policy decisions regarding Sino-American relations from the State Department, and

funding requests by federal agencies for AI research and development. These documents will create the foundation of first-hand data collection for this thesis.

In terms of second-hand sources, a mix of academic papers, think tank papers, books, and news articles will be used to further explore and understand the implications of the government policies. Major sources from think tanks will include the Council on Foreign Relations, the Center for Strategic and International Studies, the Brookings Institute, the McKinsey & Company, and the Future of Life Institute. These think tanks have produced numerous documents exploring the contemporary Sino-American relationship, as well as AI development, which will provide valuable information in the exploration of the topic. News articles will be sourced through reliable and trustworthy sources such as Reuters, AP, Financial Times, South China Morning Post, the Washington Post, CNN, and New York Times.

## 1.2 Framework

This research aims to explore how AI development, a domestic policy decision, plays into the ongoing great power competition between China and the United States. The main objects of study are the foreign and domestic policy decisions of the two nations, as well as the ongoing Sino-American great power competition. Due to the nature of this study, the theoretical framework used by this paper is that of neoclassical realism.

Anarchy is one of the four key pillars within the field of realism, the other three being groupism, egoism, and power politics, which are shared by all realist fields.<sup>6</sup> Within this model, anarchy is essentially the glue that binds the realist view of international relations together. Wohlforth describes this through his definition of power politics as “The intersection of

---

<sup>6</sup>William C. Wohlforth, “Realism,” *Oxford Handbooks Online*, 2008, <https://doi.org/10.1093/oxfordhb/9780199219322.003.0007>.

groupism and egoism in an environment of anarchy makes international relations, regrettably, largely a politics of power and security.”<sup>7</sup> Because the international system is one of anarchy, the influence of power politics and "might make right" mentalities are vital to how realists examine and understand the international system. This anarchistic international system is a key factor in how states react and is a common cause of war. Due to this, the realists argue that states can cooperate somewhat, but that conflict between states is common and that the fear of war will be the key driver of states' foreign policy.<sup>8</sup> This overarching theory of anarchy, and the debates that followed, would lead to realism splitting into multiple different sub-theories of realism that differ on how states can act in the state of anarchy.

Neoclassical realism takes the overarching premises presented in the field of realism, but instead of attempting to create a unified theory of international relations, determines which theories to use on a case-by-case basis.<sup>9</sup> Another key difference, which is beneficial to this paper is the focus on domestic policy as a determinant of foreign policy actions and goals of a state.<sup>10</sup> This examination of domestic policy also described as "Innenpolitik" provides a framework to explore how domestic and foreign policy of nations interact in creating national goals.<sup>11</sup> Dr. Norrin Ripsman describes neoclassical realism as

Taking neorealism as their point of departure, its adherents posit that states respond primarily to the constraints and opportunities of the international system when they conduct their foreign and security policies, but that their responses are conditioned by

---

<sup>7</sup>William C. Wohlforth, "Realism"

<sup>8</sup>William C. Wohlforth, "Realism"

<sup>9</sup>William C. Wohlforth, "Realism"

<sup>10</sup>Norrin M. Ripsman, "Neoclassical Realism," *Oxford Research Encyclopedia of International Studies*, 2011, <https://doi.org/10.1093/acrefore/9780190846626.013.36>; James D. Fearon, "Domestic Politics, Foreign Policy, and Theories of International Relations," *Annual Review of Political Science* 1, no. 1 (1998): pp. 289-313, <https://doi.org/10.1146/annurev.polisci.1.1.289>.

<sup>11</sup>Norrin M. Ripsman, "Neoclassical Realism"

unit-level factors, such as state–society relations, the nature of their domestic political regimes, strategic culture, and leader perceptions.<sup>12</sup>

This emphasis provides an avenue to describe the role AI development (domestic policy) impacts the goal of Chinese power projection and competition with the United States (foreign policy).

The hypothesis of this paper is focused on the two sets of interactions; Sino-American great power competition, as well as the relationship between domestic and foreign policy decisions within these two nations. As such, the strategy used to examine this hypothesis is to explore the relationship between domestic and foreign policy decisions in the United States and China. The key actors this paper will focus on are the government bureaucracies of China and the United States, which are the bodies that make the policies that will be examined in this thesis. Due to the more assertive positioning of China as a rising great power, there are more realms of competition between the two nations. One such avenue of competition that has been explored in recent Chinese political developments is the advancement of Chinese high-tech industries. This is seen as an area where China can challenge the hegemony of the United States as the world leader in technological innovation, especially in the field of Artificial Intelligence.<sup>13</sup> As such, the domestic policy decisions to further develop the high-tech industry of China also work as an attempt to challenge US hegemony in the field of technological innovation and provide valuable power projection options to China as a rising power. While these decisions were being made in China, the United States began to push towards AI development as well in response through increased funding, development of new government departments, and incentives for private businesses in the technology sector to focus on AI development.<sup>14</sup> This can be seen as an attempt to use

---

<sup>12</sup>Norrin M. Ripsman, “Neoclassical Realism”

<sup>13</sup> “China's New Generation of Artificial Intelligence Development Plan.” FLIA. Chinese State Council.

<sup>14</sup>Executive Order No. 13,859, 84 C.F.R. 3967 (2019); “NIST Requests Information on Artificial Intelligence Technical Standards and Tools”

domestic policy as a realm of competition between nations, which influences the sphere of foreign policy. These events show the relationship between Sino-American great power competition and the development of domestic and foreign policy within the two nations that this paper plans to examine through the framework of neoclassical realism.

### **1.3 Limitations of Research**

In terms of limitations of the research, the language barrier is the most prevalent. Many government documents and academic work on the topic of AI policy in China are not translated to English. Due to a lacking Chinese reading skill, this paper is heavily reliant on English translations of governmental, academic, and journalistic documents from China. This limits the scope of Chinese sources available to the paper.

### **1.4 Chapter Arrangement**

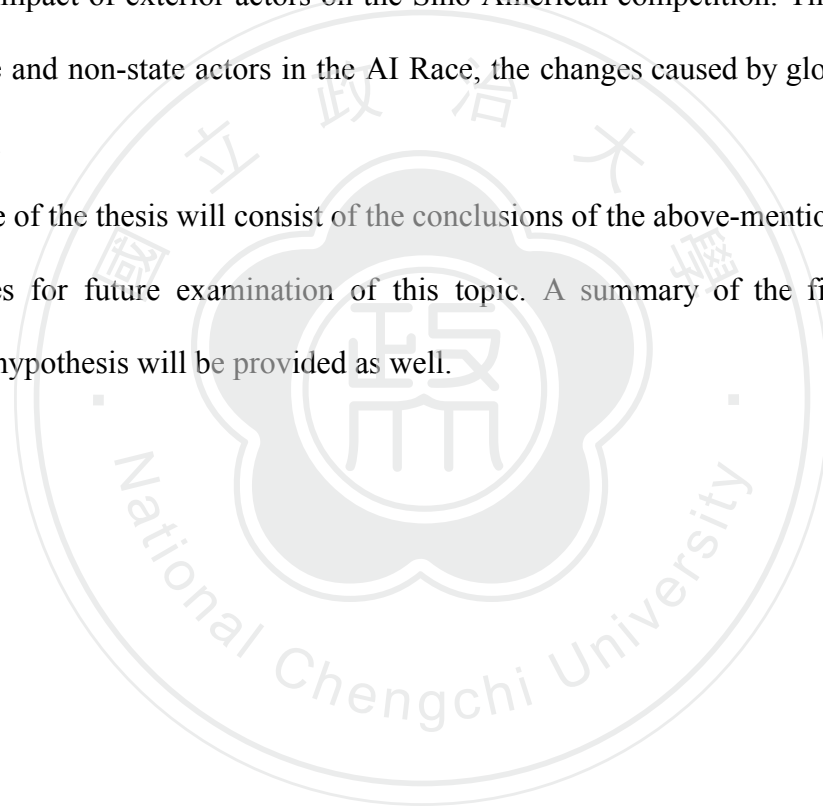
Chapter Two of this thesis will be the literature review. This will be broken into six sections. Section One will focus on defining and describing AI, providing examples of the uses of AI, and exploring the importance of AI as a future technology. Sections Two and Three will be focused on AI policies developed by China and the United States in recent years. Section Four will examine the potential limitations of the Chinese high-tech sector, as well as how China hopes to combat these limitations. Section Five will explore past examples of the use of technological innovation as a tool for foreign policy through a historical analysis of the Soviet-American Space Race. Section Six will discuss the evolution and history of the Sino-American relationship.

Chapter Three of the thesis will explore the evolution of technological competition. This will be achieved through examining the differences between the Soviet-American Space Race and the

current technological competition surrounding the development of AI. By providing a historical comparison to the Space Race, the evolutions of technological competition can be better examined. Following a brief history of the Space Race, this chapter will discuss the impacts of the Space Race on hard and soft power. This will be concluded with a comparison between the two competitions.

Chapter Four of the thesis will explore the differences of the two competitions, focusing mostly on the impact of exterior actors on the Sino-American competition. Through examining the role of state and non-state actors in the AI Race, the changes caused by globalization can be better observed.

Chapter Five of the thesis will consist of the conclusions of the above-mentioned research and provide avenues for future examination of this topic. A summary of the findings and their impacts on the hypothesis will be provided as well.



## Chapter 2. Literature Review

### 2.1 What is Artificial Intelligence?

Technological advancements, especially in the fields of Artificial Intelligence(AI) and automation, in recent years have the potential to drastically change society. However, this is not a recent line of thinking. In 1933, John Maynard Keynes wrote in a letter that:

We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come – namely, technological unemployment. This means unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour.<sup>15</sup>

While the warning was premature, the issue still stands. Gordon Moore, a computer scientist predicted that "From careful observation of an emerging trend, Moore extrapolated that computing would dramatically increase in power, and decrease in relative cost, at an exponential rate."<sup>16</sup> This prediction, known as Moore's law has so far proved true, which has led to significant advancements since the mid-20th century. As power has increased and the price has decreased, the role of technology in the private and public spheres has increased. This comes with many possible negative consequences: namely job loss due to automation and the increasing role of AI in the modern political climate.

Before discussing the issues regarding AI and automation, a definition for each is needed. In his book *The Sentient Machine*, entrepreneur Amir Husain defines AI as "...the overarching

<sup>15</sup>Keynes, John Maynard. Economic Possibilities for our Grandchildren by John Maynard Keynes 1930. Accessed February 23, 2021. <https://www.marxists.org/reference/subject/economics/keynes/1930/our-grandchildren.htm>.

<sup>16</sup>"Over 50 Years of Moore's Law," Intel, accessed February 23, 2021, <https://www.intel.com/content/www/us/en/silicon-innovations/moores-law-technology.html>.



science that is concerned with intelligent algorithms, whether or not they learn from data.”<sup>17</sup> AI, in this sense, is an overarching field with numerous ways AI is being developed. For instance, Husain notes the differences between Machine Learning(ML) -using a set of datasets to train AI- and Cognitive Computing(CC) -having AI complete tasks freely and develop a process based on its tests-, two significantly different approaches to AI with their own merits and downsides.<sup>18</sup> An example of ML being used successfully can be found within the field of agriculture. An example of this is the Spanish food processing company El Duze, which “...now uses robotics to pick up heads of lettuce from a conveyor belt, rejecting heads that do not comply with company standards.”<sup>19</sup> This allows for a more efficient system of quality control, as the aspect of human error is removed. While ML can be effective at certain tasks, there are limitations to its effectiveness. By making decisions based on a set of data, there is not a possibility for these machines to adapt to CCs.<sup>20</sup> Compared to Machine Learning, Cognitive Computing provides an AI system that can learn based on new experiences.<sup>21</sup> This is best represented in the AlphaGo:

This was through the Deep Learning program's ability to gain insight from their past experiences. By doing so, AlphaGo Next has played at a level that most human players cannot comprehend, as the thought process behind moves is significantly different from human players.<sup>22</sup>

Automation, by comparison, is a much broader field, as it is not solely the realm of AI. Former Secretary of State Henry Kissinger discussed the two, saying “Automation deals with

<sup>17</sup> Amir Husain, *The Sentient Machine: The Coming Age of Artificial Intelligence* (New York, NY: Scribner, 2018).

<sup>18</sup> Amir Husain, *The Sentient Machine: The Coming Age of Artificial Intelligence*

<sup>19</sup> Carl Benedikt Frey and Michael A. Osborne, “The Future of Employment: How Susceptible Are Jobs to Computerisation?,” *Technological Forecasting and Social Change* 114 (2017): pp. 254-280, <https://doi.org/10.1016/j.techfore.2016.08.019>.

<sup>20</sup> Amir Husain, *The Sentient Machine: The Coming Age of Artificial Intelligence*

<sup>21</sup> Amir Husain, *The Sentient Machine: The Coming Age of Artificial Intelligence*

<sup>22</sup> Dawn Chan, “The AI That Has Nothing to Learn From Humans,” *The Atlantic* (Atlantic Media Company, October 20, 2017), <https://www.theatlantic.com/technology/archive/2017/10/alphago-zero-the-ai-that-taught-itself-go/543450/>.

means; it achieves prescribed objectives by rationalizing or mechanizing instruments for reaching them. AI, by contrast, deals with ends; it establishes its own objectives.”<sup>23</sup> While AI research is focused on creating thinking machines, automation is focused on the use of robotics and computer science, including AI, to replace or work in tandem with humans, to increase efficiency in the workplace. For example, the United States automotive industry “now ranks 3<sup>rd</sup> globally in robot density in the automotive industry, with a density of 1,111 units. Robot density is defined as the number of industrial robots in operation per 10,000 employees in the automotive industry. Additionally, 56% of all industrial robot orders in North America were made by automotive manufacturers.”<sup>24</sup> This field shows that the age of automation is now upon us. According to Nowack, this is because “The implementation of industrial robotics can help manufacturers realize reduced time-to-market, cut product costs, lower consumption, and more,” which incentivizes companies to adopt automation in the workforce.<sup>25</sup> This process is slowly happening in other fields of the economy as well. In their paper *The Future of Employment: How Susceptible Are Jobs to Computerisation*, Doctors Carl Benedikt Frey and Michael A. Osborne estimated that “...47 percent of total US employment is in the high risk category, meaning that associated occupations are potentially automatable over some unspecified number of years, perhaps a decade or two.”<sup>26</sup> A report from the McKinsey Institute estimates that worldwide “between 400 million and 800 million individuals could be displaced by automation and need to find new jobs by 2030 around the world... ...Of the total displaced, 75 million to 375 million

---

<sup>23</sup>Henry A. Kissinger, “How the Enlightenment Ends,” *The Atlantic* (Atlantic Media Company, August 30, 2019), <https://www.theatlantic.com/magazine/archive/2018/06/henry-kissinger-ai-could-mean-the-end-of-human-history/559124/>.

<sup>24</sup>Jason Nowack, “Automated Solutions for Automotive Manufacturing & Distribution,” *Automotive Industry Solutions* | Bastian Solutions, April 20, 2016, <https://www.bastiansolutions.com/blog/index.php/2015/09/17/industrial-robotics-automotive-industry/>.

<sup>25</sup>Jason Nowack, “Automated Solutions for Automotive Manufacturing & Distribution”

<sup>26</sup> Carl Benedikt Frey and Michael A. Osborne, “The Future of Employment: How Susceptible Are Jobs to Computerisation?”

may need to switch occupational categories and learn new skills.”<sup>27</sup> This means that nearly half of all current jobs available in the United States job market, and a significant portion of the global job market will possibly be automated in the near future as automation becomes more prevalent in the workforce. However, machines still are not as efficient as humans at some tasks. Tasks that include irregular actions are still more difficult for machines, whereas jobs that include repeating the same action constantly are ones that machines excel at.<sup>28</sup> While there are developmental roadblocks ahead of AI and autonomous workers, there are many applications regarding data collection and analysis that they can succeed in, which will eventually lead to an increase in automation in the workforce.

In terms of more practical effects of AI and automation on political systems, the examples of Autonomous Vehicles(AV), China’s Closed Circuit Television (CCTV) facial recognition program, and China’s Social Credit program. The American Planning Association research into autonomous vehicles found that “This technology is moving very quickly, with the 11 largest automakers planning to have fully-autonomous vehicles on highways between 2018 and 2021.”<sup>29</sup> This rapid adoption and advancement of AVs by large automakers leads to a situation where AVs could have an impactful role to play in the future job market. This impact would mostly be felt in freight services and transportation jobs that could become safer and more efficient with an autonomous vehicle than with a human driver.<sup>30</sup> While humans need salaries, paid leave, and, in some cases, healthcare, robots represent a one-time cost, with minor maintenance costs. This can

---

<sup>27</sup>James Manyika et al., “Jobs Lost, Jobs Gained: What the Future of Work Will Mean for Jobs, Skills, and Wages,” McKinsey & Company (McKinsey & Company, May 11, 2019), <https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will-mean-for-jobs-skills-and-wages>.

<sup>28</sup>Carl Benedikt Frey and Michael A. Osborne, “The Future of Employment: How Susceptible Are Jobs to Computerisation?”

<sup>29</sup>American Planning Association, “Autonomous Vehicles,” American Planning Association, accessed February 23, 2021, <https://www.planning.org/knowledgebase/autonomousvehicles/>.

