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Comparison of International AI Strategies



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[Abstract] The development of artificial intelligence (AI) is entering a new stage where it is integrated with various economic and social sectors faster, enables industrial upgrading, facilitates economic transition and drives social progress. The Chinese government issued the *Next Generation Artificial Intelligence Development Plan and Three-Year Action Plan for Promoting Development of a New Generation Artificial Intelligence Industry (2018-2020)* in 2017, which made AI a key strategic emerging industry in China. The United States (US), the European Union (EU), Japan and Russia have also released strategic reports and documents to develop AI in the last few years. Based on the latest AI strategic reports of the US, the EU, Japan, Russia and China, this paper compares the common ground and differences of these countries or actors in respect of AI strategy and policy from the perspectives of strategic highlights, development principles and measures, and thereby proposes the possibilities of cooperation in AI industries and security governance.

[Key words] AI, AI strategy, international governance, international initiatives

In 1950, British scientist Alan Turing proposed the concept of “Turing Test” in his paper *Computing Machinery and Intelligence*. Specifically, the test assumes that if a human examiner cannot tell whether the test subject is

human or not by asking various questions, the machine is to be considered intelligent. Afterwards, the first AI workshop Dartmouth Summer Research Project on Artificial Intelligence was held in New Hampshire, US in 1956, through which AI was officially founded as a discipline in the scientific community.¹

The research on AI has set a course for fast growth since the first AI workshop was held in the 1960s. Although the academia is yet to come up with a specific definition of the emerging domain, academic forerunners have already launched discussions and research on the ideas proposed in the workshop. The Massachusetts Institute of Technology (MIT) and International Business Machines Corporation (IBM), among other research organizations put together AI research centers in no time. The US government also provided support and funds to AI research. In 1963, the MIT Computer Science and Artificial Intelligence Lab (CSAIL) was awarded a research grant worth USD 2.2 million by the Defense Advanced Research Projects Agency (DARPA). The grant was to ensure that the US beats its former rival the Soviet Union in technological advances, and, as it turned out, the grant practically sped up AI research. The 1970s marked a decade of highly productive AI research. For instance, new AI technologies including expert systems for forecasting and machine vision systems were developed and ready for application in various fields through experiments. AI developed even faster and achieved a greater level of commercialization in the following decade. In 1986, the sales value of AI-related hardware and software in the US totaled up to USD 425 million. GE Digital, General Motors (GM) and Boeing began using AI expert systems (ES) massively.

1 Fu Ying, "Preliminary Analysis of AI's Influence on International Relations", *Quarterly Journal of International Politics*, Vol.4. (1) 2019, p.2, <http://www.imir.tsinghua.edu.cn/publish/iis/7238/20190123180702719613866/1554792786844.pdf>.

In the meantime, a large group of AI research and manufacturing firms, such as Teknowledge and IntelliCorp emerged in response to the growing commercial demands. From the 1990s onwards, AI has been influencing the human society in every way and dealing closely with more and more fields of production and daily life. It almost equals to or outshines human brains in a few specialized sectors. As a ubiquitous technology promising the potential to change the human society, AI is extensively discussed in scientific, technological, industrial, military, social and ethical fields.²

AI has come to play an increasingly prominent role in international competition and cooperation. Since 2017, countries and actors leading the development of AI, including the US, China, the EU, Japan and Russia have released reports and documents of AI industrial strategy or ethical standards. This paper seeks to analyze the latest AI strategic reports issued by these countries and regions, examine their industrial strategies and governance rules for AI technology, compare their common ground and differences, and propose policy suggestions for international governance cooperation accordingly.

I. US: Maintaining American Leadership in AI

Since AI was officially founded as a discipline in the scientific community more than 60 years ago, the US has been a global leader in the development, innovation and investment in it. However, the nation has been reducing innovative upfront investments in different technological sectors, including AI technology on a yearly basis since the 21st century.

² Fu Ying, "A Preliminary Analysis of AI's Influence on International Relations", *Quarterly Journal of International Politics*, Vol.4. (1) 2019, p.2, <http://www.imir.tsinghua.edu.cn/publish/iis/7238/20190123180702719613866/1554792786844.pdf>.

Following the financial crisis in 2008, the US government, relevant enterprises and institutions have cut their investments in AI and other emerging technologies gradually due to the impact of the crisis, triggering sluggish development trends. In the meantime, many countries and actors including the EU, Japan, Russia and China, a leading player in the field, have been stepping up the development of AI since the 2000s.

From where the US stands, China has become its main rival in AI development, because China's AI technology has been developing exponentially in recent years, gradually shifting from a laggard to an equal, and eventually a leader in a few technological sectors. With regard to investment, according to a research report released on February 12, 2019 by CB Insights, a venture capital investment research institute, "Chinese AI startups took 48% of all AI funding dollars that year (2017), surpassing the US for the first time."³ In light of the academic research, the Trump administration's budget for federal research and development (R&D) funding in 2018 was 15% less than that of 2017, and China already surpassed the US in published AI papers that year⁴. As to the military domain, Lieutenant General John "Jack" N.T. Shanahan, Director of the Department of Defense Joint Artificial Intelligence Center and Chief Information Officer, pointed out in a hearing before the Senate Armed Services Committee Subcommittee on Emerging Threats and Capabilities: "other nations, particularly strategic competitors such as China and Russia, are making significant investments in AI for military purposes. These investments threaten to erode our technological and operational advantages

3 CB Insights, "China Is Starting To Edge Out The US In AI Investment", February 12, 2019, <https://www.cbinsights.com/research/china-artificial-intelligence-investment-startups-tech/>.