<sup>30</sup> American Planning Association, “Autonomous Vehicles”

make some autonomous systems cheaper than their human counterparts. For example, the Baxter autonomous robot from Rethink robotics can be programmed to complete thousands of basic tasks with a price of under \$25,000 for a basic model, it is much cheaper than hiring an employee in the long term.<sup>31</sup> These advancements, and costs, will soon compete for human labor at a greater level.

In China, the use of AI and automation has mostly risen out of the need of authoritarian control to modernize for the 21st century. As China continues to modernize and advance, the Chinese Communist Party must innovate to hold on to its power. In this line, "Beijing is embracing technologies like facial recognition and artificial intelligence to identify and track 1.4 billion people."<sup>32</sup> This has allowed for the Chinese state to preserve its power in a way that, according to Mozur, seemingly doesn't create outrage within the public.<sup>33</sup> The use of AI in facial recognition is an effective way of China handling a population of well over a billion. This has not been missed by the police in China, who "...will spend an additional \$30 billion in the coming years on techno-enabled snooping, according to one expert quoted in state media."<sup>34</sup> These two distinct ways of using technologies will affect the foreign and domestic policies of both nations.

In terms of the applications of AI, aside from the economic uses of general automation, several applications will likely have an impact on international relations. The two most visible of these applications are lethal autonomous weapons (LAWS) and deepfake technology.

LAWS, which are currently in development in multiple countries including the US and China, are seen as the third revolution in warfare that would allow for nations to conduct targeted

---

<sup>31</sup>ReThink Robotics, "Cobots Guide," CobotsGuide, March 1, 2018, <https://cobotsguide.com/2016/06/rethink-robotics-baxter/>.

<sup>32</sup> Mozur, Paul. "Beijing Wants A.I. to Be Made in China by 2030."

<sup>33</sup> Mozur, Paul. "Beijing Wants A.I. to Be Made in China by 2030."

<sup>34</sup> Mozur, Paul. "Beijing Wants A.I. to Be Made in China by 2030."

warfare without the need of soldiers being put in danger.<sup>35</sup> Currently, drones are used as semi-autonomous weapons which can make certain decisions without instruction from human operators, but as developments in the field of AI continue, LAWS would be able to complete military actions without human involvement.<sup>36</sup> LAWS could be seen through small, precise drones which target individual targets to autonomous tanks.<sup>37</sup> These developments would fundamentally change how war is waged by removing the risk of mass human casualties on the sides of those with LAWS, which could lead to a major military deterrent (the loss of human life) being marginalized.<sup>38</sup> This issue has been raised to the UN in recent years, with the Secretary-General of the United Nations arguing that "...machines with the power and discretion to take lives without human involvement are politically unacceptable, morally repugnant and should be prohibited by international law."<sup>39</sup>

Deepfakes pose less of a militaristic threat to global stability, but can potentially lead to an increased emphasis on disinformation campaigns. Deepfakes are AI programs that can create "highly realistic and difficult-to-detect depictions of real people doing or saying things they never said or did."<sup>40</sup> Due to the realistic nature of deepfakes, these could help in creating more successful, and therefore more dangerous, disinformation campaigns.<sup>41</sup> The Council on Foreign

---

<sup>35</sup>"Lethal Autonomous Weapons Systems," Future of Life Institute, August 12, 2020, <https://futureoflife.org/lethal-autonomous-weapons-systems/?cn-reloaded=1>.

<sup>36</sup>"Lethal Autonomous Weapons Systems," Future of Life Institute

<sup>37</sup>"Lethal Autonomous Weapons Systems," Future of Life Institute

<sup>38</sup>"Lethal Autonomous Weapons Systems," Future of Life Institute

<sup>39</sup>Michael Møller, "Secretary-General's Message to Meeting of the Group of Governmental Experts on Emerging Technologies in the Area of Lethal Autonomous Weapons Systems Secretary-General," United Nations (United Nations, March 25, 2019),

<https://www.un.org/sg/en/content/sg/statement/2019-03-25/secretary-generals-message-meeting-of-the-group-of-governmental-experts-emerging-technologies-the-area-of-lethal-autonomous-weapons-systems>.

<sup>40</sup>Robert Chesney and Danielle K. Citron, "Disinformation on Steroids: The Threat of Deep Fakes," Council on Foreign Relations (Council on Foreign Relations, October 16, 2018),

<https://www.cfr.org/report/deep-fake-disinformation-steroids>.

<sup>41</sup>William A. Galston, "Is Seeing Still Believing? The Deepfake Challenge to Truth in Politics," Brookings (Brookings, January 8, 2020),

<https://www.brookings.edu/research/is-seeing-still-believing-the-deepfake-challenge-to-truth-in-politics/>.

Relations, in their discussions on the impacts of deepfakes, provide several examples that show the danger of this technology;

For example, a credible deep fake audio file could emerge purporting to be a recording of President Donald J. Trump speaking privately with Russian President Vladimir Putin during their last meeting in Helsinki, with Trump promising Putin that the United States would not defend certain North Atlantic Treaty Organization (NATO) allies in the event of Russian subversion. Other examples could include deep fake videos depicting an Israeli soldier committing an atrocity against a Palestinian child, a European Commission official offering to end agricultural subsidies on the eve of an important trade negotiation, or a Rohingya leader advocating violence against security forces in Myanmar.<sup>42</sup>

These concerns are no longer hypothetical as the AI-based systems which create these deepfakes have become prevalent, and effective enough in testing to fool experts concerning their authenticity.<sup>43</sup> As such, this technology will likely be successful in spreading disinformation and could have a catastrophic impact on international relations.

## 2.2 Chinese AI Policies

As the 21st-century continues forward, the role AI and emerging technologies play in international relations (IR) will continue to increase. Indeed, the Chinese State Council earlier this year released a press release saying:

Artificial intelligence is thought to be the strategic technology leading the future...  
...China's national security and international competition situation are more complex, so  
we must look at the world, lay out the artificial intelligence development on the national

---

<sup>42</sup>Robert Chesney and Danielle K. Citron, "Disinformation on Steroids: The Threat of Deep Fakes"

<sup>43</sup>William A. Galston, "Is Seeing Still Believing? The Deepfake Challenge to Truth in Politics"

strategic level, and firmly grasp the strategic initiative of international competition during the new stage of artificial intelligence development.<sup>44</sup>

This recognition of AI's role in foreign policy and the future of China has led to a push for China to invest and adopt new technologies as quickly as possible. As China continues to push forward its new AI policy, "China could emerge as a leading force in AI, improving the productivity of its industries and helping it become a leader in creating new businesses that leverage the technology. And if, as many believe, AI is the key to future growth, China's prowess in the field will help fortify its position as the dominant economic power in the world."<sup>45</sup> This can lead to direct competition with the United States which could help make technological advancements occur at a quicker pace. However, that may be better for China, than the United States, as China may be able to more quickly adapt than the United States, namely due to "...a wealth of talented engineers and scientists, for one. It also is rich in the data necessary to train AI systems".<sup>46</sup> These advantages will play a vital role as China continues to challenge the dominance of the United States.

This competition will continue onwards, especially as China continues to gain more international traction and technology continues to advance. If Moore's Law is continuously followed, then the advancements made will grow exponentially. This "pace of change is so swift that being left behind will make it nearly impossible to catch up."<sup>47</sup> While this may seem to be a concern mainly for developing countries, it is true for developed nations as well. Many European countries, including France and Germany, are currently struggling to keep up with the

<sup>44</sup> "China's New Generation of Artificial Intelligence Development Plan." FLIA. Chinese State Council

<sup>45</sup> Knight, Will. "The West Should Stop Worrying about China's AI Revolution."

<sup>46</sup> Knight, Will. "The West Should Stop Worrying about China's AI Revolution."

<sup>47</sup> Nicolas Berggruen and Nathan Gardels, "Opinion | A Wakeup Call for Europe," The Washington Post (WP Company, April 1, 2019), [https://www.washingtonpost.com/news/theworldpost/wp/2018/09/27/europe/?utm\\_term=.a87569d0ddec](https://www.washingtonpost.com/news/theworldpost/wp/2018/09/27/europe/?utm_term=.a87569d0ddec).



technological advancements made by China and the United States.<sup>48</sup> However, it is not too late for the countries that have begun to lag behind. Through a mix of developing AI industries at home, as well as trading internationally for new technology, countries can continue to advance. Indeed, Emmanuel Macron, President of France, said that his “...goal is to recreate a European sovereignty in AI,” with the German Chancellor also airing a sentiment of the European Union working together on AI Development.<sup>49</sup> These initiatives will help Europe keep on pace with the developments being made by China and the United States.

An important factor in the development of Artificial Intelligence is the ability of the nation to develop a unified strategy for developing Artificial Intelligence. Indeed, China has developed its own AI national strategy, which includes government funding and support for these projects.<sup>50</sup> This promotes a guided approach to development that helps to solidify the advancements within Chinese society. At the same time, this incentivizes researchers to work in China, where there is funding for their research available. Other nations, including India, France, and Japan have introduced national AI strategies that help focus the developments in their nations, while also providing new funding opportunities.<sup>51</sup> These plans can help make the AI industries within these nations flourish, as they are supported in their developments.

In terms of trade, China hopes to place itself as the dominant maker of artificial intelligence in the near future. During the Chinese State Council's address on AI in March, the Chinese government announced \$150 billion RMB in investments in AI development in China.<sup>52</sup> These investments will solidify the strength of China's technology sector, as it will allow for companies to develop new technologies faster. Indeed, China hopes to be the dominant world producer and

---

<sup>48</sup>Nicolas Berggruen and Nathan Gardels, “Opinion | A Wakeup Call for Europe”

<sup>49</sup>Nicolas Berggruen and Nathan Gardels, “Opinion | A Wakeup Call for Europe”

<sup>50</sup> “China's New Generation of Artificial Intelligence Development Plan.” FLIA. Chinese State Council

<sup>51</sup> Simon Owens, “Sponsored Content: Is Current U.S. Tech Policy Ready for AI?,” Politico, October 25, 2018, <http://www.politico.com/sponsor-content/2018/10/becoming-a-leader-in-ai?cid=201810fc>.

<sup>52</sup>“China's New Generation of Artificial Intelligence Development Plan.” FLIA. Chinese State Council



seller of AI by 2030, as part of the Made in China 2025 plan.<sup>53</sup> However, for China to be successful, it needs to continue to be on friendly trade terms with the rest of the world, and more specifically the United States.

Since the creation of the AI plans set forward by the Chinese State Council in 2017, China has continued to adopt new and innovative policies to further its goals of AI domination. In 2018, the PRC released a three-year plan for the development of the AI industry, which laid out the goals of China: develop a stable AI industry by 2020, overtake the US as the AI power by 2025, and become the undisputed AI developmental power by 2030 to facilitate new economic growth.<sup>54</sup> This was just the start for the People's Republic of China, however, as it would continue to put forward its AI policies, plans, and regulations throughout 2018 and 2019. This culminated with the Beijing AI Principles in late 2018, which were developed by experts in the field of AI, policymakers, and business leaders to put forward a unified vision of China's AI dream.<sup>55</sup> In doing so, the People's Republic of China has successfully integrated the needs and wants of both state and private actors in developing the local AI field.

In tandem with these developments has been an ever-growing local AI industry, which has been developed by emerging start-ups within China. These startups include some of the highest-earning AI startups in the world, with 6 out of the top 10 AI startups in terms of revenue being located in China.<sup>56</sup> This growing marketplace has allowed China to push rapid development through innovation and competition. Of these new startups, the majority are focused on the development of autonomous systems, especially within the fields of transportation, healthcare, and finance, which are being funded by both private funders and the

---

<sup>53</sup> Mozur, Paul. "Beijing Wants A.I. to Be Made in China by 2030."

<sup>54</sup> Triolo, Paul, Elsa Kania, and Graham Webster. "Translation: Chinese Government Outlines AI Ambitions through 2020."

<sup>55</sup> "Beijing AI Principles." Beijing AI Principles, 2018.

<sup>56</sup> Kai-Fu Lee and Paul Triolo. "China's Artificial Intelligence Revolution: Understanding Beijing's Structural Advantages."

government to rapidly mobilize its AI industry.<sup>57</sup> These developments have been led by the Chinese government, which has played the role of finance, insurer, and regulator in the industry, giving unprecedented control of the industry to the PRC. By creating a vibrant economic ecosystem for AI startups, China will be able to draw highly skilled and educated laborers to work for these Chinese companies, which will allow for further development, as China will be able to take potential employees in the industry from the US, where the majority of experts are currently working.<sup>58</sup> To facilitate this industry and the radical growth the PRC is expecting, the AI Industrial Development Alliance was formed with 230 companies and governmental bodies working to further push development, regulate the industry, and allow for the healthy growth of the Chinese AI industry.<sup>59</sup>

In the last five years, China has pushed rapidly to develop its internal AI industry. This shows the importance of which they hold AI as a seriously impactful field in the future of Chinese power. As shown in this and the previous section, AI will have a significant impact on the economy of the future, especially in terms of automation. China, in recognizing these issues, has placed itself at the forefront of this new development.

## 2.3 US AI Policies

In comparison to the People's Republic of China, the United States has been slow to adopt AI-based policies and create government solutions for these new technologies. Whereas the People's Republic of China began its AI policy development starting in late 2016 and early 2017,

---

<sup>57</sup> Kai-Fu Lee and Paul Triolo. "China's Artificial Intelligence Revolution: Understanding Beijing's Structural Advantages."

<sup>58</sup> Kai-Fu Lee and Paul Triolo. "China's Artificial Intelligence Revolution: Understanding Beijing's Structural Advantages."

<sup>59</sup> Cheng Yu, "China Calls for AI Alliance," China calls for AI alliance - Business - Chinadaily.com.cn, October 13, 2017, [http://www.chinadaily.com.cn/business/2017-10/13/content\\_33216440.htm](http://www.chinadaily.com.cn/business/2017-10/13/content_33216440.htm).

the United States of America was not as quick to react to this new technological advancement. While throughout 2016 and 2017, the US House of Representatives and Senate held meetings and worked on potential AI-based legislation, none have yet to pass due to bipartisan stalling which has seriously impacted the US in the past decade. In February 2019, President Donald Trump signed the *Executive Order on Maintaining American Leadership in Artificial Intelligence (13,859)*, which outlined the US policy on AI and the role the US planned on taking in the field.<sup>60</sup> It calls for funding for Research & Development initiatives in the field of AI, listening to regulatory advice from major actors in the field, and developing international standards and guidelines for the United Nations, G20, and other international advisory committees and boards.<sup>61</sup> Executive Order 13,859 also instructed the Office of Science and Technology Policy to create a research group that would begin looking into comprehensive policies for the US to develop and follow throughout 2019. It also outlined the importance of developing the US economy and industries to prepare the potentially radical changes that AI could create and exacerbate through the creation of the American AI Initiative, which oversees these developments as a branch of the Office of Science and Technology Policy.<sup>62</sup> Following this, in May, the Department of Commerce's National Institute of Science and Technology (NIST) released a public Request for Information regarding AI, which allowed for comments from experts in the field to be taken into consideration when creating policy and making federal regulations and guidelines.<sup>63</sup> This shows the rapid development of US-based policy in the past year, which shows the ability of the US to engage in this topic. However, these were just the beginning steps.

---

<sup>60</sup> Executive Order No. 13,859, 84 C.F.R. 3967 (2019).

<sup>61</sup> Executive Order No. 13,859, 84 C.F.R. 3967 (2019).

<sup>62</sup> Executive Order No. 13,859, 84 C.F.R. 3967 (2019).

<sup>63</sup> "NIST Requests Information on Artificial Intelligence Technical Standards and Tools"

In 2019, the US was a key architect of the G20 AI Principles, which were agreed upon in June which was held in Japan, which was the host country of this meeting of G20. It laid out international standards for the development of AI.<sup>64</sup> These include international trade, responsible and open development, and limiting the development of military-based AI while emphasizing human-centered development.<sup>65</sup> These outlines, developed in part by the US, show the ability of the US to work to create and develop an international agreement on the issues, a key aspect of their abilities as a hegemonic power.

In terms of funding, an aspect which the People's Republic of China has heavily emphasized, there have been two tracks of limited funding from the US government; one focused on military uses and one focused on non-military uses. As research and development funding typically falls under discretionary funding, the amount placed into these fields will vary from year to year. In the Fiscal Year 2020 budget, \$917 million was added to the budget by the National Science and Technology Council (NSTC) and was approved by the legislature and signed into law by President Trump.<sup>66</sup> These funds would be used for non-military research and development funding for private businesses, as well as corresponding agencies to analyze these new technologies.<sup>67</sup> Meanwhile, the military was pushing for funding as well. In late 2018, the Department of Defense announced it would spend roughly \$2 billion on research and

<sup>64</sup>“G20 Ministerial Statement on Trade and Digital Economy,” G20 Ministerial Statement on Trade and Digital Economy § (2019), pp. 1-14, [https://trade.ec.europa.eu/doclib/docs/2019/june/tradoc\\_157920.pdf](https://trade.ec.europa.eu/doclib/docs/2019/june/tradoc_157920.pdf).

<sup>65</sup>G20 Ministerial Statement on Trade and Digital Economy,” G20 Ministerial Statement on Trade and Digital Economy § (2019)

<sup>66</sup>National Science and Technology Council, “Executive Office of the President of the United States, Networking and Information Technology Research and Development Program. The Networking & Information Technology Research & Development Program Supplement To The President's FY2020 Budget, The Networking & Information Technology Research & Development Program Supplement To The President's FY2020 Budget1–52,” September 2019, <https://web.archive.org/web/20201125132608/https://www.whitehouse.gov/wp-content/uploads/2019/09/FY2020-NI-TRD-AI-RD-Budget-September-2019.pdf>.

<sup>67</sup>National Science and Technology Council, “Executive Office of the President of the United States, Networking and Information Technology Research and Development Program. The Networking & Information Technology Research & Development Program Supplement To The President's FY2020 Budget, The Networking & Information Technology Research & Development Program Supplement To The President's FY2020 Budget1–52,”

development of AI for military uses (namely autonomous weapons systems such as drones and missile defense systems) as a way to continue to modernize the military to keep it as the most effective fighting force in the world.<sup>68</sup> These recent developments show the pace at which the United States can move to adjust to an issue as it arises and why it is well-advised to not think China will ultimately win this AI Race.

The political developments in China and the US have shown the weight that both nations have put on the creation and advancement of artificial intelligence. Both see it as a field of international competition and recognize its importance in the 21st century. AI could become a field of technological and ideological competition between these two nations, which has similarities to a previous period of technological innovation and political competition. It is possible that this previous era could further our understanding of current events.

## **2.4 Limitations on the Chinese Hi-Tech Industry**

A possible limitation to the development of China's high-tech industry, in general, is the reliance on the importation of key components from foreign nations. This limitation is also seen within the field of AI development, which is reliant on many of the same components as other high-tech industries. Of these components, the most crucial for the continued development of AI systems and machines that are reliant on them are computer chips; more specifically, semiconductors and microprocessors. In 2017, China imported 90% of the various computer chips needed to fuel its local high-tech industry, with the majority being imported from Japan,

---

<sup>68</sup> Drew Harwell, "Defense Department Pledges Billions toward Artificial Intelligence Research," The Washington Post September 8, 2018, <https://www.washingtonpost.com/technology/2018/09/07/defense-department-pledges-billions-toward-artificial-intelligence-research/>.

the United States, Taiwan, and South Korea.<sup>69</sup> In 2018, during the ongoing US-China trade war, the United States placed limitations on the import of computer chips to China on various tech companies including Huawei and ZTE which produce smartphones, tablets, and computers.<sup>70</sup> In 2019, China imported \$300bn worth of chips for the third straight year, predominantly from the previously mentioned nations to shore up their internal markets which are currently unable to keep up with the chip demands of the Chinese high-tech industry.<sup>71</sup>

With the trade war showing the damage that could be done to the Chinese high-tech industry through sanctions and limitations on the importation of computer chips, China in recent years has pushed to further develop its internal chip manufacturing capabilities. By 2025, China hopes to be able to decrease foreign to 75% from the current 90% importation reliance as it invests in and develops the national chip manufacturing industry.<sup>72</sup> However, it is unclear if these investments will provide the necessary development to strengthen the national industry. In 2014, China established "...a \$22 billion National Integrated Circuit Industry Investment Fund in 2014 (known as the Big Fund) in a bid to reduce its reliance on imported chips, but to little avail. Today, only 16 percent of China's semiconductors are made locally, and these tend to be the least sophisticated in every category."<sup>73</sup> This investment was followed up in 2019 with a \$29 billion investment into the semiconductor industry, showing the resurgent push to develop the chip industry in the face of the trade war.<sup>74</sup> However, even with the past investments and development pushes in the industry, the quality of Chinese chips cannot compete with their foreign

---

<sup>69</sup>Salvatore Babones, "China's Drive to Make Semiconductor Chips Is Failing," Foreign Policy, December 14, 2020, <https://foreignpolicy.com/2020/12/14/china-technology-sanctions-huawei-chips-semiconductors/>; Sherisse Pham, "China Is Trying to Kick Its Dependence on Foreign Computer Chips," CNNMoney (Cable News Network, June 8, 2018), <https://money.cnn.com/2018/06/08/technology/china-computer-chips-foreign-reliance/index.html>.

<sup>70</sup>Sherisse Pham, "China Is Trying to Kick Its Dependence on Foreign Computer Chips"

<sup>71</sup>"China to Import \$300 Billion of Chips for Third Straight Year: Industry Group," Reuters (Thomson Reuters, August 26, 2020), <https://www.reuters.com/article/us-china-semiconductors-idUSKBN25M1CX>.

<sup>72</sup>Salvatore Babones, "China's Drive to Make Semiconductor Chips Is Failing"

<sup>73</sup>Salvatore Babones, "China's Drive to Make Semiconductor Chips Is Failing"

<sup>74</sup>Salvatore Babones, "China's Drive to Make Semiconductor Chips Is Failing"



competitors. For example, Semiconductor Manufacturing International Corporation, the most advanced chip foundry in China, is unable to produce chips thinner than 14 nanometers while Taiwan Semiconductor Manufacturing Industry and other competitors are developing chips as thin as 5 nanometers.<sup>75</sup> Due to the capabilities differences, China is still reliant, and will likely continue to be so, on importing computer chips. This leaves China vulnerable to sanctions and restrictions on imports to China.

While there is a current developmental restraint on the high-tech industry in China due to the reliance on the importation of key materials, China has increased research and development funding to strengthen its internal development in recent years. Since 1991, China has increased its GDP spending on research and development from 0.72% in 1991 to 2.14% in 2018, which is an increase from \$13.1 billion to \$462.6 billion- an increase of nearly 35 times that in 1991.<sup>76</sup> As seen in Figure 1, this remarkable amount was more than the amount spent by the next four nations- Japan, Germany, South Korea, and France- combined.<sup>77</sup> This increase places total spending on research and development as the second highest in the world behind the United States, which spent \$551.5 billion in 2019.<sup>78</sup> Of the funding, in 2018, businesses provided 76.6% while the government provided 20.2% of research and development funding, which is the second-highest percent provided by businesses in the world behind Japan.<sup>79</sup> Of the total funding, roughly 80% goes towards so-called “experimental research,” which includes app development, computer technology improvements, and funding for machine learning and AI- the highest percent spent on experimental funding in the world.<sup>80</sup>

---

<sup>75</sup>Salvatore Babones, “China's Drive to Make Semiconductor Chips Is Failing”

<sup>76</sup>China Power Team, “Is China a Global Leader in Research and Development?,” ChinaPower Project, January 28, 2021, <https://chinapower.csis.org/china-research-and-development-rnd/#easy-footnote-bottom-1-3458>.

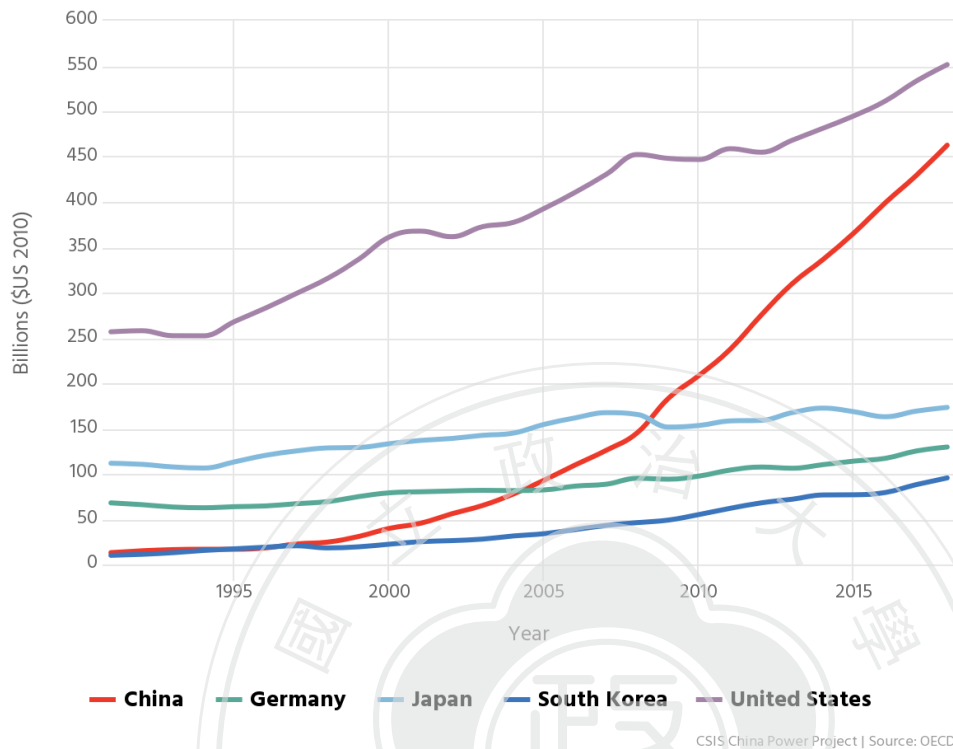
<sup>77</sup>China Power Team, “Is China a Global Leader in Research and Development?”

<sup>78</sup>China Power Team, “Is China a Global Leader in Research and Development?”

<sup>79</sup>China Power Team, “Is China a Global Leader in Research and Development?”

<sup>80</sup>China Power Team, “Is China a Global Leader in Research and Development?”

## Gross Domestic Spending on R&D



**Figure 1: Gross Domestic Spending on R&D, China Power Team, “Is China Leading in Global Innovation?,” ChinaPower Project, January 28, 2021, fig. 2**

This increased funding for research and development has proved successful for China. In 2018, patent applications from China made up 42.2% of all patents globally, twice as many as produced by the United States in the same year.<sup>81</sup> However, they only make up 6.9% of triadic patent applications- patent applications in the EU, United States, and Japan- which falls well below triadic patents from the United States (25.4%) and Japan (31%).<sup>82</sup>

<sup>81</sup>China Power Team, “Is China Leading in Global Innovation?,” ChinaPower Project, January 28, 2021, <https://chinapower.csis.org/china-innovation-global-leader/>.

<sup>82</sup>China Power Team, “Is China Leading in Global Innovation?”



## 2.5 From Cooperation to Competition

The history of the Sino-American diplomatic relationship is a key factor in examining the competitive nature of the current relations between the two nations. Following the establishment of the People's Republic of China, the United States and China did not have official ties as the US believed the Republic of China under Chiang Kai-shek was the legitimate government of China due to the anti-communist sentiment in American foreign policy during this period.<sup>83</sup> This lack of relations between the two nations would be the status quo over the next few decades. In 1969, a border conflict between China and the Soviet Union which spread from the Sino-Soviet relationship deteriorating throughout the 1960s led to the breakdown of relationships between the two communist nations.<sup>84</sup> Following this development was a period of warming Sino-American relations. In 1971, the US Ping-Pong team was invited to Beijing, being the first Americans to visit China since 1949 with Secretary of State Henry Kissinger visiting the nation secretly later that year.<sup>85</sup> In that same year, the People's Republic of China was recognized by the United Nations, leading to the country gaining a permanent seat on the UN Security Council, as well as leading to international recognition.<sup>86</sup> In 1972, President Richard Nixon traveled to Beijing, where he met with Chairman Mao Zedong, as well as other high-ranking officials, and signed the Shanghai Communiqué.<sup>87</sup> This document laid out the framework of Sino-American foreign relations. Within it, the United States and China agreed to work on creating beneficial bilateral

---

<sup>83</sup>“Timeline: U.S. Relations With China 1949–2020,” Council on Foreign Relations (Council on Foreign Relations, 2020), <https://www.cfr.org/timeline/us-relations-china>.

<sup>84</sup>Timeline: U.S. Relations With China 1949–2020,” Council on Foreign Relations.

<sup>85</sup>Timeline: U.S. Relations With China 1949–2020,” Council on Foreign Relations.

<sup>86</sup>Timeline: U.S. Relations With China 1949–2020,” Council on Foreign Relations.

<sup>87</sup>Timeline: U.S. Relations With China 1949–2020,” Council on Foreign Relations.

trade agreements, preventing international military conflicts, clarified US-Taiwanese relations with regard to China and agreed to work to further normalize Sino-American relations.<sup>88</sup>

Throughout the 1970s, both nations worked to normalize relations with one another. In 1979, the United States officially recognized the PRC under President Jimmy Carter with Vice Premier Deng Xiaoping visiting the United States later that same year.<sup>89</sup> During this period, bilateral trade, as well as the opening of the Chinese economy to the global market, helped to bring China's economic rise whilst internal economic liberalization and reform occurred.<sup>90</sup>

During the administrations of President Reagan and President Bush, the relationship between the two nations continued on the same course, with economic ties being built. In 1982, a third Communiqué between China and the United States emerged. In it, the one-China policy was established while also providing room for continued weapons sales and military support for Taiwan from the United States.<sup>91</sup> Under President Bill Clinton, the United States passed the U.S.-China Relations Act of 2000, which granted non-discriminatory trade status to China.<sup>92</sup> Due to the strengthening of Sino-American relations, especially within the realm of trade, the trade value between the two nations rose from \$5 billion in 1980 to \$231 billion in 2004.<sup>93</sup>

From the early 1970s until the early-to-mid 2010s the relationship between China and the United States was heavily focused on trade and cooperation. This led to an amicable relationship between the two states. While there were periods of tension during this time, the relationship was

---

<sup>88</sup>“Joint Communiqué of the United States of America and the People's Republic of China (Shanghai Communiqué),” Joint Communiqué of the United States of America and the People's Republic of China (Shanghai Communiqué), accessed March 14, 2021, <http://www.china.org.cn/english/china-us/26012.htm>.

<sup>89</sup>Timeline: U.S. Relations With China 1949–2020,” Council on Foreign Relations.

<sup>90</sup>Timeline: U.S. Relations With China 1949–2020,” Council on Foreign Relations; Mark Preen, “China's Reforms and Opening-Up: Future Prospects,” China Briefing News, April 3, 2019, <https://www.china-briefing.com/news/economic-reform-china-opening-up-future-prospects/>.

<sup>91</sup>“Joint Communiqué of the People's Republic of China and the United States of America (August 17, 1982),” Joint Communiqué of the People's Republic of China and the United States of America (August 17, 1982), accessed March 14, 2021, <http://www.china-embassy.org/eng/zmgx/doc/ctc/t946664.htm>.

<sup>92</sup>“H.R. 4444 (106th): China Trade Bill,” GovTrack.us, 2004, <https://www.govtrack.us/congress/bills/106/hr4444/text>.

<sup>93</sup>Timeline: U.S. Relations With China 1949–2020,” Council on Foreign Relations

stable. However, as it became clear that China was moving into a position to compete with the United States as a great power, which could potentially undermine US hegemony, the relationship began to become more combative. In 2011, US Secretary of State Hillary Clinton announced the Pivot to Asia strategy that would be the focus of American foreign policy in President Barack Obama's second term. To counter the rising economic, diplomatic, and military strength of China, Secretary Clinton called for “increased investment—diplomatic, economic, strategic, and otherwise—in the Asia-Pacific region.”<sup>94</sup> That same year, President Obama announced the Trans-Pacific Partnership, a multilateral free trade agreement with Pacific countries, which was seen as a way to counter Chinese economic growth, create an Asia-Pacific free trade zone, and strengthen US relations with nations in the Asia-Pacific.<sup>95</sup> The view of China as a potential rival to US hegemony was exacerbated by President Donald Trump, whose trade war with China saw the US further create a combative relationship with China.<sup>96</sup>

Meanwhile, policies in China have also changed dramatically in the last decade. Following the ascension of President Xi Jinping in 2013, Chinese foreign policy strategy changed dramatically through the transition from the Keeping a Low Profile (KLP) to the Striving for Achievement strategy under President Xi.<sup>97</sup> This policy shift changed the way that China interacts with other nations. The KLP, which was originally designed by Deng Xiaoping, argued for Chinese foreign policy to be focused on developing economic ties, growing the strength of China, and pursuing Chinese development.<sup>98</sup> The goal was to use the international economic

<sup>94</sup>Hillary Clinton, “America's Pacific Century,” *Foreign Policy*, October 11, 2011, <https://foreignpolicy.com/2011/10/11/americas-pacific-century/>.

<sup>95</sup>“APEC and Trans-Pacific Partnership Mutually Useful: Research,” APEC, October 25, 2011, [https://www.apec.org/press/news-releases/2011/1025\\_tpp.aspx](https://www.apec.org/press/news-releases/2011/1025_tpp.aspx).

<sup>96</sup>Rosemary Foot and Amy King, “Assessing the Deterioration in China–U.S. Relations: U.S. Governmental Perspectives on the Economic-Security Nexus,” *China International Strategy Review* 1, no. 1 (2019): pp. 39-50, <https://doi.org/10.1007/s42533-019-00005-y>.

<sup>97</sup>Xuetong Yan, “From Keeping a Low Profile to Striving for Achievement,” *The Chinese Journal of International Politics* 7, no. 2 (April 22, 2014): pp. 153-184, <https://doi.org/10.1093/cjip/pou027>.

<sup>98</sup>Xuetong Yan, “From Keeping a Low Profile to Striving for Achievement”

system led by the United States to benefit China while placing themselves in a position where they would receive too much attention from other nations.<sup>99</sup> In essence, the strategy worked towards China keeping a low profile while it strengthened itself.

This policy was eventually replaced by the SFA strategy in 2013 under President Xi Jinping. Within the strategy is a focus on developing relations with other nations, establishing international credibility, and competing on an international level with the United States.<sup>100</sup> The goal of the strategy is to create situations where China can take leadership positions within the international order that have historically been controlled by the US or Western Europe.<sup>101</sup> In many ways, this new policy has been successful for China. It has further improved relations with developing and least-developed nations, where it has positioned itself as the leader and defender of these nations in international organizations.<sup>102</sup> At the same time, the United States has accepted the Chinese terminology of “...new major power relations...” to describe Sino-American relations, which legitimizes the role of China as an emerging great power.<sup>103</sup> The policy of SFA provides the framework for China to compete with the United States, which is a direct contrast to the KLP which hoped to prevent competition or confrontation with other nations.