4 Carissa Schoenick, "China to Overtake US in AI Research, AI2, March 13, 2019, <https://medium.com/ai2-blog/china-to-overtake-us-in-ai-research-8b6b1fe30595>.

and destabilize the free and open international order. The Department of Defense, together with our allies and partners, must adopt AI to maintain its strategic position, prevail on future battlefields, and safeguard this order.”⁵

The Trump administration has introduced measures to counter its rivals which are narrowing the divide by the day. On February 11, 2019, US President Donald Trump signed the *Executive Order on Maintaining American Leadership in Artificial Intelligence* (hereinafter referred to as the *Executive Order*), which pledges to drive the economic growth of the US and enhance the nation’s economic and national security. The *Executive Order* lists ten sections of the nation’s current AI strategies, namely: policy and principles, objectives, roles and responsibilities, Federal investment in AI research and development, data and allocation of computing resources for AI research and development, guidance for regulation of AI applications, AI and the American workforce, action plan for protecting American advantages in AI technologies, definitions and general provisions.⁶

1. Positioning—Maintaining American Leadership in AI

According to the *Executive Order*, “continued American leadership in AI is of paramount importance to maintaining the economic and national security of the United States and to shaping the global evolution of AI in a manner consistent with our Nation’s values, policies, and priorities. The Federal Government plays an important role in facilitating AI R&D,

5 United States Committee on Armed Services, “Artificial Intelligence Initiatives”, March. 12, 2019, https://www.armed-services.senate.gov/imo/media/doc/Shanahan_03-12-19.pdf.

6 White House, “Executive Order on Maintaining American Leadership in Artificial Intelligence”, Feb. 11, 2019, <https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence>.

promoting the trust of the American people in the development and deployment of AI-related technologies, training a workforce capable of using AI in their occupations, and protecting the American AI technology base from attempted acquisition by strategic competitors and adversarial nations.”⁷

2. Priority Areas—Six Leading Strategic areas

The *Executive Order* emphasizes that AI will affect the missions of nearly all executive departments and agencies, and federal implementing agencies should pursue six strategic objectives to promote and protect American advancements in AI.

First, to carry out multilateral comprehensive cooperation. Governments, private enterprises and labs should strengthen international multilateral cooperation in AI to examine the strategy deployment of other nations, clearly understand their core technologies and thereby accurately define the position of the US.

Second, to keep state secrets. While expediting AI development, the Federal Government should lead relevant agencies to enhance the quality of data, strengthen security measures and improve confidentiality mechanism.

Third, to comprehensively speed up innovative efforts. Federal governments at all levels should provide effective policies to enable full-fledged support for AI innovations across all fields and reduce policy barriers to innovative AI applications.

Fourth, to develop international AI standards. The Federal Government should actively build robust international AI standards and set up a security-based mechanism featuring public trust and confidence in AI.

⁷ Ibid.

Fifth, to fully promote AI-related educational outreach. The Federal Government should encourage private enterprises, universities, labs and other relevant institutions to promote AI-related education.

Sixth, to spare no effort to maintain the nation's leadership in AI so as to protect national security and retain advantages over its strategic competitors. The Federal Government should conduct accurate surveys on all fields and effectively allocate different kinds of resources to protect the nation's advantage in AI across all sectors and national security interests against strategic competitors and foreign adversaries.⁸

The priorities mentioned in the six strategic objectives of the *Executive Order* map out the pathway of US domestic and international AI development, which is characterized by development and competition.

3. Implementation Tools—Comprehensive AI Development Driven by Enterprises, Universities and Labs

According to the *Executive Order*, the Federal Government has basically determined to push through a comprehensive AI development guideline, taking government regulation as the core and enterprises, universities and labs as the main driving forces.

A. Government Regulation at the Core

First of all, by coordinating with the National Science and Technology Council (NSTC) Select Committee on Artificial Intelligence (Select Committee), the Federal Government should actively conduct basic AI R&D, and deploy applications of AI technologies, provide educational

⁸ White House, “Executive Order on Maintaining American Leadership in Artificial Intelligence”, Feb. 11, 2019, <https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence>.

grants, and formulate regulations of guidance for AI.

Second, the Federal Government requests heads of all agencies to review their federal data to identify opportunities to increase access and use by the greater non-Federal AI research community in a manner that benefits that community, while protecting privacy and confidentiality. The Secretaries of Defense, Commerce, Health and Human Services, and Energy, the Administrator of the National Aeronautics and Space Administration, and the Director of the National Science Foundation should, to the extent appropriate and consistent with applicable law, prioritize the allocation of high-performance computing resources for AI-related applications through the discretionary allocation of resources and resource reserves.