---

<sup>99</sup>Xuetong Yan, “From Keeping a Low Profile to Striving for Achievement”

<sup>100</sup>Xuetong Yan, “From Keeping a Low Profile to Striving for Achievement”

<sup>101</sup>Xuetong Yan, “From Keeping a Low Profile to Striving for Achievement”

<sup>102</sup>Xuetong Yan, “From Keeping a Low Profile to Striving for Achievement”

<sup>103</sup>Xuetong Yan, “From Keeping a Low Profile to Striving for Achievement”

## **Chapter 3. Past and Present Technological Competition**

The current competition surrounding the development of Artificial Intelligence shares some similarities to a past great power technological competition: the Space Race between the United States and the Union of Soviet Socialist Republics (USSR). It was a form of great power competition, where the adversaries competed in non-violent showings of superiority to prove the dominance of one ideology over another. While the technological achievements that occurred during this period were not directly correlated to power, they still played a role in power politics. From both a soft power and hard power perspective, the Space Race increased the standing of the United States with their victory. In comparison, the Sino-American AI Race also provides a venue in which the US and China can compete with one another in a non-violent fashion with similar hard and soft power incentives to secure a victory available to each nation.

By exploring the Space Race, this chapter will provide a point of contrast in comparing the AI and Space races to explore how technological competition between states has changed since the Space Race. Following a brief overview of the key events of the Space Race will be an exploration of the hard and soft power applications of the Space Race. This will culminate with a comparison between the Space and AI Races in order to compare the two races.

### **3.1 The History of the Space Race**

The beginnings of the Space Race between the United States and the Soviet Union can find its roots in the post-World War Two power politics. With the surrender of Nazi Germany in 1945, two major ideological superpowers turned from allies to rivals. In terms of technological achievement during this period, both the US and USSR used the collapse of Nazi Germany to

gain technological insight from Nazi scientific experiments and scientists.<sup>104</sup> This would culminate with Operation Paperclip in the US, which helped to relocate Nazi scientists to work on American scientific projects, which was a strategy also used by the Soviets as well.<sup>105</sup> These scientists were mostly related to two fields of study: the development of rockets and atomic research, with German scientists developing many of the design improvements to both in each nation.<sup>106</sup> In the Space Race, the missile technologies that were developed and improved were key to space flight. With the development of intercontinental ballistic missiles by 1957 (ICBMs) by both nations- predominantly built by the recruited German scientists- the key technological innovation necessary for space flight had occurred.<sup>107</sup>

In 1955, the Space Race officially started with the announcement of the US intentions to launch a satellite into orbit, which was quickly followed by a Soviet declaration of the same.<sup>108</sup> This was the first event related to the Space Race where signs of competition became clear. With the Soviet challenge to the United States, the stage had been set. Instead of competition solely through military means, a more peaceful use of the acquired missile tech was found that would allow for competition sans destruction. This was an especially important innovation as it allowed for two nuclear-armed nations to clash without the fear of an apocalyptic atomic war between the two. This starting salvo would culminate on October 4th, 1957, when the USSR launched *Sputnik 1*, the first-ever artificial satellite.<sup>109</sup> In doing so, the USSR created a new frontier in which great power could compete, without a focus on conventional hard power struggles: outer

<sup>104</sup> Alejandro De La Garza, "The Nazi Science That Fed the Apollo 11 Moon Landing," Time (Time, July 18, 2019), <https://time.com/5627637/nasa-nazi-von-braun/>.

<sup>105</sup> Alejandro De La Garza, "The Nazi Science That Fed the Apollo 11 Moon Landing"

<sup>106</sup> Alejandro De La Garza, "The Nazi Science That Fed the Apollo 11 Moon Landing"

<sup>107</sup> Lance Kokonos and Ian Ona Johnson, "The Forgotten Rocketeers: German Scientists in the Soviet Union, 1945–1959," War on the Rocks, October 29, 2019, <https://warontherocks.com/2019/10/the-forgotten-rocketeers-german-scientists-in-the-soviet-union-1945-1959/>.

<sup>108</sup> Alejandro De La Garza, "The Nazi Science That Fed the Apollo 11 Moon Landing,"

<sup>109</sup> Teasel Muir-Harmony, "The Space Race and American Foreign Relations," *Oxford Research Encyclopedia of American History*, 2017, <https://doi.org/10.1093/acrefore/9780199329175.013.274>.

space. This event launched a competition between the United States and the USSR that saw “Two major powers each flexing their military might, technological savvy, and cultural capital in an effort to secure space superiority over the opposition”.<sup>110</sup> At the same time, this Space Race began with the USSR taking the first moves and leading from the start.

The Soviet Union would follow the successful launch of the first unmanned satellite into space with *Sputnik 2* in November of 1957, which carried a dog named Laika, becoming the first living being to enter space.<sup>111</sup> This was followed by *Explorer 1*, the first satellite launched by the US in January 1958. While the United States had been first to declare their intentions to launch a satellite into space, it was overshadowed by the first successful launch occurring in the Soviet Union. These successes by the Soviet Union led to a crisis of faith in the liberal democratic capitalist system of the United States, where concerns were raised in regards to the capabilities of the US to breed research and innovation.<sup>112</sup> Whilst these discussions were taking place, the politics of the Space Race began to change with the election of President John F. Kennedy in 1960.

In the 1960 presidential campaign, then-candidate John F. Kennedy stressed the importance of catching up with the USSR in the exploration of space.<sup>113</sup> Upon taking office, President Kennedy began a mission to take humanity to the Moon using American innovation. With the launch of cosmonaut Yuri Gagarin on April 12, 1961, the Space Race once again began to heat up. Up to this point, all major innovations and successes in space exploration had occurred by the Soviet

---

<sup>110</sup> Cameron Hickert, “Space Rivals: Power and Strategy in the China-India Space Race,” Schwarzman Scholars, August 14, 2017,

<https://www.schwarzmanscholars.org/events-and-news/space-rivals-power-strategy-china-india-space-race/>.

<sup>111</sup> Marcus Lindroos, “The Soviet Manned Lunar Program,” The Soviet Manned Lunar Program, 2000, [https://fas.org/spp/eprint/lindroos\\_moon1.htm](https://fas.org/spp/eprint/lindroos_moon1.htm).

<sup>112</sup> Marcus Lindroos, “The Soviet Manned Lunar Program”

<sup>113</sup> Kerry Kolbe, “Space Race Timeline: a Battle beyond Earth,” The Telegraph (Telegraph Media Group, February 3, 2017), <https://www.telegraph.co.uk/films/hidden-figures/space-race-events-timeline/>.



Union.<sup>114</sup> In response, the Kennedy administration quickly and decisively pushed for an American moon landing under the Apollo project.<sup>115</sup> This push towards space was key in the eventual success of the United States in reaching its goal of landing a man on the moon.

Throughout the 1960s, the competition became significantly closer between the two nations. Due to the passing of Sergei Korolev, the Soviets chief engineer in the space program in 1966, the Soviet space program was hindered in their lunar missions.<sup>116</sup> However, even with the setback, the *Kosmicheskaya programma SSSR* was the first to land a probe on the moon and launch a probe into lunar orbit in 1967.<sup>117</sup> But, the successes of the Soviet Union were running low. Without Korolev's leadership, the manned mission to the moon ran into numerous technological setbacks.<sup>118</sup> As the United States and the USSR developed new technologies related to space exploration in an attempt to show their dominance as global powers, it was becoming clear that the United States was poised to be the victorious nation. This culminated with the landing of Apollo 11 on the Moon on July 20th, 1969 by the United States.<sup>119</sup> As 723 million people watched the landing, it became clear the victory had been secured by the United States.<sup>120</sup> This success helped in the development of hard and soft power in the United States in this era, which was a goal of the Space race.<sup>121</sup>

### 3.2 Soft Power Implications of the Space Race

While the military applications of new missile, satellite, and radar technology developed during the Space Race had mostly obvious hard power applications, there was a more subtle and

---

<sup>114</sup>Marcus Lindroos, "The Soviet Manned Lunar Program"

<sup>115</sup>Marcus Lindroos, "The Soviet Manned Lunar Program"

<sup>116</sup>Marcus Lindroos, "The Soviet Manned Lunar Program"

<sup>117</sup>Marcus Lindroos, "The Soviet Manned Lunar Program"

<sup>118</sup>Marcus Lindroos, "The Soviet Manned Lunar Program"

<sup>119</sup>Kerry Kolbe, "Space Race Timeline: a Battle beyond Earth"

<sup>120</sup>Kerry Kolbe, "Space Race Timeline: a Battle beyond Earth"

<sup>121</sup>Marcus Lindroos, "The Soviet Manned Lunar Program"



nuanced application of soft power as well. In describing soft power, Nye argues that states can influence nations through non-coercive ways, stating

A country may obtain the outcomes it wants in world politics because other countries – admiring its values, emulating its example, aspiring to its level of prosperity and openness – want to follow it. In this sense, it is also important to set the agenda and attract others in world politics, and not only to force them to change by threatening military force or economic sanctions. This soft power – getting others to want the outcomes that you want – co-opts people rather than coerces them.<sup>122</sup>

This soft power can reside within both nation-states and non-state actors within the international community which can influence policy, perceptions, and outcomes in the international community.<sup>123</sup> While the term “soft power” was yet to be coined during the Space Race, how it was projected to both national and international audiences are in line with the goals of soft power. In the case of the Space Race, technological innovation spurred by competition was seen as a soft power victory. Taylor Dinerman describes the soft power gained by NASA stating:

It’s easy to belittle this as just PR fluff. What is often misunderstood is the source of soft power. It is more than just prestige—though that is a part of it—but it flows naturally from real achievements. It is built on a foundation of hard power, the ability of a nation to set ambitious goals and then to realize them.<sup>124</sup>

Indeed, it was the technological capabilities, especially the advancements made in missile technology and associated fields, which the United States were able to use as soft power.

<sup>122</sup>Nye Joseph S. Jr, *Soft Power The Means to Success in World Politics* (New York, NY: Public Affairs, 2004).

<sup>123</sup>Nye Joseph S. Jr, *Soft Power The Means to Success in World Politics*

<sup>124</sup>Taylor Dinerman, “NASA and Soft Power, Again,” *The Space Review: NASA and soft power, again*, June 15, 2009, <http://www.thespacereview.com/article/1396/1>.

This use of space exploration as a foreign policy tool was seen as a critical objective of NASA. One of the stated goals of NASA was to “...build a world community dedicated to the peaceful exploration of space with American help, under American leadership, and in line with the general objectives of American foreign policy.”<sup>125</sup> This points to the United States spreading its influence abroad to its Western allies while also promoting the technological supremacy of the US. By doing so, the American soft power was able to expand during this period. This idea was seen in its 1959 statements to the International Committee on Space Research (COSPAR), where NASA announced they would be willing to launch experiments and satellites of other nations using US rockets.<sup>126</sup>

In 1961, the Kennedy administration began to explore ways in which the United States could compete with the Soviet Union space program which led to Moon exploration being chosen as the realm in which the United States could succeed.<sup>127</sup> As such, this became the lynchpin of the American strategy to win the Space Race. While addressing both the House and Senate in March 1961, President Kennedy sold Congress on Project Apollo by arguing that it “...would persuade people in developing countries to choose American ‘freedom’ over Soviet ‘tyranny,’ and in turn secure the status of U.S. global leadership.”<sup>128</sup> This emphasis on the ability to influence nations through landing men on the Moon shows that soft power was on the minds of the Kennedy administration. Indeed, the messaging argued that the development of technological advancements could help in showing the superiority of western liberal democracy as an ideology.

In 1969, Apollo 11 successfully landed astronauts Buzz Aldrin, Neil Armstrong, and Michael Collins, which was followed by an additional five manned moon missions through 1972.<sup>129</sup>

---

<sup>125</sup>John Krige, “NASA as an Instrument of U.S. Foreign Policy,” in *Societal Impact of Spaceflight* (Washington D.C.: US National Aeronautics & Space Admin, 2009), pp. 207-218.

<sup>126</sup>John Krige, “NASA as an Instrument of U.S. Foreign Policy”

<sup>127</sup>Teasel Muir-Harmony, “The Space Race and American Foreign Relations”

<sup>128</sup>Teasel Muir-Harmony, “The Space Race and American Foreign Relations”

<sup>129</sup>Kerry Kolbe, “Space Race Timeline: a Battle beyond Earth”

These six landings marked the victory of the United States over the USSR in the Space Race and established a soft power victory for the US, which was capitalized on. Indeed, this victory gave the US propaganda to use in their attempts to sway over other nations to their side during the Cold War. The victory in the Space Race was "...a symbol of the idea that America represents a technologically advanced and optimistic future".<sup>130</sup> Before the launch, many within the US government knew that this event could be a great publicity opportunity for the United States of America. If successful, the US could point to manned missions to the Moon as an example of their scientific prowess and capability. This led to "...the USIA invested a significant portion of its annual budget in an extensive array of programs designed to heighten anticipation and excitement, sparing no expense to take advantage of this unprecedented public diplomacy opportunity".<sup>131</sup> By anticipating the effects of this event, the United States was able to capitalize on the event. This helped to build up the soft power reputation of the United States at the time, as well as depict the USSR as the lesser of two powers in technological capabilities.

At the same time, the United States attempted to create the image of the manned missions to the Moon as an international event. The Apollo 8 mission, which went to the Moon but did not land, was broadcast globally and included mission leader Frank Borman quoting the Bible due to the universal message the Bible had.<sup>132</sup> This universal message allowed for the Moon missions to be seen as more than just a US pet project; instead, it portrayed the mission as one which showed the technological capabilities of all humanity. By portraying this mission as such, it helped the perception the Moon missions would get from international audiences. This universalism would be a centerpiece of the Apollo missions. For example, the plaque attached to the lunar module read "Here Men from the Planet Earth First Set Foot Upon the Moon, July 1969, A.D. We Came

---

<sup>130</sup>Taylor Dinerman, "NASA and Soft Power, Again,"

<sup>131</sup>Teasel Muir-Harmony, "The Space Race and American Foreign Relations"

<sup>132</sup>Teasel Muir-Harmony, "The Space Race and American Foreign Relations"

in Peace for All Mankind,” while the astronauts on board carried keepsakes from the three astronauts and two cosmonauts who had died in previous space exploration missions.<sup>133</sup> While the plaque could have only mentioned the United States and the astronauts only carried mementos from American astronauts, the mission leaders ensured that international recognition was a piece of the landing. In doing so, the United States was able to portray the Moon landings as a technological success for the entirety of humanity. This helped in developing more international credibility, which could translate to influencing the perceptions of other nations. This soft power approach allowed for the Space Race to transform from a nationalistic enterprise to one of international advancement.

### 3.3 Hard Power Implications of the Space Race

Underlying the Space Race were the military applications that the new technologies developed during the period had enabled, especially in the realm of missile technology. Indeed the origins of the rockets used to launch men and technology into space were the ICBMs created by the competing nations, as well as by Germany, in the years leading to the Space Race.<sup>134</sup> These ICBMs had the capabilities to hit targets globally and launch nuclear payloads. As such, their role in the Cold War cannot be understated. However, the missile technology used could also be used in launching objects into space. As such, the Space Race gave a safe pretext for both the Soviets and Americans to develop their missile technology in a way that was seen as less threatening than tests using nuclear weapons. By keeping the development of missile technology tied to space exploration, the premise of peaceful competition arose. It allowed for innovations while limiting potential military actions that the development and testing of new missiles would

---

<sup>133</sup>Teasel Muir-Harmony, “The Space Race and American Foreign Relations”

<sup>134</sup>Lance Kokonos and Ian Ona Johnson, “The Forgotten Rocketeers: German Scientists in the Soviet Union, 1945–1959”

have justified if it was seen as a military project. This balance between peaceful competition and military development in the Space Race can be best observed through United States Project A119.

With the launching of *Sputnik 1* in 1957, the United States began to look for potential responses to the satellite launch that would show the world it was not technologically lagging behind the Soviet Union. From this concern, Project A119 was developed. In early 1958, the United States developed a plan to launch a nuclear missile to be detonated on the surface of the Moon.<sup>135</sup> The goal was “...to create an explosion and lunar mushroom cloud so awe-inspiring and unavoidable that no matter where you lived on planet Earth, it would be impossible to ignore the extent of America's military and technological might.”<sup>136</sup> This show of power would work as a clear threat to the Soviet Union and other nations that found themselves at odds with the United States: if our weapons can reach the Moon, they can surely and easily reach Moscow or any other strategic target. Project A119 shows that the line between the military and the space program was razor-thin. In many ways, NASA and the peaceful competition it engaged in during the Space Race was a tool of the military.

This use of the Space Race to develop military technology was not solely used by the United States. Indeed, the Soviets had also recruited German scientists and engineers following the end of World War Two.<sup>137</sup> Like their counterparts at NASA, these German scientists worked on weapons development, especially with the development of the R-7 missile, Russia's first ICBM system in 1957.<sup>138</sup> While Soviet engineer Sergei Korolev -who had been sent to the gulags

---

<sup>135</sup> Antony Funnell, “Before There Was a Plan to Land on the Moon, There Was a Plan to Nuke It,” ABC News (ABC News, July 15, 2019), <https://www.abc.net.au/news/2019-07-17/moon-us-plans-cold-war-russia-sputnik/11220340>.

<sup>136</sup> Antony Funnell, “Before There Was a Plan to Land on the Moon, There Was a Plan to Nuke It”

<sup>137</sup> Lance Kokonos and Ian Ona Johnson, “The Forgotten Rocketeers: German Scientists in the Soviet Union, 1945–1959”

<sup>138</sup> Lance Kokonos and Ian Ona Johnson, “The Forgotten Rocketeers: German Scientists in the Soviet Union, 1945–1959”

during Stalin's purge- led the Soviet ICBM project and the *Kosmicheskaya programma SSSR*, it was the technology recovered from German scientists that allowed for their development.<sup>139</sup>

Similarly, the United States had Wernher von Braun, a chief designer of the German V-2 missile, to develop the Saturn V rocket which was the launch vehicle for the Apollo missions.<sup>140</sup>

The reliance on missile technology by the space programs ensured that the Space Race would be inextricably tied together. At the same time, using the space programs to develop rocket technology, which had significant military applications alongside the uses in space exploration, provided a guise in which military developments could occur.

### 3.4 Comparing the Space Race and AI Race

Between the Space Race and the modern AI Race, there are many similarities and differences which provide insight into the changes that technological competition has undergone since the 1960s.

A key similarity between the two competitions is the role it plays in an ongoing great power competition. With the threat of mutually assured destruction (MAD) looming large over any great power conflict, states look towards other forms of competition which will not lead to war. This was seen during the Cold War through the Space Race, where the Soviet Union and the United States clashed ideologically while providing a realm of peaceful competition. This has also been observed with the current Sino-American competition. Both nations have nuclear weapons, which provides the threat of MAD, which helps in curtailing the escalation of conflicts between nuclear states. At the same time, a narrative of a so-called "new Cold War" with China

<sup>139</sup>Lance Kokonos and Ian Ona Johnson, "The Forgotten Rocketeers: German Scientists in the Soviet Union, 1945–1959"

<sup>140</sup>Amy Shira Teitel, "Wernher Von Braun: History's Most Controversial Figure?," Germany | Al Jazeera (Al Jazeera, May 3, 2013), <https://www.aljazeera.com/opinions/2013/5/3/wernher-von-braun-historys-most-controversial-figure/>

has preoccupied academics and journalists alike in recent years.<sup>141</sup> As such, the AI Race provides a similar role to the Space Race within this new framework. It allows for ideological competition to occur sans the risk of MAD, while also providing a platform for hard and soft power development.

Similar to the Space Race, the AI Race combines both hard and soft power projection through ideological and technological competition. The AI technology being developed within the US and China have military uses alongside civil uses, which has led to investments and grants from both nations militaries into AI development.<sup>142</sup> Indeed, if a vehicle can drive itself, that same program could control a drone. This hard power development comes in the form of LAWs, which uses similar programming to autonomous vehicles, which have been a key development in the AI Race so far.<sup>143</sup> Like the rocket technology of the Space Race, autonomous systems have military uses which could drastically shift the realities of war. By using autonomous weapons, militaries could limit the necessity of placing human lives at risk during wars, which would be of great advantage with nations that have developed LAWs. This could allow for even more efficient and deadly warfare, which could be used as a deterrent to engaging in conflict.

In terms of the soft power applications, the user would be practically the same as the Space Race: the goal of proving technological domination against an ideological or geopolitical threat.

---

<sup>141</sup>Vincent Ni, "Cold War or Uneasy Peace: Does Defining US-China Competition Matter?," The Guardian (Guardian News and Media, June 11, 2021), <https://www.theguardian.com/world/2021/jun/11/cold-war-or-uneasy-peace-does-defining-us-china-competition-matter>; Jon Talton, "China and America Are Stuck in a Dangerous Standoff," The Seattle Times (The Seattle Times Company, June 11, 2021), <https://www.seattletimes.com/business/china-and-america-are-stuck-in-a-dangerous-standoff/>; Hung Tran, "Is the US-China Strategic Competition a Cold War?," Atlantic Council, April 21, 2021, <https://www.atlanticcouncil.org/blogs/new-atlanticist/is-the-us-china-strategic-competition-a-cold-war/>; James Palmer, "A New Era of U.S.-China Competition Begins," Foreign Policy, May 19, 2021, <https://foreignpolicy.com/2021/05/19/china-us-competition-technology-endless-frontier-new-cold-war/>.

<sup>142</sup>Michael Møller, "Secretary-General's Message to Meeting of the Group of Governmental Experts on Emerging Technologies in the Area of Lethal Autonomous Weapons Systems Secretary-General," "Lethal Autonomous Weapons Systems," Future of Life Institute; Drew Harwell, "Defense Department Pledges Billions toward Artificial Intelligence Research"; American Planning Association, "Autonomous Vehicles,"

<sup>143</sup>Lethal Autonomous Weapons Systems," Future of Life Institute:



This can be done in a similar way to how the lunar missions were presented to both national and global audiences. This elevation of AI development to an international audience can be seen with the increased visibility of AI developments in the news.<sup>144</sup> By using the public interest in AI, the US and China could emphasize their breakthroughs in AI development as a form of international propaganda to show the superiority of their political ideologies in technological innovation.

Of the differences between the Space Race and AI Race, a key one is the increased actors in the decision-making and development of AI policy in comparison to the Space Race. While the rockets were developed by government agencies in the US and Soviet Union, there is an increased role of private enterprise in the decision-making process. Whereas the state was the main actor in the development of rocket technology, states are much more reliant on corporations for technological innovation. Meanwhile, there is also a reliance on certain technological components- chief among them being semiconductors- that are often developed outside of the United States and China, leading to a reliance on imports.<sup>145</sup> With the increased role of multinational corporations in the development of AI, the role of globalization and geo economics has become a great concern for the developers of AI who are reliant on global trade. Due to this, the policies of other international institutions and states can impact the development of AI in the United States and China.

---

<sup>144</sup>Kia Kokalitcheva, "Startups and VCs Refocus Autonomous Vehicle Efforts," Axios, June 12, 2021, <https://www.axios.com/startups-vcs-autonomous-vehicle-efforts-60c48505-2b73-4c99-9694-c893efbe5cc6.html>; James Vincent, "Google Is Using AI to Design Its next Generation of AI Chips More Quickly than Humans Can," The Verge (The Verge, June 10, 2021), <https://www.theverge.com/2021/6/10/22527476/google-machine-learning-chip-design-tpu-floorplanning>; Anurag Gurtu, "Council Post: Five Industries Reaping The Benefits Of Artificial Intelligence," Forbes (Forbes Magazine, June 2, 2021), <https://www.forbes.com/sites/forbestechcouncil/2021/06/02/five-industries-reaping-the-benefits-of-artificial-intelligence/>; Daniel Malloy, "Can the US Win the AI Race with China?," Atlantic Council, April 30, 2021, <https://www.atlanticcouncil.org/blogs/new-atlanticist/can-the-us-win-the-ai-race-with-china/>.

<sup>145</sup>Sherisse Pham, "China Is Trying to Kick Its Dependence on Foreign Computer Chips"



## **Chapter 4. Geopolitics and Globalization in the Sino-American AI Race**

Of the differences between the Space Race and the AI Race, it is the increased number of actors in the technological competition which is the most important to explore. These new actors- nation-states and corporations more specifically- actively change the framework of great power competition. No longer is the competition confined to the great powers, instead, exterior factors and actors play an important role. These new actors, whose interactions with the United States and China impact the AI race, have risen in importance due to globalization and the modern interconnectedness of nation-states in the current international system. This places a greater emphasis on the foreign policy, trade, and economic policy of other nations than during the Space Race, which was more insulated by the state apparatuses of the US and Soviet Union.

In this ongoing AI Race between the United States of American and the People's Republic of China, the most important item needed is semiconductors for computer chips. Without them, the development of AI systems can be limited as the base hardware needed for research and development is unavailable. Indeed, with both the United States and China heavily reliant on imports for computer components and semiconductors, the countries and corporations who develop these required technologies play a large role in the national AI industries.<sup>146</sup> As such countries and companies that produce these chips for the international market could be very influential in the AI Race. This chapter will explore this relationship by examining the role of Taiwan and the European Union in the AI Race. This will explore both state policies and actions

---

<sup>146</sup>Sherisse Pham, "China Is Trying to Kick Its Dependence on Foreign Computer Chips"; Saheli Roy Choudhury, "Tough Road Ahead for U.S. Firms Trying to Cut Reliance on Taiwan Chipmakers," CNBC (CNBC, April 13, 2021), <https://www.cnbc.com/2021/04/13/semiconductor-shortage-us-tech-companies-and-their-reliance-on-taiwan.html>.

as well as the role that multinational corporations based in these areas impact AI development in the United States and China.

#### 4.1 The European Union and European Corporations in the AI Race

While much of the interest in the AI Race has been centered on the United States and China, the role of outside competitors must not be forgotten. In the AI Race, the European Union (EU) acts as a potential third great competitor to the US and China, as well as a major market for AI products. Indeed, the Information Technology & Innovation Foundation ranks the EU as a distant third to the United States and China.<sup>147</sup> According to their metrics, the United States scored 44.2. China scored 32.3, and the EU scored 23.5.<sup>148</sup> While the United States is the dominant AI player currently, China has closed the lead compared to the analysis done in 2019.<sup>149</sup> However, the EU has continued to lag behind due to private capital investments being mostly directed to the US over the EU, causing a lack of funding to EU-based AI research.<sup>150</sup> This lack of funding due to American overshadowing limits the capabilities of the EU to develop as highly efficient of an AI industry compared to the US and China. While the lack of funding may weaken the AI industries of Europe, the EU still plays a vital role in the AI Race.

With the lack of investment being a key limitation to the EU AI industry, some nations have taken national steps to enable industry growth. For example, in 2018 France created investment

---

<sup>147</sup>Michael McLaughlin and Daniel Castro, “Who Is Winning the AI Race: China, the EU, or the United States? - 2021 Update,” Who Is Winning the AI Race: China, the EU, or the United States? - 2021 Update (Information Technology and Innovation Foundation, January 25, 2021), <https://itif.org/publications/2021/01/25/who-winning-ai-race-china-eu-or-united-states-2021-update>.

<sup>148</sup>Michael McLaughlin and Daniel Castro, “Who Is Winning the AI Race: China, the EU, or the United States? - 2021 Update.”

<sup>149</sup>Michael McLaughlin and Daniel Castro, “Who Is Winning the AI Race: China, the EU, or the United States? - 2021 Update.”

<sup>150</sup>Michael McLaughlin and Daniel Castro, “Who Is Winning the AI Race: China, the EU, or the United States? - 2021 Update.”

funds that totalled \$11.2 billion for AI startups in order to help develop the French AI industry.<sup>151</sup> Meanwhile in Southern Germany, two technical universities, local automotive manufacturers, and local governments have created “Cyber Hub,” a new technological hub in Germany which focuses on developing the local AI industry.<sup>152</sup> These national policies in France and Germany clearly emphasize a key aspect of the EU: the federalization of the EU with an overarching legal system mixed with the ability for states to make unilateral decisions that could impact the national AI industry. This allows each state to set their own AI development policies, as long as they keep in line with EU regulations creating a region where significant innovation can occur in the right context.

While nations including France and Germany have set their own national AI policies and strategies, the EU as a whole have taken significant steps towards a unified European response to AI development. In April the European Commission proposed a series of AI regulations under the Artificial Intelligence Act, which set the framework of EU regulations.<sup>153</sup> These regulations are quite strict, and set an important precedent as the first regulatory oversight system established for the AI Industry.<sup>154</sup> The new regulations include the banning of AI systems used for mass surveillance, social credit systems, and programs that are meant to influence human inhibition,

---

<sup>151</sup>Romain Dillet, “France Wants to Become an Artificial Intelligence Hub,” TechCrunch (TechCrunch, March 29, 2018), <https://techcrunch.com/2018/03/29/france-wants-to-become-an-artificial-intelligence-hub/>.

<sup>152</sup>Patrick McGee, “Germany's Cyber Valley Aims to Become Leading AI Hub,” Financial Times (Financial Times, November 23, 2017), <https://www.ft.com/content/1d0b2770-7226-11e7-93ff-99f383b09ff9>.

<sup>153</sup>Mark MacCarthy and Kenneth Propp, “Machines Learn That Brussels Writes the Rules: The EU's New AI Regulation,” Brookings (Brookings, May 4, 2021), <https://www.brookings.edu/blog/techtank/2021/05/04/machines-learn-that-brussels-writes-the-rules-the-eus-new-ai-regulation/>.

<sup>154</sup>Jeremy Khan, “The Sun Is Setting on A.I.'s Wild West,” CompTIA Technology Interest Groups, April 28, 2021, <https://tig.comptia.org/t/y4hfmc8/the-sun-is-setting-on-a-i-s-wild-west>; Randy Gosda, “EU Proposes Legal Framework for Artificial Intelligence,” American Chamber of Commerce in Sweden (American Chamber of Commerce in Sweden, April 23, 2021), <https://www.amcham.se/newsarchive/2021/4/23/eu-proposes-legal-framework-for-artificial-intelligence>.

while placing strict oversight on other “high-risk” technologies.<sup>155</sup> Proposed regulations would encompass both internal oversight of the industry, as well as the importation of AI technology into the EU.<sup>156</sup> As such, the regulations would have a dramatic impact on the shape and scope of the Sino-American AI Race.

With the regulations impacting AI imports into the EU, both the US and China will likely be forced to alter their strategies in order to comply with the regulations. As the AI Race is much more reliant on companies and corporations within the United States and China, the market lost by not following EU regulations is massive. Economically, there is now an incentive for the international AI companies to adhere to the strict regulations in order to gain market access. While the US and Chinese AI industries could continue to develop AI technologies that do not adhere to EU regulation, a large part of research and development funding would likely go to innovations that can reap more economic benefit. This would also likely not affect the military development of AI technologies. But, the proposed regulations mark what could become a new era in AI development, where states begin to regulate the industry and place innovations under more political scrutiny.<sup>157</sup> With the EU regulations as a framework, other nations as well may look to explore what a regulated AI industry may entail. This could also lead to potential international regulations through the UN and associated bodies of AI.

Through taking steps to regulate their AI industry, the EU has changed the nature of the AI Race. Regulations will help in shaping what AI competition looks like for the US and China, as well as likely limiting the developmental path of AI in general. Due to the global economic

---

<sup>155</sup>“Europe Fit for the Digital Age: Commission Proposes New Rules and Actions for Excellence and Trust in Artificial Intelligence,” European Commission - European Commission, April 21, 2021, [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_21\\_1682](https://ec.europa.eu/commission/presscorner/detail/en/IP_21_1682).

Mark MacCarthy and Kenneth Propp, “Machines Learn That Brussels Writes the Rules: The EU's New AI Regulation.”

<sup>156</sup>Mark MacCarthy and Kenneth Propp, “Machines Learn That Brussels Writes the Rules: The EU's New AI Regulation.”

<sup>157</sup>Jeremy Khan, “The Sun Is Setting on A.I.'s Wild West.”

system of trade, incentives for complying to regulations for market access is a strong way to directly impact AI development. This will likely be the most important European impact in the AI Race. While the EU is not able to compete significantly with the US and China in the AI Race, actions taken by the EU can lead to shifts in the competition.

## 4.2 Taiwan- The Semiconductor Foundry of the World

Of the countries associated with the ongoing AI Race between the United States and China, few are as important as the Republic of China, also known as Taiwan. The technology industry of Taiwan, alongside the geographical and political positioning of Taiwan, has allowed Taiwan to take a more important role in the international system. This relationship between Taiwan, China, and the United States is made even more complicated due to the general lack of recognition of Taiwan as a country internationally. Indeed, only 15 other nations recognize Taiwan as an independent state, with most of these nations being island and Latin American countries.<sup>158</sup> Both the United States and China do not officially recognize Taiwan as an independent nation, but both continue to have economic and political ties nonetheless.<sup>159</sup>

In the United States, its relationship between Taiwan and the US is built upon the Taiwan Relations Act of 1979. This act of Congress de facto, yet unofficial, diplomatic relations which were established with Taiwan.<sup>160</sup> These ties established the ability for each to interact and develop trade and economic ties. However, the issue of military protection was not a piece of the bill, which has allowed for an ambiguous military strategy from the United States to be

<sup>158</sup>“Countries That Recognize Taiwan 2021,” Countries That Recognize Taiwan 2021, 2021, <https://worldpopulationreview.com/country-rankings/countries-that-recognize-taiwan>.

<sup>159</sup>“Countries That Recognize Taiwan 2021”

<sup>160</sup>TRA; Pub.L. 96–8, 93 Stat. 14, enacted April 10, 1979; H.R. 247

developed.<sup>161</sup> While this had been the status quo of Taiwanese-American diplomatic relations, the Trump administration and early Biden administration saw significant emphasis put on the relationship. In 2019, the United States passed the TAIPEI Act, with the provisions of the document calling for Taiwanese inclusion in international institutions, while also affirming US support for these initiatives.<sup>162</sup> This was followed by the Taiwan Assurance Act in 2020, which notes the importance of Taiwan in the US Indo-Pacific strategy, while also enacting the sales of arms and military technology to Taiwan.<sup>163</sup> By enacting these two laws, the United States shows the geopolitical importance of Taiwan to the US.