Third, the Federal Government requests that the Office of Management and Budget (OMB), the Office of Science and Technology Policy (OSTP), the Domestic Policy Council, and the National Economic Council should lead to issue a memorandum on the regulation of AI applications in consultation with relevant agencies. The memorandum should inform the development of regulatory and non-regulatory approaches by such agencies regarding technologies and industrial sectors that are either empowered or enabled by AI, and consider ways to promote innovation and reduce barriers to the use of AI technologies.

Fourth, “the Assistant to the President for National Security Affairs, in coordination with the OSTP Director, shall organize the development of an action plan to protect the United States advantage in AI and AI technology critical to United States economic and national security interests against strategic competitors and adversarial nations.”⁹

9 White House, “Executive Order on Maintaining American Leadership in Artificial Intelligence”, Feb. 11, 2019, <https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence>.

The above four requests raised by the Federal Government in the *Executive Order* for governments at all levels and different sectors give rise to a concrete development pattern centered on government regulation.

B. Enterprises, Universities and Labs as the Main Driving Forces

First, the Federal Government urges relevant agencies, including enterprises, universities and labs to consider AI R&D as an investment priority, prioritize AI R&D and innovation, budget an amount for AI R&D in accordance with relevant standards, and keep close ties with the Federal Government. To the extent appropriate and consistent with applicable law, heads of AI R&D agencies should explore opportunities for collaboration with non-Federal entities.

Second, the Federal Government urges relevant agencies, including enterprises, universities and labs to provide educational grants to all AI sectors, and urges heads of these implementing agencies, to the extent consistent with applicable law, to consider AI as a priority area within existing federal fellowship and service programs, covering education, training and the direct commissioning programs of the United States Armed Forces.¹⁰

These two requests proposed by the Federal Government in the *Executive Order* to enterprises, universities and labs with respect to investment and development foster a comprehensive AI development pattern where these entities are to implement the executive order.

4. Domestic Differences

In the US, people are not on the same page regarding AI strategy, most notably regarding whether international cooperation on AI should be

¹⁰ Ibid.

allowed. In this regard, the US primarily splits into two camps. For one thing, the hawks led by the Trump administration, senators and representatives refuse international cooperation. In *The 5G Ecosystem: Risks & Opportunities for DoD* released on April 3, 2019, the US Department of Defense (DoD) said that “DoD should advocate for aggressive protection of U.S. technology intellectual property rights (IPR) in an effort to slow down China’s telecommunications ecosystem expansion.”, and argued that “DoD should also encourage CFIUS to block transactions of companies with a history of selling products with documented backdoors and security vulnerabilities.”¹¹ These two recommendations arguably targeted Chinese AI-related enterprises, such as Huawei, and emphasized the need to draw the line between two sides. For another, the doves consist of Google, Intel, Microsoft and other enterprises and experts who support rational cooperation on AI. As far as they can tell, it is ill-advised to launch an “arms race” of AI R&D between China and the US, and conversely, they consider cooperation as the solution to win-win development. For instance, the Microsoft Research Asia (MSRA) established in Beijing, China more than two decades ago is the company’s largest research institute outside its headquarters in the US, and plays a pivotal role in forging China’s AI ecological system. Meanwhile, the company is also improving its AI technology through China’s large user group via its projects, such as the immensely popular chatbot. In addition, Google spokesman Chris Brummitt disclosed that Huawei and Google built the Track AI system together, and a creative team that worked with

11 DEFENSE INNOVATION BOARD, *THE 5G ECOSYSTEM: RISKS & OPPORTUNITIES FOR DoD*, April. 3, 2019, https://media.defense.gov/2019/Apr/03/2002109302/-1/-1/0/DIB_5G_STUDY_04.03.19.PDF.

Google's advertising clients also provided marketing help to Huawei.¹²

II. EU: Developing AI Rules to Shake off Backwardness

AI is not new to Europe. Home to a favorable academic environment, Europe led the way in AI R&D since the technology emerged in the 1950s. Alan Turing, father of modern computer science who coined the concept of "Turing Test" came from the United Kingdom (UK), and once worked in the University of Cambridge for a long time. When it comes to research institutes, the German Research Center for Artificial Intelligence (DFKI) founded in 1988 is the nation's best research institute of its kind as well as the world's largest non-profit AI research institute, funded by top high-tech enterprises, including Google, Intel, Microsoft, BMW, SAP and Airbus.