From the Chinese side, the relationship with Taiwan is very tense. Under the One-China Principle, the People's Republic of China sees Taiwan as a rogue region of China while asserting that there is only one legal government of all China.<sup>164</sup> However, even with the One-China Principle, there have been close economic and cultural ties between the two nations. For instance, from 1991 to March of 2019, Taiwanese investments in China totaled \$188.5 billion USD while trade between the nations totaled \$149.2 billion in 2010.<sup>165</sup> These ties have been vital in keeping the peace between the straits. But, it seems that the relationship between the two nations has become strained in recent years. With Taiwan pursuing closer economic and military ties with the United States, a new China-Taiwan diplomatic landscape seems to be forming.

Throughout 2020 and 2021, China has become more aggressive in their handling of Taiwan. For

---

<sup>161</sup>Simon Shin-wei Chen, Wang Kai-chun, and Samuel Hui, "Why US Strategic Ambiguity Is Safer for Taiwan," – The Diplomat (for The Diplomat, April 28, 2021),

<https://thediplomat.com/2021/04/why-us-strategic-ambiguity-is-safer-for-taiwan/>.

<sup>162</sup> TAIPEI Act; Pub.L. 116–135, 134 Stat. 278, enacted March 26, 2020; S. 1678

<sup>163</sup>CNA Staff Writer, "TSMC Mulls US Packaging Plant," Taipei Times, June 13, 2021,

<https://www.taipeitimes.com/News/biz/archives/2021/06/14/2003759116>.

<sup>164</sup>Michael J Green, "What Is the U.S. 'One China' Policy, and Why Does It Matter?," What Is the U.S. "One China" Policy, and Why Does it Matter? | Center for Strategic and International Studies, May 25, 2021,

<https://www.csis.org/analysis/what-us-one-china-policy-and-why-does-it-matter>.

<sup>165</sup>"Cross Strait Relations," Government Portal of the Republic of China, 2020,

[https://www.taiwan.gov.tw/content\\_6.php#:~:text=Today%2C%20Taiwan%20is%20one%20of,2.68%20million%20visits%20to%20Taiwan](https://www.taiwan.gov.tw/content_6.php#:~:text=Today%2C%20Taiwan%20is%20one%20of,2.68%20million%20visits%20to%20Taiwan).



instance, for over a year, there have been daily incursions of the Taiwanese ADIZ by Chinese fighter jets and bombers with impunity, which have increased in size in recent months.<sup>166</sup> This works as a threat against Taiwan from China. Each flight into the Taiwanese Air Defense Identification Zone (ADIZ) by Chinese planes shows weakness and an inability of Taiwan to respond or protect its claimed land from military threat. At the same time, these threats play into a growing concern over an imminent invasion of Taiwan by China, which has become a hotly discussed topic in the United States.<sup>167</sup> As such, while the relationship between the US and Taiwan has improved, the Sino-Taiwanese relationship has deteriorated significantly.

While the diplomatic relations between Taiwan and the United States are interesting, it is the semiconductor manufacturing capabilities of Taiwan that elevate its importance in the AI Race between the US and China. Taiwan Semiconductor Manufacturing Company (TSMC) has become the most important force in the global computer technology industry. This is due to the market dominance of TSMC in the semiconductor industry. The market share of TSMC in semiconductor manufacturing grew to 56% in 2020.<sup>168</sup> This growth and continued market dominance come from the unique position TSMC has settled into in the semiconductor industry. While many semiconductor companies fabricate the chips into processors, TSMC is in the sole business of fabrication of semiconductors, allowing them to sell freely to other companies without the risk of unintended competition.<sup>169</sup> With the focus on fabrication by TSMC, the

<sup>166</sup>Jacob Knutson, "China Flies at Least 20 War Planes in Taiwan Airspace," Axios, March 26, 2021, <https://www.axios.com/china-incursion-war-planes-taiwan-airspace-3d5994f1-71d1-41f7-a4c8-f825d6043262.html>; Stephen McDonnell, "Taiwan: 'Record Number' of China Jets Enter Air Zone," BBC News (BBC, April 13, 2021), <https://www.bbc.com/news/world-asia-56728072>; Huizhing Wu, "China Sends Record 28 Fighter Jets toward Taiwan," ABC News (ABC News Network, June 15, 2021), <https://abcnews.go.com/International/wireStory/china-sends-record-28-fighter-jets-taiwan-78288190>.

<sup>167</sup>Rebecca Kheel, "Concerns Grow over China's Taiwan Plans," TheHill (The Hill, June 12, 2021), <https://thehill.com/policy/defense/558103-concerns-grow-over-chinas-taiwan-plans>.

<sup>168</sup>Khavien Investments, "Taiwan Semiconductor Stock: Further Market Share Gains (NYSE:TSM)," SeekingAlpha, June 3, 2021, <https://seekingalpha.com/article/4432785-tsmc-expanding-foundry-market-leadership>.

<sup>169</sup>Taiwan Semiconductor Manufacturing Company, "Company Info," Taiwan Semiconductor Manufacturing Company Limited (Taiwan Semiconductor Manufacturing Company, September 3, 2020), [https://www.tsmc.com/english/aboutTSMC/company\\_profile](https://www.tsmc.com/english/aboutTSMC/company_profile).

production capabilities are immense and highly innovative, as it is one of only three companies able to produce next-generation 7nm, 5nm, and 3nm chips, while also announcing recent breakthroughs in 1nm semiconductor manufacturing.<sup>170</sup> Due to their fabrication capabilities, the semiconductors produced are often used in the development of computer chips and processors by other semiconductor and chip companies such as Qualcomm, NVIDIA, and AMD among other large tech companies.<sup>171</sup> These companies that purchase semiconductors fabricated by TSMC ensure that the global market is dominated by TSMC.

In the United States, the dominance of Taiwanese semiconductors is prevalent. Taiwanese chip producers fabricate around 90% of chips used by US-based tech companies.<sup>172</sup> While the United States controls 48% of the market share of semiconductors, the vast majority of the chips are produced in Asia with the US only producing 12% of the global chip supply.<sup>173</sup> As TSMC continues to expand in the global market, it has shrunk its presence in China. Following the US sanctions and restrictions placed on Huawei, TSMC discontinued the production of semiconductors for the company to retain its position in the American semiconductor industry.<sup>174</sup> This reliance on Taiwanese chips by the US semiconductor industry, alongside the global dominance of TSMC, ensures that TSMC is a centerpiece of the Sino-American AI Race.

In China, there is also a reliance on foreign semiconductors for use in their national industry. 90% of the semiconductors used in the Chinese high-tech industry are imported, which has been

---

<sup>170</sup>Sherisse Pham, "Taiwan Could Become the next Flashpoint in the Global Tech War," CNN (Cable News Network, August 1, 2020), <https://www.cnn.com/2020/07/31/tech/tsmc-intel-semiconductors-hnk-intl/index.html>; Matthew Strong, "Taiwan's TSMC Claims Breakthrough on 1nm Chips," Taiwan News (Taiwan News, May 19, 2021), <https://www.taiwannews.com.tw/en/news/4206524>.

<sup>171</sup>Saheli Roy Choudhury, "Tough Road Ahead for U.S. Firms Trying to Cut Reliance on Taiwan Chipmakers."

<sup>172</sup>Saheli Roy Choudhury, "Tough Road Ahead for U.S. Firms Trying to Cut Reliance on Taiwan Chipmakers."

<sup>173</sup>FP Analytics, "Semiconductors and the U.S.-China Innovation Race," Foreign Policy (Foreign Policy, February 16, 2021), <https://foreignpolicy.com/2021/02/16/semiconductors-us-china-taiwan-technology-innovation-competition/#:~:text=For%20decades%2C%20the%20U.S.%20has%20of%20revenue%20as%20of%202020.&text=China%20is%20a%20net%20importer.enable%20most%20of%20its%20technology>.

<sup>174</sup>FP Analytics, "Semiconductors and the U.S.-China Innovation Race."



a great concern for China as sanctions or trade disputes could damage their high-tech industries.<sup>175</sup> As such, China has invested heavily in the semiconductor fabrication industry to limit the reliance on imports.<sup>176</sup> However, this has been less than successful as the fabrication in China is significantly less advanced than the capabilities of competitors.<sup>177</sup> This is a key limitation as the less advanced chips are not as viable in the development of AI.

In the development of US AI, TSMC reigns as the fabrication king. Indeed, many of the large tech companies developing AI systems in the US including Apple, Google, and NVIDIA, use the chips developed by TSMC to power their AI-based systems.<sup>178</sup> If the United States is to be the victor in the AI Race, it will be systems built on Taiwanese chips, with the vast majority developed by TSMC. Meanwhile, TSMC has continued to expand its semiconductor fabrication business in the US market. First was the announcement of a new TSMC manufacturing plant being constructed in Arizona and interest in developing more American manufacturing.<sup>179</sup> At the same time, TSMC announced that they would soon begin the development of 16nm chips for automotive makers which are being used in the creation and use of autonomous vehicles.<sup>180</sup>

The role that Taiwan plays in the ongoing AI Race is the fabrication of the computer chips that will be the basis of AI systems globally. Indeed, as the largest producer of chips which has already begun to benefit from the new round of Sino-American competition, the room for growth is expanding. With both nations reliant on chip imports and TSMC's role as the largest

---

<sup>175</sup>Salvatore Babones, "China's Drive to Make Semiconductor Chips Is Failing."

<sup>176</sup> Salvatore Babones, "China's Drive to Make Semiconductor Chips Is Failing."

<sup>177</sup>Salvatore Babones, "China's Drive to Make Semiconductor Chips Is Failing."

<sup>178</sup>Saheli Roy Choudhury, "Tough Road Ahead for U.S. Firms Trying to Cut Reliance on Taiwan Chipmakers."

<sup>179</sup>Ch eng Ting-Fang, "TSMC Considering First Chip Packaging Plant in US," Nikkei Asia (Nikkei Asia, June 11, 2021),

<https://asia.nikkei.com/Business/Tech/Semiconductors/TSMC-considering-first-chip-packaging-plant-in-US>; Sam Shead, "Why Intel and TSMC Are Building Water-Dependent Chip Factories in One of the Driest U.S. States," CNBC (CNBC, June 4, 2021),

<https://www.cnbc.com/2021/06/04/why-intel-tsmc-are-building-water-dependent-chip-plants-in-arizona.html>.

<sup>180</sup>Eric Chang, "Taiwan's TSMC Begins Production on Two 16 Nm Automotive Chips," Taiwan News, June 10, 2021, <https://www.taiwannews.com.tw/en/index>.

manufacturer of chips, Taiwan has found itself once again stuck in the middle of Sino-American competition. However, this poses a great risk to the stability of the global semiconductor market. Several factors such as earthquakes, droughts, or even military actions against Taiwan could cripple the global chip market.<sup>181</sup> But, the same reliance that poses a risk to Taiwan could help in protecting Taiwan from Chinese military action. Indeed, with the US reliance on TSMC, Taiwan could leverage chip accessibility as a means of ensuring protection from Chinese interference. This seems to be a possible plan that Taiwan is pursuing as it has continued to strengthen economic and military ties with the United States, even though some argue that the role Taiwan plays in the semiconductor field is not enough to ensure security.<sup>182</sup>

With the recent changes to Taiwanese foreign policy, the relationship between the United States and Taiwan has improved while Sino-Taiwanese relations have soured significantly. This has led to stronger military and economic ties with the US while Chinese warplanes invade Taiwanese ADIZ. These stronger ties, as well as US reliance on Taiwanese chips, have established Taiwan as a key strategic partner of the US in the AI Race it is currently undergoing. With the AI Race reliant on semiconductor manufacturing, TSMC plays a significant role in the ability of the US and China to develop AI-based computer systems. As such, Taiwan and TSMC are key outside actors which have influenced the AI Race significantly. While the rockets and all the required components of the Space Race were built by NASA and *Kosmicheskaya programma SSSR*, the AI systems of the United States and China look almost bound to be built on Taiwanese components.

---

<sup>181</sup>Eric Cheung, "The Chipmaking Factory of the World Is Battling Covid and the Climate Crisis," CNN Business, June 11, 2021, <https://keyt.com/news/money-and-business/2021/06/10/the-chipmaking-factory-of-the-world-is-battling-covid-and-the-climate-crisis/>; Kelvin Chen, "US Warns Taiwan's TSMC Not Solution to China Threat," Taiwan News (Taiwan News, May 23, 2021), <https://www.taiwannews.com.tw/en/news/4208369>.

<sup>182</sup>Kelvin Chen, "US Warns Taiwan's TSMC Not Solution to China Threat."

The position between the US and China is likely to continue to be exploited by research in the pursuit of AI development, especially through TSMC. With its position as the global leader of semiconductor forging and exportation, TSMC plays a primary role in the AI Race. The chips that are manufactured power Chinese and American technological innovations in computing, robotics, and AI among many other tech-related fields.

The recent push towards the US market by TSMC coexists alongside the recent resurgence of industrial policy in the United States under the current Biden administration. The resurgence comes following the signing of Executive Order 14017, which called for an examination of American critical supply chains and how to better protect them from potential external threat.<sup>183</sup> The report that followed this Executive Order noted four key supply chains, including semiconductor manufacturing.<sup>184</sup> As noted, the heavy reliance on semiconductor imports presents a key concern for the United States, especially in the development of emerging technologies. In discussing the semiconductor industry, the report recommended that the US invest an additional \$50 billion to develop the local advanced semiconductor manufacturing industry, as well as “strengthen engagement with allies and partners to promote fair semiconductor chip allocations, increase production, and promote increased investment.”<sup>185</sup> The Executive Order also warns of overreliance on Taiwanese chips, as well as Japan and Korea.<sup>186</sup>

---

<sup>183</sup>“Fact Sheet: Biden-Harris Administration Announces Supply Chain Disruptions Task Force to Address Short-Term Supply Chain Discontinuities,” The White House (The United States Government, June 8, 2021), <https://www.whitehouse.gov/briefing-room/statements-releases/2021/06/08/fact-sheet-biden-harris-administration-announces-supply-chain-disruptions-task-force-to-address-short-term-supply-chain-discontinuities/>.

<sup>184</sup>“Fact Sheet: Biden-Harris Administration Announces Supply Chain Disruptions Task Force to Address Short-Term Supply Chain Discontinuities,” The White House.

<sup>185</sup>“Fact Sheet: Biden-Harris Administration Announces Supply Chain Disruptions Task Force to Address Short-Term Supply Chain Discontinuities,” The White House .

<sup>186</sup>Lauly Li and Cheng Ting-Fang, “Taiwan Tech Firms Fear Fallout after US Raises Supply Chain Alarm,” Nikkei Asia (Nikkei Asia, June 15, 2021), <https://asia.nikkei.com/Business/Tech/Semiconductors/Taiwan-tech-firms-fear-fallout-after-US-raises-supply-chain-alarm>.

This report coincided with the passing of a bill through the Senate that would provide \$200 billion to advance the competitiveness with China and bolster American manufacturing and research and development in the technology sector.<sup>187</sup> This would also allow for the United States to play a more active role in the tech sector through directing research through funding similar to the Made In China 2025.<sup>188</sup> The push towards a reinvigorated industrial policy focused on developing manufacturing in the US represents a shift away from the main economic policy of neoliberalism that has ushered the US since the 1970s.<sup>189</sup> With the focus on creating new high-paying jobs in the technology sector through investments, the US may be able to limit the importance of TSMC and other international corporations in the tech sector.

These mentioned adjustments in American tech policy could work to either benefit or harm the role of TSMC as a global leader in semiconductor manufacturing. The most likely to be of concern is the emphasis placed on investments into US companies to manufacture semiconductors for the US market. This would damage the importance of TSMC, and Taiwan more generally, in the international economy as reliance declines. If the US successfully limits the reliance on chip imports, the value of TSMC would fall significantly. However, it is uncertain that the investments would indeed lead to the US semiconductor industry growing. This has been an ongoing problem for China, whose past attempts at developing their own semiconductor

---

<sup>187</sup>Cissy Zhou, "US Turning to Aggressive 'Industrial Policy' to Counter Beijing, Experts Say," South China Morning Post, June 9, 2021, <https://www.scmp.com/economy/global-economy/article/3136617/us-china-relations-bidens-trade-strike-force-sees-us-turn>.

<sup>188</sup>Robert Farley, "With Focus on China, US Senate Passes Major Industrial Policy Bill," The Diplomat, June 12, 2021, <https://thediplomat.com/2021/06/with-focus-on-china-us-senate-passes-major-industrial-policy-bill/>.

<sup>189</sup>Keith B Belton, "The US Has an Emerging Industrial Policy. Biden Should Build on It," Industry Week, February 7, 2021, <https://www.industryweek.com/the-economy/public-policy/article/21154441/the-us-has-an-emerging-industrial-policy-biden-should-build-on-it>; Robert Reich, "Biden's Industrial Policy Is the Key to His Economic Restructuring," baltimoresun.com (Baltimore Sun, April 22, 2021), <https://www.baltimoresun.com/opinion/op-ed/bs-ed-op-0423-reich-industrial-policy-20210422-cb2krfulr5b6rbmd6j-dkaffgne-story.html>.

industry through investments have failed to wane their need of foreign chips.<sup>190</sup> As such, while these investments pose a significant risk to TSMC's dominance, it is unclear whether the US will be able to do so successfully.