However, it appears now that Europe has not got a head start in the new era of AI development. In the short run, it still faces a great deal of difficulties in claiming a principal role in AI development due to the lack of a complete AI industrial system. Three reasons may account for the situation. First of all, the number of AI startups across EU member states is far less than that of countries with the most sophisticated AI technology in the world, namely China and the US. Secondly, EU is a laggard compared with these two countries with regard to the quantity and quality of AI-related academic research results and investments in AI. Thirdly, owing to obsolete policies, EU faces severe brain drain and the large-scale acquisition of local high-tech enterprises. These three reasons invariably

¹² "Trade war didn't stop Google, Huawei AI tie-up", The Economic Times, April. 2, 2019, <https://economictimes.indiatimes.com/tech/internet/trade-war-didnt-stop-google-huawei-ai-tie-up/articleshow/68680797.cms>.

result from insensitivity of governments to AI industries across the EU and the absence of AI strategies and policies. In order to catch up with the state-of-art - AI technology, the European Commission (hereinafter referred to as the Commission) introduced *Artificial Intelligence* on April 8, 2019 to comprehensively advance the development of AI industries in the EU.¹³

1. Positioning—Focusing on the Development of International Rules and Standards Based on Complementarity

As *Artificial Intelligence* reads, the EU not only seeks to catch up with the most developed players in the field with regard to AI technology and development, but also highlights potential privacy and security risks associated with AI and the need to initiate the development of international rules and standards in such underdeveloped fields as AI ethics. It lists seven ethical principles that AI systems in the EU should meet in order to be deemed trustworthy and benefit the people, namely human agency and oversight, technical robustness and safety, privacy and data governance, transparency, diversity, non-discrimination and fairness, societal and environmental well-being and accountability¹⁴ This set of AI ethical principles represents the tentative international rules and standards that the EU seeks to develop.

2. Priority Areas—Building Three Pillars for AI Development: Investment, Transformation and Rules

Artificial Intelligence puts forward a European AI strategy based on three pillars. In the first place, the EU is going to increase investment in AI by encouraging uptake by both public and private sectors. In this way, it will

¹³ European Commission, “Artificial Intelligence”, April 8, 2019, <https://ec.europa.eu/digital-single-market/en/artificial-intelligence>.

¹⁴ Ibid.

substantially increase support for startups and remove barriers to facilitate their development. Secondly, it will step up policy support for AI-related fields, improve AI-related education systems, revamp AI-related institutions and enterprises, attract and keep more AI talents in the EU, prevent high-tech enterprises from leaving the EU and speed up the development of AI. Thirdly, it will ardently engage in the development of international AI rules in an effort to stay at the forefront of international rules and standards, and draw on each other's strength to improve the relatively backward technological development.

3. Implementation Measures—Investing AI Development by Public and Private Sectors

It is emphasized in *Artificial Intelligence* that the EU will encourage uptake by both public and private sectors in pursuing AI development. First of all, it will speed up the development of AI by encouraging solid investment from both public and private sectors. In regard to public investment, the Commission is increasing its annual investments in AI by 70% under the research and innovation program “Horizon 2020”. It will reach EUR 1.5 billion by the end of 2020. With regard to private investment, joining forces from both public and private sectors, the goal is to reach altogether more than EUR 20 billion per year over the next decade.

Second, it will actively deal with the potential socio-economic changes brought about by AI. To that end, the EU will work to support business-education partnerships to attract and keep more AI talents in Europe, set up dedicated training and retraining schemes for professionals, foresee changes in the labor market and skills mismatch, support digital skills and competences in science, technology, engineering, mathematics (STEM), and encourage member states to modernize their education and training systems.

Third, it will establish an appropriate ethical and legal framework. The Commission assumes that new AI applications may raise new ethical and legal questions, related to liability or fairness of decision-making. The General Data Protection Regulation (GDPR) is a major step for building trust and the Commission wants to move a step forward on ensuring legal clarity in AI-based applications. The Commission is scheduled to present *Ethical Guidelines for Trustworthy AI* and issue guidance on the interpretation of the Product Liability Directive in 2019.¹⁵

4. Ethical Standards—People-oriented “Three Laws of Robotics” in Reality

The seven AI ethical principles mentioned above are considered as EU’s “Three Laws of Robotics” in reality¹⁶. They jointly guide the development principles of AI in the EU and contribute constructive opinions of ethical rules and standards to the international development of AI.

The set of seven principles are as follows:

The first principle deals with human agency and oversight: AI systems should not infringe upon human autonomy, and the ability of a human to exercise oversight or conduct interventions in every decision cycle of an AI system must be ensured to establish levels of human discretion.

The second principle deals with technical robustness and safety: AI systems

¹⁵ European Commission, “Artificial Intelligence”, April 8, 2019, <https://ec.europa.eu/digital-single-market/en/artificial-intelligence>.

¹⁶ The “Three Laws of Robotics” are a set of rules devised by the US science fiction author Isaac Asimov. They are as follows: A robot may not injure a human being or, through inaction, allow a human being to come to harm. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

must be secure and reliable, and be developed with a preventative and resilient approach to external risks and in a manner such that they reliably behave as intended.

The third principle deals with privacy and data governance: AI systems must guarantee the security, privacy and access security of all data collected.

The fourth principle deals with transparency: Human beings must have the ability to explain the decisions made by AI systems appropriately and ensure that the data and algorithms used by AI systems are openly available.

The fifth principle deals with diversity, non-discrimination and fairness: It must be ensured that AI systems treat every human being fairly, regardless of his/her anthropological traits, including age, gender and race.

The sixth principle deals with societal and environmental well-being: AI systems must be sustainable and conducive to social transformation.

The seventh principle deals with accountability: AI systems must be auditable and reportable and capable of being independently audited and reporting of potential negative impacts¹⁷

III. Japan: Addressing Social and Cultural Issues and Accelerating the Development

Japan did not enter the field of AI until the 1980s when the first independent research institute Japanese Society for Artificial Intelligence

¹⁷ “Ethics Guidelines for Trustworthy AI-Building trust in human-centric AI”, European Commission, April. 8, 2019, <https://ec.europa.eu/futurium/en/ai-alliance-consultation/guidelines>.

(JSAI) was established in 1986. The nation worked hard to enable AI research during the heyday of the second AI wave by expanding its budget for AI significantly, and captured notable progress, as evidenced by the fifth generation computer and robots working under critical conditions. However, AI was underdeveloped in Japan before the technology is elevated to a key agenda globally in the 21st century, because numerous resources were spent on social governance to tackle problems like the aging of population.

In recent years, the Japanese government has come to realize the nation's sluggish AI development, so it has released a series of plans to boost AI technology. Unfortunately, these plans suffer setbacks because the nation has overlooked AI development over the years and is thus severely underdeveloped in this field. There are three main causes. First of all, Japan's venture capital is much less vibrant than its international rivals. In 2016, venture capital in Japan totaled 300 billion yen, two times more than the previous year. Even so, the capital pool was just 5% of the US and 10% of China. Second, Japanese enterprises are too rigid to pursue adventurous entrepreneurship. In other words, they would oftentimes measure any investment by short-term returns.¹⁸ Third, Japan's social environment fails to offer incentives to stimulate the growth of AI industries. Despite the generous policy support endorsed by a wide array of rejuvenation plans issued by the Japanese government, long-term material abundance and the aging of population have severely dampened and paralyzed public acceptance and identification with emerging technologies. Meanwhile, private consumption has remained feeble for years, so it cannot effectively stimulate growth. Riding the trends, the Japanese government issued the

18 "Third AI Wave: Japan Spares no Effort to Catch up", Yicai, September. 16, 2018, <https://baijiahao.baidu.com/s?id=1611774098388586617&wfr=spider&for=pc>.

Artificial Intelligence Technology Strategy (hereinafter referred to as the *Strategy*) on March 31, 2017.

1. Positioning – Driving AI development by Governmental Policies

Compared with the US and China, Japan is slow in AI development primarily due to its conservative social culture and environment. Japan's government has implemented a set of plans to promote AI development, however, the outcome has been less than satisfactory. According to the *Strategy*, the Japanese government will, based on previous plans, focus on optimization, details and policies to change the country's disadvantaged status in AI development. In the meantime, the *Strategy* and other relevant official documents point out that Japan will try to set international rules and standards on AI to increase Japan's international influence in the field of AI.¹⁹

2. Priority Areas – Taking Initiative to Set International Laws on Lethal Autonomous Weapons

On the 2019 United Nations Group of Governmental Experts (GGE) meeting on Lethal Autonomous Weapons Systems (LAWS), Japan submitted a working paper which proposes to develop AI-centered international law on LAWS. The working paper aims to set a direction of possible legislative actions of the international community in the future and identify the main elements that require common understanding among stakeholders. The working paper emphasizes that “regarding the definition of LAWS, it is necessary to deepen the discussion on the lethality and form of human control...It would be desirable that the international community,

¹⁹ Strategic Council for AI Technology, “Artificial Intelligence Technology Strategy (Report of Strategic Council for AI Technology)”, March 31, 2017, <https://www.nedo.go.jp/content/100865202.pdf>.

including States with advanced technologies, reach consensus on the modality and content of rules concerning lethal fully-autonomous weapons systems without meaningful human control. However, it would be difficult to formulate such an effective legally-binding international framework immediately due to the divergence of views. Japan will cooperate with stakeholders going forward.”²⁰

3. Implementation Measures –Comprehensively Coordinating and Resolving Social Challenges

The *Strategy* lists four parts that would comprise a sound AI technology strategy for Japan. First, it detailed the necessary conditions surrounding AI technology, data, and computing. This section explains the importance of AI technology, data, and computing in Japan’s ambition to master state-of-art technologies both at home and abroad. It also draws an AI development path that is based on policies, fueled by investments and supported by public recognition. Second, it explains the structure and functions of relevant governmental ministries in relation to AI development. It urges each ministry to promote AI development by specifying the allocation of funds and responsibilities to engage both public and private sectors in AI research. Third, it draws an industrialization roadmap projected by the fusion of AI and other related technologies. The section points out that AI development is closely related and also complementary to other existing technologies, therefore Japan should achieve the comprehensive and interactive development between AI technology and other areas. It defines priority areas and lays out development phases. The industrialization roadmap is pivotal for Japan’s future AI development. Fourth, the Strategy

20 GGE meeting, “Possible outcome of 2019 GGE and future actions of international community on LAWS”, 2019, <https://www.mofa.go.jp/mofaj/files/000459707.pdf>.