The Executive Order report also provides an opportunity for TSMC to become even more important to the US semiconductor if reliance on chip imports does not decrease. The mention of strengthening ties with international partners and companies provides room for TSMC to engrain itself as a key geopolitical interest for the US.<sup>191</sup> At the same time, TSMC has begun development of new semiconductor forges in the United States, leading to potentially increased ties between the United States and TSMC.<sup>192</sup> This push into the US ensures that the US technology sector will become more dependent on TSMC chips. However, this move towards opening new factories in the US also provides chip security for the United States at the same time. While the US is still reliant on foreign companies to provide semiconductors, having chip foundries in the US allows for a safer supply chain and lessens the reliance on imports for American companies. This would likely lead to TSMC being seen as vital to the US supply chain and potentially leading to an even more important place in American supply chains.

---

<sup>190</sup>Saheli Roy Choudhury, "Tough Road Ahead for U.S. Firms Trying to Cut Reliance on Taiwan Chipmakers;" Salvatore Babones, "China's Drive to Make Semiconductor Chips Is Failing."

<sup>191</sup>"Fact Sheet: Biden-Harris Administration Announces Supply Chain Disruptions Task Force to Address Short-Term Supply Chain Discontinuities," The White House.

<sup>192</sup> Cheng Ting-Fang, "TSMC Considering First Chip Packaging Plant in US."

## Chapter 5. Conclusion

The exploration of the similarities and differences between the AI Race and Space Race brought to light the changes caused by globalization. Both of these technological competitions had hard and soft power benefits for the competing nations, but the most prevalent and noticeable change was the increased number of actors who were central to the development of AI and the necessary technological components. Whereas the Space Race was solely engaged through the United States and the Soviet Union, the AI Race includes many new minor actors who can influence the competition. These new actors included both nation-states and multinational corporations. This increase in actors is due to AI being mostly developed through private enterprises in both China and the United States. Due to globalization, the semiconductor industry is heavily intertwined with global trade. With the United States and China, each reliant on the import of semiconductors to fuel the high-tech industries that are at the forefront of AI development, the companies and countries that produce the computer chips are of vital importance.<sup>193</sup> This allows states and multinational corporations outside of the two main actors to impact the race to their own benefit. This was explored in both the case of the European Union and Taiwan. In the case of the European Union, the policies and new regulations developed by the EU have caused US AI development to shift to accommodate the regulatory system of the EU.<sup>194</sup> In the case of Taiwan, the global dominance of semiconductor fabrication by TSMC has called for Taiwan to become an integral actor within the Sino-American AI Race.<sup>195</sup> This constitutes a dramatic shift away from the Space Race version of bilateral competition into a

---

<sup>193</sup> Salvatore Babones, “China's Drive to Make Semiconductor Chips Is Failing”; Saheli Roy Choudhury, “Tough Road Ahead for U.S. Firms Trying to Cut Reliance on Taiwan Chipmakers.”

<sup>194</sup> Jeremy Kahn, “Law Firms Are Building A.I. Expertise as Regulation Looms,” *Fortune* (Fortune, May 25, 2021), <https://fortune.com/2021/05/11/law-firms-are-building-a-i-expertise-as-regulation-looms/>.

<sup>195</sup> FP Analytics, “Semiconductors and the U.S.-China Innovation Race.”

modern version of great power competition where the decisions in other nations can have a significant impact on the competitors. While the Soviets and Americans were able to control the entirety of the supply chain necessary to develop new rocket technology, that is no longer the case in the AI Race. As such, the states have made adjustments to their developmental policies to succeed.

From a neoclassical realist perspective, the case of the ongoing Artificial Intelligence Race between the United States and China provides a clear link between the domestic and foreign interests of nations. With the release of the Made in China 2025 industrial policy, China introduced new domestic policies to improve the technological industries of China, as well as encouraging development in specific fields which included AI.<sup>196</sup> This domestic policy also had aspects related to Chinese foreign policy through its emphasis on becoming a leader of innovation and technological development in order to better compete with the United States. The emphasis was then specifically noted as a reason by the Chinese State Council in their public addressing of the topic.<sup>197</sup> Meanwhile, the US has begun to adopt industrial policies focused on countering Made in China 2025 and further compete with China. Figure 2 explores the strengths and weaknesses of the US and Chinese AI development strategies to better illustrate the differences in their strategies. The AI Race was established as a foreign policy response to the industrial policies set by China and later on the United States. Like the Space Race, the AI Race provides a realm of competition for great powers while avoiding the trap of military conflict. Alongside the military advancements that AI development can provide nations, the competition also allows the spread of influence to potential allies and regional partners.

---

<sup>196</sup>Mozur, Paul. "Beijing Wants A.I. to Be Made in China by 2030."

<sup>197</sup>"China's New Generation of Artificial Intelligence Development Plan." FLIA. Chinese State Council



## US and Chinese AI Development Strengths and Weaknesses Analysis

<b>US Strengths</b> <ul style="list-style-type: none"> <li>- Strong relations with the three major importers of semiconductors to America (Taiwan, South Korea, and Japan)</li> <li>- Silicon Valley and high levels of technological innovation</li> </ul>	<b>US Weaknesses</b> <ul style="list-style-type: none"> <li>- Reliance on semiconductor imports</li> <li>- Slow response to AI developments in policymaking</li> <li>- No official AI policies yet to pass into law</li> <li>- Low levels of government funding for research and development</li> </ul>
<b>Chinese Strengths</b> <ul style="list-style-type: none"> <li>- Early and continued adoption of new AI policies by the PRC</li> <li>- Significant government funding towards AI and semiconductor development</li> <li>- Large talent pool of engineers and computer scientists</li> </ul>	<b>Chinese Weaknesses</b> <ul style="list-style-type: none"> <li>- Reliance on semiconductor imports</li> <li>- Tense relations with key importers of semiconductors</li> <li>- Less foreign talent in the labor pool</li> </ul>

**Figure 2: US and Chinese AI Development SW Analysis**

The effects of the technology policies of the US and China have not only impacted one another, but have worked to shape the foreign policy decisions of many different state and non-state entities. This can be seen with the regulatory policies of the EU, whose passing into law would force the United States and China to adhere to the regulations or lose access to the European market. As such, this provides another example from the AI Race in which the domestic policies of a nation impacts the scope of competition. This relationship between the domestic policies- especially in regards towards industrial policy in the technology sector- and the foreign policy decisions of nations has shaped the race between the US and China.

### 5.1 Recommendations for Future Research

In the future, academic research on the topic of AI policy will become more prevalent as public interest continues to grow and new AI developments continue to occur. As such, explorations that more closely examine the history of AI development and the route of

development it has taken inside China would be of great interest to explore. Due to the lack of Chinese scholarship in the West written by Chinese academics and foreign policy elites, a study of their views on technological competition would be enlightening.

More research could also occur in exploring the global semiconductor industry. As AI development continues forward, semiconductors and components necessary to build AI systems will become even more important than they already are. Due to the pervasiveness of computers in the contemporary world, a more in-depth analysis of the growing semiconductor industry would be of academic benefit.

In both the United States and China, industrial policy is playing a larger role in planning economic growth, especially in high-tech industries. This represents a shift in the US economic policies, as industrial guidance by the government had been largely tossed to the side since the late 1970s.<sup>198</sup> Further exploration of this new shift towards industrial policy in the United States and the reasons behind the shift could be undertaken.

Lastly, developments in AI and its role in international politics could increase political interest in the development of other emerging technologies. The so-called “New GRAINS- genetics, robotics, artificial intelligence, and nanotechnology- are areas where breakthroughs in recent years have increased the political interests in the technologies. Like AI, the other three emerging technologies have the possibility to radically change society. As such, if public interest in the industries and new developments continue, further examination of the political impacts of these technologies will provide clearer insights into the relationship between technology and society.

---

<sup>198</sup>Robert Reich, “Biden's Industrial Policy Is the Key to His Economic Restructuring.”

## 5.2 In Conclusion

Developments in the field of Artificial Intelligence (AI) could have drastic effects on international power systems, with both the United States and the People's Republic of China actively pursuing international dominance in this emerging field in recent years. Indeed, all evidence points to the AI Race having already started, and for the United States to keep its position as a global power, it must actively compete against China in this field. This paper examined this topic through the lens of the realist theory of great power competition, which provides an overarching explanation of the current US-Sino relationship, as well as the competitive- and sometimes combative- relationship that the two nations currently have with one another. What started with the intent of the People's Republic of China to become a global leader in AI development, has instead turned into a competition between the United States and China to be the global leader in AI innovation and creation.<sup>199</sup> This recognition of the importance of competing on this issue brought the development of AI into the realm of both domestic and foreign policy. This has led to an increase in direct government references to AI, as well as the abundance of policy papers and government funding referencing the importance of AI development as a foreign and domestic concern.

Currently, the AI Race is a two-nation race, with external actors influencing the actions and decisions of both the United States and China. The current state, based on analysis done of the race in both nations shows the United States currently having an edge over China but with the gap between the two nations closing.<sup>200</sup> As such, it is likely that the issue of technological innovation especially in the field of AI will continue to be an area of concern and interest among foreign policy experts and academics.

---

<sup>199</sup>Mozur, Paul. "Beijing Wants A.I. to Be Made in China by 2030."

<sup>200</sup> Michael McLaughlin and Daniel Castro, "Who Is Winning the AI Race: China, the EU, or the United States? - 2021 Update."

Through the AI Race, China looks to show the world that it can compete technologically with the United States. This would help in legitimizing China's rise as a new hegemonic power that can compete with the United States on equal footing. Meanwhile, an American victory would once again show the innovativeness that comes from the liberal economic and political order of the United States.

In the upcoming years, the AI Race which has already begun will expand as innovations are made and the goals of AI development are established. Currently, the AI Race is just beginning and many of the deciding factors have yet to be established. However, with the speed that the AI Race began and the rapid shifts in foreign and domestic policies it caused, it looks like a great deal of importance has been placed upon securing technological superiority over the competing power. It will be a while until victory is achieved by either the United States and China, but the victorious nation will have done so due to the ability to adapt to new technological and political realities.

## Resources

G20 Ministerial Statement on Trade and Digital Economy § (2019).

[https://trade.ec.europa.eu/doclib/docs/2019/june/tradoc\\_157920.pdf](https://trade.ec.europa.eu/doclib/docs/2019/june/tradoc_157920.pdf).

“APEC and Trans-Pacific Partnership Mutually Useful: Research.” APEC, October 25, 2011.

[https://www.apec.org/press/news-releases/2011/1025\\_tpp.aspx](https://www.apec.org/press/news-releases/2011/1025_tpp.aspx).

“Beijing AI Principles.” Beijing AI Principles, 2018.

<https://www.baai.ac.cn/blog/beijing-ai-principles>.

“China to Import \$300 Billion of Chips for Third Straight Year: Industry Group.” Reuters.

Thomson Reuters, August 26, 2020.

<https://www.reuters.com/article/us-china-semiconductors-idUSKBN25M1CX>.

“China's New Generation of Artificial Intelligence Development Plan.” FLIA. Chinese State Council, July 31, 2017.

<https://flia.org/notice-state-council-issuing-new-generation-artificial-intelligence-development-plan/>.

“Cross Strait Relations.” Government Portal of the Republic of China, 2020.

[https://www.taiwan.gov.tw/content\\_6.php#:~:text=Today%2C%20Taiwan%20is%20one%20of,2.68%20million%20visits%20to%20Taiwan](https://www.taiwan.gov.tw/content_6.php#:~:text=Today%2C%20Taiwan%20is%20one%20of,2.68%20million%20visits%20to%20Taiwan).

“Europe Fit for the Digital Age: Commission Proposes New Rules and Actions for Excellence and Trust in Artificial Intelligence.” European Commission - European Commission,

April 21, 2021. [https://ec.europa.eu/commission/presscorner/detail/en/IP\\_21\\_1682](https://ec.europa.eu/commission/presscorner/detail/en/IP_21_1682).

“Fact Sheet: Biden-Harris Administration Announces Supply Chain Disruptions Task Force to

Address Short-Term Supply Chain Discontinuities.” The White House. The United States

Government, June 8, 2021.

<https://www.whitehouse.gov/briefing-room/statements-releases/2021/06/08/fact-sheet-biden-harris-administration-announces-supply-chain-disruptions-task-force-to-address-short-term-supply-chain-discontinuities/>.

"Globalization: Threat or Opportunity?". International Monetary Fund. 12 April 2000.

"H.R. 4444 (106th): China Trade Bill." GovTrack.us, 2004.

<https://www.govtrack.us/congress/bills/106/hr4444/text>.

"Lethal Autonomous Weapons Systems." Future of Life Institute, August 12, 2020.

<https://futureoflife.org/lethal-autonomous-weapons-systems/?cn-reloaded=1>.

"Over 50 Years of Moore's Law." Intel. Accessed February 23, 2021.

<https://www.intel.com/content/www/us/en/silicon-innovations/moores-law-technology.html>.

"Timeline: U.S. Relations With China 1949–2020." Council on Foreign Relations. Council on Foreign Relations, 2020. <https://www.cfr.org/timeline/us-relations-china>.

American Planning Association. "Autonomous Vehicles." American Planning Association. Accessed February 23, 2021.

<https://www.planning.org/knowledgebase/autonomousvehicles/>.

Babones, Salvatore. "China's Drive to Make Semiconductor Chips Is Failing." Foreign Policy, December 14, 2020.

<https://foreignpolicy.com/2020/12/14/china-technology-sanctions-huawei-chips-semiconductors/>.

Belton, Keith B. "The US Has an Emerging Industrial Policy. Biden Should Build on It."

Industry Week, February 7, 2021.

<https://www.industryweek.com/the-economy/public-policy/article/21154441/the-us-has-a-n-emerging-industrial-policy-biden-should-build-on-it>.

Berggruen, Nicolas, and Nathan Gardels. “Opinion | A Wakeup Call for Europe.” The Washington Post. WP Company, April 1, 2019.

[https://www.washingtonpost.com/news/theworldpost/wp/2018/09/27/europe/?utm\\_term=.a87569d0ddec](https://www.washingtonpost.com/news/theworldpost/wp/2018/09/27/europe/?utm_term=.a87569d0ddec).

Chan, Dawn. “The AI That Has Nothing to Learn From Humans.” The Atlantic. Atlantic Media Company, October 20, 2017.

<https://www.theatlantic.com/technology/archive/2017/10/alphago-zero-the-ai-that-taught-itself-go/543450/>.

Chang, Eric. “Taiwan’s TSMC Begins Production on Two 16 Nm Automotive Chips.” Taiwan News, June 10, 2021. <https://www.taiwannews.com.tw/en/index>.

Chen, Kelvin. “US Warns Taiwan's TSMC Not Solution to China Threat.” Taiwan News. Taiwan News, May 23, 2021. <https://www.taiwannews.com.tw/en/news/4208369>.

Chen, Simon Shin-wei, Wang Kai-chun, and Samuel Hui. “Why US Strategic Ambiguity Is Safer for Taiwan.” – The Diplomat. for The Diplomat, April 28, 2021.

<https://thediplomat.com/2021/04/why-us-strategic-ambiguity-is-safer-for-taiwan/>.

Chesney, Robert, and Danielle K. Citron. “Disinformation on Steroids: The Threat of Deep Fakes.” Council on Foreign Relations. Council on Foreign Relations, October 16, 2018.

<https://www.cfr.org/report/deep-fake-disinformation-steroids>.

Cheung, Eric. “The Chipmaking Factory of the World Is Battling Covid and the Climate Crisis.” CNN Business, June 11, 2021.



<https://keyt.com/news/money-and-business/2021/06/10/the-chipmaking-factory-of-the-world-is-battling-covid-and-the-climate-crisis/>.

China Power Team. “Is China a Global Leader in Research and Development?” ChinaPower Project, January 28, 2021.

<https://chinapower.csis.org/china-research-and-development-rnd/#easy-footnote-bottom-1-3458>.

China Power Team. “Is China Leading in Global Innovation?” ChinaPower Project, January 28, 2021. <https://chinapower.csis.org/china-innovation-global-leader/>.

Choudhury, Saheli Roy. “Tough Road Ahead for U.S. Firms Trying to Cut Reliance on Taiwan Chipmakers.” CNBC. CNBC, April 13, 2021.

<https://www.cnbc.com/2021/04/13/semiconductor-shortage-us-tech-companies-and-their-reliance-on-taiwan.html>.

Clinton, Hillary. “America's Pacific Century.” Foreign Policy, October 11, 2011.

<https://foreignpolicy.com/2011/10/11/americas-pacific-century/>.

CNA Staff Writer. “TSMC Mulls US Packaging Plant.” Taipei Times, June 13, 2021.

<https://www.taipeitimes.com/News/biz/archives/2021/06/14/2003759116>.

Countries That Recognize Taiwan 2021, 2021.

<https://worldpopulationreview.com/country-rankings/countries-that-recognize-taiwan>.

De La Garza, Alejandro. “The Nazi Science That Fed the Apollo 11 Moon Landing.” Time.

Time, July 18, 2019. <https://time.com/5627637/nasa-nazi-von-braun/>.

Dillet, Romain. “France Wants to Become an Artificial Intelligence Hub.” TechCrunch.

TechCrunch, March 29, 2018.

<https://techcrunch.com/2018/03/29/france-wants-to-become-an-artificial-intelligence-hub/>.

Dinerman, Taylor. “NASA and Soft Power, Again.” *The Space Review: NASA and soft power*, again, June 15, 2009. <http://www.thespacereview.com/article/1396/1>.

Executive Order No. 13,859, 84 C.F.R. 3967 (2019).