lays out the approaches related to R&D and the social implementation of AI technology. It points out that “three centers” are pivotal to Japan’s incorporation of AI technology into social implementation. The “three centers” referred to 1) fostering of human resources, 2) maintenance of the development environment of data and tools owned by the industry, academia, and government, and 3) support of start-ups in both public and private sectors.²¹

IV. Russia – Catching Up by Formulating Comprehensive AI Strategy

The history of AI in the former Soviet Union started as early as the 1970s, which primarily focused on autonomous control systems as an important step to institute a massive economic system. On the 7th Soviet Union Control Conference of 1977, experts proposed to use man-machine conversation to solve control issues and use robots and AI to solve problems of industrial production and social efficiency. However, as the former Soviet Union collapsed, it shut down most of the technologies it had developed, including AI, and only left a few technological applications for military enterprises. After the former Soviet Union collapsed, these technologies and knowledge were brought to different parts of the world by its scientists. In the meantime, the Russian government completely blocked European and American Internet-based companies, which made Russia lag behind China, the US, and other major countries in AI development. At present, to stay relevant to the booming global AI development trends,

²¹ Strategic Council for AI Technology, “Artificial Intelligence Technology Strategy (Report of Strategic Council for AI Technology)”, March 31, 2017, <https://www.nedo.go.jp/content/100865202.pdf>.

Russia urgently needs an official AI development strategy.

1. Positioning – Starting AI Development from Scratch

The first thing is to create an "AI infrastructure" – a set of complementary and overlapping relationships between the country's public and private hi-tech sectors that aim to mobilize the community for an AI breakthrough. More broadly, it supports Russian government efforts to give the country a modern digital economy and turn it into a major S&T development power."²²

2. Priority areas – Taking AI Technologies for Military Purposes to the Priority

During the past few years, the Putin government has been supportive of AI development in only a few specific areas, namely military, security, and anti-surveillance. At present, Russia's AI strategy is built on a 2018 ten-point draft plan for national AI development assembled by the Russian Academy of Sciences, the Advanced Research Foundation and the Ministry of Defense. Like the White House's AI development strategy released in February 2019, the Russian draft plan calls for AI-related research and development, support for AI standards, and the creation of a reliable workforce system. However, the draft plan still focuses on serving military demands, such as "aircraft, missiles, electronic warfare, radars, and unmanned systems".²³

22 Samuel Bendett, "Russia Racing to Complete National AI Strategy by June 15", *Defense One*, March 14, 2019, <https://www.defenseone.com/threats/2019/03/russia-racing-complete-national-ai-strategy-june-15/155563/>.

23 Samuel Bendet, "Putin Orders Up a National AI Strategy", *Defense One*, January 31, 2019, <https://www.defenseone.com/technology/2019/01/putin-orders-national-ai-strategy/154555/>.

3. Implementation Measures – Accelerating Integration and Allocation and Releasing An Overarching Strategy As Soon As Possible

At the current stage, Russia’s AI strategy has come into shape, but there still lacks an official AI strategic report or document. To address this matter, Russian President Vladimir Putin handed the Russian government several deadlines to deliver such strategy reports or documents: on July 1, 2019, find ways to stimulate investment in broader areas of technology, including the Internet of Things, robotics, and processing of large data arrays by small and medium-sized businesses; on September 1, 2019, connect all Russian schools to high-speed internet service; on December 31, 2019, open five new scientific and educational centers, and open another ten by the end of 2021.” All in all, a major factor that holds Russia back from achieving all-around AI development is the lack of an overarching official document. On January 15, 2019, Putin ordered the Russian government to deliver a national AI strategy before June 15, 2019.

V. China – Policy-driven AI Development and Governance Strategy

AI has been developing very fast in China since the nation expanded into the field. Currently at a world-class level, it is poised to become a world leader in the field. With respect to AI investment, China has maintained stable and sound growth. According to an analysis report that CB Insights published in February 2019, Chinese AI startups received more funding dollars in the global investment in the AI area, surpassing the US counterparts for the first time. The trend continued in 2018 and the first quarter of 2019, which saw China keeping its leading position in

the world.²⁴ In the academic area, China also achieved remarkable results. Since 2006, China has surpassed the US in the number of published AI-related academic papers. According to projection of AI2 in 2019, “China is poised to overtake the US in the most-cited 50% of papers this year, in the most-cited 10% of papers next year, and in the 1% of most-cited papers by 2025.”²⁵ In terms of national strategy and policy, the Chinese government has also been making every effort to continuously support AI development. In 2017, the government issued two official documents, the *Next Generation Artificial Intelligence Development Plan* (hereinafter referred to as the *Development Plan*) and the *Three-Year Action Plan for Promoting Development of a New Generation Artificial Intelligence Industry (2018-2020)* (hereinafter referred to as the *Action Plan*), which mark that the AI industry has become a national strategy.

1. Positioning – Continuous Strategic Development for All-around Leadership

On July 8, 2017, the State Council issued the *Development Plan*, which, as the guiding document for China to capture the first-mover advantage, specifies the three-step AI development strategy. First, by 2020, overall AI technology and application will reach a globally advanced level. The AI industry will become a new economic growth point. AI applications will become a new approach to improving people’s livelihood and supporting the goal of becoming an innovation-driven country and the building a moderately prosperous society in all respects. Second, by 2025, basic AI

24 CB Insights, “China Is Starting To Edge Out The US In AI Investment”, February 12, 2019, <https://www.cbinsights.com/research/china-artificial-intelligence-investment-startups-tech/>.

25 Carissa Schoenick, “China to Overtake US in AI Research, AI2”, March 13, 2019, <https://medium.com/ai2-blog/china-to-overtake-us-in-ai-research-8b6b1fe30595>.

theory will make groundbreaking progress. Some AI technologies and applications will reach a globally advanced level. AI will become a major driving force for China's industrial upgrading and economic transition. Progress will be made in the building of an intelligent society. Third, by 2030, AI theory, technology, and application will reach a globally advanced level. China will become a key global AI innovation center. Intelligent economy and society will secure marked progress, laying a solid foundation for China to become a leading innovation-driven economy.²⁶

2. Priority areas – International Competition, International Ethics, and International Standards

The *Development Plan* outlines three key phrases, namely international competition, international ethics, and international standards.

First, on international competition, the *Development Plan* points out that China's current national security and international competition face more complex landscape, so it must look at the world, take AI development as part of the national strategy, actively devise AI development plans, grasp firmly the strategic initiative of international competition at the new stage of AI development, create new competitive edges, open up new spaces of development, and effectively protect national security.

Second, on international ethics, the *Development Plan* points out that China should develop appropriate ethical standards and a code of conduct for R&D designers of AI products, strengthen assessments of potential hazards and benefits of AI, and develop solutions to emergencies under complex AI scenarios. It should actively participate in the global governance of

²⁶ State Council, "Circular of the State Council on Printing and Issuing the Plan for Development of the New Generation of Artificial Intelligence", July 20, 2017, http://www.gov.cn/zhengce/content/2017-07/20/content_5211996.htm.

AI, and strengthen the study on major common international issues such as robot alienation and safety supervision. It should deepen international cooperation in AI laws and regulations, international rules and so on to jointly cope with global challenges.

Third, on international standards and rules, the *Development Plan* points out that China should support domestic AI enterprises to cooperate with leading international AI universities, research institutes, and teams. It should encourage domestic AI enterprises to “go global,” and provide services to help capable AI enterprises carry out overseas mergers and acquisitions, equity investment, and venture capital (VC) and establish overseas R&D centers. It should encourage foreign AI enterprises and research institutions to set up R&D centers in China. Relying on the Belt and Road Initiative (BRI), it should promote the construction of international AI scientific and technological cooperation bases and joint research centers to speed up AI application in BRI partner countries. It should promote the establishment of international AI organizations to jointly develop relevant international standards. It should support relevant industry associations, alliances and service agencies to build global service platforms for AI enterprises.²⁷

3. Implementation Measures –All-round Governmental Policy Support for AI Development at All Levels

On December 13, 2017, the Ministry of Industry and Information Technology (MIIT) issued the *Action Plan*. According to the officials of the Department of Science and Technology, MIIT, the *Action Plan*,

²⁷ State Council, “Circular of the State Council on Printing and Issuing the Plan for Development of the New Generation of Artificial Intelligence”, July 20, 2017, http://www.gov.cn/zhengce/content/2017-07/20/content_5211996.htm.

with a view to promoting industrial development, in combination with the strategy of “Made in China 2025”, gives a detailed description and requirements for the tasks listed in the *Development Plan*. Focusing on the in-depth fusion of information technology and manufacturing technology, it aims to push for the industrialization and integrated application of next-generation AI technology, develop advanced intelligent products, enhance core foundations, boost intelligent manufacturing, and improve public infrastructure systems.²⁸ In terms of development directions and areas, following the principle of “systematic layout, key breakthroughs, collaborative innovation, and orderly opening-up,” the *Action Plan* puts forward four major tasks covering 17 products or areas based on in-depth research.

To ensure the effective implementation of all development tasks, the *Action Plan* proposes a set of feasible policies and guarantee measures. First, it will strengthen organization and implementation. The government should strengthen policy guidance, and enterprises and industry associations should promote coordinated development. The cooperation between provinces and ministries will be strengthened to encourage local governments to develop AI-related industries and establish a statistics system in the AI industry. Second, it will increase support. It will give full play to the existing funds in guiding and supporting AI development, and motivate local enterprises to increase spending on relevant fields, and support increased cooperation between AI enterprises and financial institutions. Third, it will encourage innovation and entrepreneurship. The nation will accelerate the construction of innovation centers and

28 “Interpretation of the Three-Year Action Plan for Promoting Development of a New Generation Artificial Intelligence Industry (2018-2020)”, December 25, 2017, <http://www.miit.gov.cn/n1146295/n1652858/n1653018/c5979643/content.html>.