Farley, Robert. “With Focus on China, US Senate Passes Major Industrial Policy Bill .” *The Diplomat*, June 12, 2021. <https://thediplomat.com/2021/06/with-focus-on-china-us-senate-passes-major-industrial-policy-bill/>.

Fearon, James D. “Domestic Politics, Foreign Policy, and Theories of International Relations.” *Annual Review of Political Science* 1, no. 1 (1998): 289–313. <https://doi.org/10.1146/annurev.polisci.1.1.289>.

Foot, Rosemary, and Amy King. “Assessing the Deterioration in China–U.S. Relations: U.S. Governmental Perspectives on the Economic-Security Nexus.” *China International Strategy Review* 1, no. 1 (2019): 39–50. <https://doi.org/10.1007/s42533-019-00005-y>.

FP Analytics. “Semiconductors and the U.S.-China Innovation Race.” *Foreign Policy*. Foreign Policy, February 16, 2021. <https://foreignpolicy.com/2021/02/16/semiconductors-us-china-taiwan-technology-innovation-competition/#:~:text=For%20decades%2C%20the%20U.S.%20has,of%20revenue%20as%20of%202020.&text=China%20is%20a%20net%20importer,enable%20most%20of%20its%20technology>.

- Frey, Carl Benedikt, and Michael A. Osborne. "The Future of Employment: How Susceptible Are Jobs to Computerisation?" *Technological Forecasting and Social Change* 114 (2017): 254–80. <https://doi.org/10.1016/j.techfore.2016.08.019>.
- Funnell, Antony. "Before There Was a Plan to Land on the Moon, There Was a Plan to Nuke It." ABC News. ABC News, July 15, 2019. <https://www.abc.net.au/news/2019-07-17/moon-us-plans-cold-war-russia-sputnik/11220340>.
- Galston, William A. "Is Seeing Still Believing? The Deepfake Challenge to Truth in Politics." Brookings. Brookings, January 8, 2020. <https://www.brookings.edu/research/is-seeing-still-believing-the-deepfake-challenge-to-truth-in-politics/>.
- Gosda, Randy. "EU Proposes Legal Framework for Artificial Intelligence." American Chamber of Commerce in Sweden. American Chamber of Commerce in Sweden, April 23, 2021. <https://www.amcham.se/newsarchive/2021/4/23/eu-proposes-legal-framework-for-artificial-intelligence>.
- Green, Michael J. "What Is the U.S. 'One China' Policy, and Why Does It Matter?" What Is the U.S. "One China" Policy, and Why Does it Matter? | Center for Strategic and International Studies, May 25, 2021. <https://www.csis.org/analysis/what-us-one-china-policy-and-why-does-it-matter>.
- Gurtu, Anurag. "Council Post: Five Industries Reaping The Benefits Of Artificial Intelligence." Forbes. Forbes Magazine, June 2, 2021. <https://www.forbes.com/sites/forbestechcouncil/2021/06/02/five-industries-reaping-the-benefits-of-artificial-intelligence/>.

Harwell, Drew. "Defense Department Pledges Billions toward Artificial Intelligence Research."

The Washington Post. WP Company, September 8, 2018.

<https://www.washingtonpost.com/technology/2018/09/07/defense-department-pledges-billions-toward-artificial-intelligence-research/>.

Henderson, Sarah. "NIST Requests Information on Artificial Intelligence Technical Standards and Tools." NIST, May 8, 2019.

<https://www.nist.gov/news-events/news/2019/05/nist-requests-information-artificial-intelligence-technical-standards-and>.

Hickert, Cameron. "Space Rivals: Power and Strategy in the China-India Space Race."

Schwarzman Scholars, August 14, 2017.

<https://www.schwarzmanscholars.org/events-and-news/space-rivals-power-strategy-china-india-space-race/>.

Husain, Amir. *The Sentient Machine: The Coming Age of Artificial Intelligence*. New York, NY: Scribner, 2018.

Joint Communiqué of the People's Republic of China and the United States of America ( August 17, 1982). Accessed March 14, 2021.

<http://www.china-embassy.org/eng/zmgx/doc/ctc/t946664.htm>.

Joint Communiqué of the United States of America and the People's Republic of China (Shanghai Communiqué). Accessed March 14, 2021.

<http://www.china.org.cn/english/china-us/26012.htm>.

jr, Nye Joseph S. *Soft Power The Means to Success in World Politics*. New York, NY: Public Affairs, 2004.

Kahn, Jeremy. “Law Firms Are Building A.I. Expertise as Regulation Looms.” *Fortune*. Fortune, May 25, 2021.

<https://fortune.com/2021/05/11/law-firms-are-building-a-i-expertise-as-regulation-looms>.

Keynes, John Maynard. *Economic Possibilities for our Grandchildren* by John Maynard Keynes 1930. Accessed February 23, 2021.

<https://www.marxists.org/reference/subject/economics/keynes/1930/our-grandchildren.htm>.

Khan, Jeremy. “The Sun Is Setting on A.I.'s Wild West.” *CompTIA Technology Interest Groups*, April 28, 2021. <https://tig.comptia.org/t/y4hfmc8/the-sun-is-setting-on-a-i-s-wild-west>.

Khaveen Investments. “Taiwan Semiconductor Stock: Further Market Share Gains (NYSE:TSM).” *SeekingAlpha*, June 3, 2021.

<https://seekingalpha.com/article/4432785-tsmc-expanding-foundry-market-leadership>.

Kheel, Rebecca. “Concerns Grow over China's Taiwan Plans.” *TheHill*. The Hill, June 12, 2021.

<https://thehill.com/policy/defense/558103-concerns-grow-over-chinas-taiwan-plans>.

Kissinger, Henry A. “How the Enlightenment Ends.” *The Atlantic*. Atlantic Media Company, August 30, 2019.

<https://www.theatlantic.com/magazine/archive/2018/06/henry-kissinger-ai-could-mean-the-end-of-human-history/559124/>.

Knight, Will. “The West Should Stop Worrying about China's AI Revolution.” *MIT Technology Review*. MIT Technology Review, October 20, 2017.

<https://www.technologyreview.com/s/609038/chinas-ai-awakening/>.

Knutson, Jacob. “China Flies at Least 20 War Planes in Taiwan Airspace.” *Axios*, March 26, 2021.

<https://www.axios.com/china-incursion-war-planes-taiwan-airspace-3d5994f1-71d1-41f7-a4c8-f825d6043262.html>.

Kokalitcheva, Kia. “Startups and VCs Refocus Autonomous Vehicle Efforts.” Axios, June 12, 2021.

<https://www.axios.com/startups-vcs-autonomous-vehicle-efforts-60c48505-2b73-4c99-9694-c893efbe5cc6.html>.

Kokonos, Lance, and Ian Ona Johnson. “The Forgotten Rocketeers: German Scientists in the Soviet Union, 1945–1959.” War on the Rocks, October 29, 2019.

<https://warontherocks.com/2019/10/the-forgotten-rocketeers-german-scientists-in-the-soviet-union-1945-1959/>.

Kolbe, Kerry. “Space Race Timeline: A Battle beyond Earth.” The Telegraph. Telegraph Media Group, February 3, 2017.

<https://www.telegraph.co.uk/films/hidden-figures/space-race-events-timeline/>.

Krige, John. “NASA as an Instrument of U.S. Foreign Policy.” Essay. In Societal Impact of Spaceflight, 207–18. Washington D.C.: US National Aeronautics & Space Admin, 2009.

Lee, Kai-Fu, and Paul Triolo. “China's Artificial Intelligence Revolution: Understanding Beijing's Structural Advantages.” Eurasia Group, December 2017.

[https://www.eurasiagroup.net/files/upload/China\\_Embraces\\_AI.pdf](https://www.eurasiagroup.net/files/upload/China_Embraces_AI.pdf).

Lee, Kai-Fu. AI Superpowers: China, Silicon Valley, and the New World Order. New York, NY: Mariner Books, 2019.

Li, Lauly, and Cheng Ting-Fang. “Taiwan Tech Firms Fear Fallout after US Raises Supply Chain Alarm.” Nikkei Asia. Nikkei Asia, June 15, 2021.

<https://asia.nikkei.com/Business/Tech/Semiconductors/Taiwan-tech-firms-fear-fallout-after-US-raises-supply-chain-alarm>.

Lindroos, Marcus. The Soviet Manned Lunar Program, 2000.

[https://fas.org/spp/eprint/lindroos\\_moon1.htm](https://fas.org/spp/eprint/lindroos_moon1.htm).

MacCarthy, Mark, and Kenneth Propp. “Machines Learn That Brussels Writes the Rules: The EU's New AI Regulation.” Brookings. Brookings, May 4, 2021.

<https://www.brookings.edu/blog/techtank/2021/05/04/machines-learn-that-brussels-writes-the-rules-the-eus-new-ai-regulation/>.

Malloy, Daniel. “Can the US Win the AI Race with China?” Atlantic Council, April 30, 2021.

<https://www.atlanticcouncil.org/blogs/new-atlanticist/can-the-us-win-the-ai-race-with-china/>.

Manyika, James, Susan Lund, Michael Chui, Jacques Bughin, Jonathan Woetzel, Parul Batra, Ryan Ko, and Saurabh Sanghvi. “Jobs Lost, Jobs Gained: What the Future of Work Will Mean for Jobs, Skills, and Wages.” McKinsey & Company. McKinsey & Company, May 11, 2019.

<https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will-mean-for-jobs-skills-and-wages>.

McDonell, Stephen. “Taiwan: 'Record Number' of China Jets Enter Air Zone.” BBC News. BBC, April 13, 2021. <https://www.bbc.com/news/world-asia-56728072>.

McGee, Patrick. “Germany's Cyber Valley Aims to Become Leading AI Hub.” Financial Times. Financial Times, November 23, 2017.

<https://www.ft.com/content/1d0b2770-7226-11e7-93ff-99f383b09ff9>.



McLaughlin, Michael, and Daniel Castro. Who Is Winning the AI Race: China, the EU, or the United States? - 2021 Update. Information Technology and Innovation Foundation, January 25, 2021.

<https://itif.org/publications/2021/01/25/who-winning-ai-race-china-eu-or-united-states-2021-update>.

Møller, Michael. "Secretary-General's Message to Meeting of the Group of Governmental Experts on Emerging Technologies in the Area of Lethal Autonomous Weapons Systems Secretary-General." United Nations. United Nations, March 25, 2019.

<https://www.un.org/sg/en/content/sg/statement/2019-03-25/secretary-generals-message-meeting-of-the-group-of-governmental-experts-emerging-technologies-the-area-of-lethal-autonomous-weapons-systems>.

Mozur, Paul. "Beijing Wants A.I. to Be Made in China by 2030." The New York Times. The New York Times, July 20, 2017.

<https://www.nytimes.com/2017/07/20/business/china-artificial-intelligence.html>.

Muir-Harmony, Teasel. "The Space Race and American Foreign Relations." Oxford Research Encyclopedia of American History, 2017.

<https://doi.org/10.1093/acrefore/9780199329175.013.274>.

National Science and Technology Council. "Executive Office of the President of the United States, Networking and Information Technology Research and Development Program.

The Networking & Information Technology Research & Development Program

Supplement To The President's FY2020 Budget, The Networking & Information

Technology Research & Development Program Supplement To The President's FY2020

Budget1–52," September 2019.

<https://web.archive.org/web/20201125132608/https://www.whitehouse.gov/wp-content/uploads/2019/09/FY2020-NITRD-AI-RD-Budget-September-2019.pdf>.

Ni, Vincent. “Cold War or Uneasy Peace: Does Defining US-China Competition Matter?” The Guardian. Guardian News and Media, June 11, 2021.

<https://www.theguardian.com/world/2021/jun/11/cold-war-or-uneasy-peace-does-defining-us-china-competition-matter>.

NIST Requests Information on Artificial Intelligence Technical Standards and Tools. (2019, May 8). Accessed June 23, 2020.

<https://www.nist.gov/news-events/news/2019/05/nist-requests-information-artificial-intelligence-technical-standards-and>.

Nowack, Jason. “Automated Solutions for Automotive Manufacturing & Distribution.”

Automotive Industry Solutions | Bastian Solutions, April 20, 2016.

<https://www.bastiansolutions.com/blog/index.php/2015/09/17/industrial-robotics-automotive-industry/>.

Owens, Simon. “Sponsored Content: Is Current U.S. Tech Policy Ready for AI?” Politico, October 25, 2018.

<http://www.politico.com/sponsor-content/2018/10/becoming-a-leader-in-ai?cid=201810f>.

Palmer, James. “A New Era of U.S.-China Competition Begins.” Foreign Policy, May 19, 2021.

<https://foreignpolicy.com/2021/05/19/china-us-competition-technology-endless-frontier-new-cold-war/>.

Pham, Sherisse. “China Is Trying to Kick Its Dependence on Foreign Computer Chips.”

CNNMoney. Cable News Network, June 8, 2018.

<https://money.cnn.com/2018/06/08/technology/china-computer-chips-foreign-reliance/index.html>.

Pham, Sherisse. "Taiwan Could Become the next Flashpoint in the Global Tech War." CNN.

Cable News Network, August 1, 2020.

<https://www.cnn.com/2020/07/31/tech/tsmc-intel-semiconductors-hnk-intl/index.html>.

Preen, Mark. "China's Reforms and Opening-Up: Future Prospects." China Briefing News, April 3, 2019.

<https://www.china-briefing.com/news/economic-reform-china-opening-up-future-prospects/>.

ReThink Robotics. "Cobots Guide." CobotsGuide, March 1, 2018.

<https://cobotsguide.com/2016/06/rethink-robotics-baxter/>.

Ripsman, Norrin M. "Neoclassical Realism." Oxford Research Encyclopedia of International Studies, 2011. <https://doi.org/10.1093/acrefore/9780190846626.013.36>.

Shead, Sam. "Why Intel and TSMC Are Building Water-Dependent Chip Factories in One of the Driest U.S. States." CNBC. CNBC, June 4, 2021.

<https://www.cnbc.com/2021/06/04/why-intel-tsmc-are-building-water-dependent-chip-plants-in-arizona.html>.

Strong, Matthew. "Taiwan's TSMC Claims Breakthrough on 1nm Chips." Taiwan News. Taiwan News, May 19, 2021. <https://www.taiwannews.com.tw/en/news/4206524>.

Taiwan Semiconductor Manufacturing Company. "Company Info." Taiwan Semiconductor Manufacturing Company Limited. Taiwan Semiconductor Manufacturing Company, September 3, 2020. [https://www.tsmc.com/english/aboutTSMC/company\\_profile](https://www.tsmc.com/english/aboutTSMC/company_profile).

Talton, Jon. “China and America Are Stuck in a Dangerous Standoff.” The Seattle Times. The Seattle Times Company, June 11, 2021.

<https://www.seattletimes.com/business/china-and-america-are-stuck-in-a-dangerous-standoff/>.

Teitel, Amy Shira. “Wernher Von Braun: History's Most Controversial Figure?” Germany | Al Jazeera. Al Jazeera, May 3, 2013.

<https://www.aljazeera.com/opinions/2013/5/3/wernher-von-braun-historys-most-controversial-figure/>.

Ting-Fang, Cheng. “TSMC Considering First Chip Packaging Plant in US.” Nikkei Asia. Nikkei Asia, June 11, 2021.

<https://asia.nikkei.com/Business/Tech/Semiconductors/TSMC-considering-first-chip-packaging-plant-in-US>.

Tran, Hung. “Is the US-China Strategic Competition a Cold War?” Atlantic Council, April 21, 2021.

<https://www.atlanticcouncil.org/blogs/new-atlanticist/is-the-us-china-strategic-competition-a-cold-war/>.

Triolo, Paul, Elsa Kania, and Graham Webster. “Translation: Chinese Government Outlines AI Ambitions through 2020.” New America, January 26, 2018.

<https://www.newamerica.org/cybersecurity-initiative/digichina/blog/translation-chinese-government-outlines-ai-ambitions-through-2020/>.

Vincent, James. “Google Is Using AI to Design Its Next Generation of AI Chips More Quickly than Humans Can.” The Verge. The Verge, June 10, 2021.

<https://www.theverge.com/2021/6/10/22527476/google-machine-learning-chip-design-tpu-floorplanning>.

Wohlforth, William C. “Realism.” Oxford Handbooks Online, 2008.

<https://doi.org/10.1093/oxfordhb/9780199219322.003.0007>.

Wu, Huizhing. “China Sends Record 28 Fighter Jets toward Taiwan.” ABC News. ABC News Network, June 15, 2021.

<https://abcnews.go.com/International/wireStory/china-sends-record-28-fighter-jets-taiwan-78288190>.

Xuetong, Yan. “From Keeping a Low Profile to Striving for Achievement.” The Chinese Journal of International Politics 7, no. 2 (2014): 153–84.

<https://doi.org/https://doi.org/10.1093/cjip/pou027>.

Yu, Cheng. “China Calls for AI Alliance.” China calls for AI alliance - Business - Chinadaily.com.cn, October 13, 2017.

[http://www.chinadaily.com.cn/business/2017-10/13/content\\_33216440.htm](http://www.chinadaily.com.cn/business/2017-10/13/content_33216440.htm).

Zhou, Cissy. “US Turning to Aggressive 'Industrial Policy' to Counter Beijing, Experts Say.” South China Morning Post, June 9, 2021.

<https://www.scmp.com/economy/global-economy/article/3136617/us-china-relations-bide-us-trade-strike-force-sees-us-turn>.