key laboratories for AI-related manufacturing, deliver contests of AI innovation, entrepreneurship and solutions, and push for the establishment of innovation exchange platforms for AI enterprises. Fourth, it will speed up talent training. The nation will attract and train high-end talents for AI, and innovation and entrepreneurship, and support the growth of a group of leading talents and top-notch young talents, strengthen the construction of AI-related disciplines, and guide the cultivation of skilled personnel urgently needed by the AI industry. Fifth, it will optimize the development environment. The nation will carry out research on AI-related policies, laws, and regulations, promote the industry to open up data rationally, and encourage bilateral and multilateral international cooperation.²⁹

Conclusions

Given the overview and comparisons of the AI strategies of major countries and regions in the world, we can draw the following conclusions:

1. AI Positioning

1) China and the US are competing for the global leadership

Currently, China and the US are the two international leaders with respect to AI development and are advancing as both competitors and partners. Aiming to achieve all-round AI development, China and the US are focused on similar priority areas including basic research, industrial applications, and international governance. The US, as the most powerful country in the world, emphasizes that it must maintain its all-around leadership in

²⁹ Ministry of Industry and Information Technology, “Circular on Issuing the Three-Year Action Plan for Promoting Development of a New Generation Artificial Intelligence Industry (2018-2020)”, December 13, 2017, <http://www.miit.gov.cn/n1146295/n1652858/n1652930/n3757016/c5960820/content.html>.

the emerging sector to keep its leading position in the world. While China, since its reform and opening up, has achieved fast economic, science and technology, and military development. It is catching up with developed countries rapidly and has substantially elevated its international status. Regarding AI technology, China has secured a global leading position in certain areas. As the globalization of AI continues, it is pivotal for China to maintain such advantages and even compete for all-around leadership to ensure its position in the future world.

2) The EU and Japan remain focused on setting rules and standards

In a manner of speaking, the EU and Japan are equals in terms of AI strength and development. They both lag behind China and the US but have been speeding up AI development in recent years. To secure a position in the future AI development trends, the EU and Japan are not only utilizing their scientific basis to speed up AI technology development but have also identified an alternative to gain an advantage in the international competition by setting international rules and standards. Like Tian Ji (Tian Ji's Horse Racing Strategy: Tian Ji used his advantages to attack the weak points of his enemy and won the race), they both give full play to their existing advantages. While continuously developing AI infrastructure, the EU and Japan are trying to control underdeveloped area. The EU is trying to set international rules related to AI ethics, while Japan focuses on international law and rules for AI-based LAWS.

3) Russia focuses on AI applications in the military area

Due to many historical issues, Russia lags far behind other leading powers in the world and the gap is in danger of further widening. However, as the world awakes to the rising AI technology, Russia has realized its shortcomings and quickly set the agenda of releasing an official overarching AI strategy. It aims to draw strength from the strategy and

utilize leading AI technology in the military field to rise above the lagging position and gain the upper hand in future competition. According to its 2018 ten-point draft plan, Russia will enhance basic AI research, and focus on the development of military application such as aircraft, missiles, electronic warfare, radars, and unmanned systems.

2. Attitudes towards China

1) The US: “hawks” are the majority

Currently, the US policy towards China in the AI area is mainly decided by hawks represented by the Trump administration, senators and representatives. They advocate “decoupling” from China in part or completely in AI development. First, the Executive Order signed off by the Trump administration expressly requires all government agencies to protect national secrets. While speeding up AI development, relevant departments led by the Federal Government shall enhance data quality, enhance confidentiality and improve confidentiality mechanisms³⁰. Second, on February 21, 2019, when interviewed by Fox Business, Mike Pompeo, Secretary of State, warned the US’s allies against using relevant products, including AI-related products provided by Chinese technology company Huawei. During the interview, Mike Pompeo implied that European countries and other countries need to understand the risks posed by Huawei telecommunication products, and if they do, they won’t use such products in their systems.³¹ Third, the Trump administration repeatedly rejected visa

30 White House, “Executive Order on Maintaining American Leadership in Artificial Intelligence”, Feb. 11, 2019, <https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence>.

31 Limitone, J. (2019). Pompeo Slams Huawei: US Won’t Partner with Countries That Use Its Technology. Fox Business, Feb. 21, 2019, <https://www.foxbusiness.com/technology/pompeo-slams-huawei-us-wont-partner-with-countries-that-use-its-technology>.

applications of Chinese experts and students in the AI area to protect its AI security.

2) The EU: excluding China from the development of international rules

The EU lags behind China in AI technology but finds a unique approach – by focusing on the development of AI international rules – to securing an advantage in the future internationalization of AI technology. For the EU, China’s advanced technologies, investment, and talents are hard to be caught up with in a short period. Therefore, focusing on the development of AI international rules and standards could effectively enhance its global influence on AI. It appears that the EU intends to exclude China from sharing this new pie with it. For example, China is excluded from discussions on the development of AI rules held by the Organization for Economic Cooperation and Development (OECD) because China is not a member state. No Chinese keynote speaker was invited to the AI for Good Global Summit held by the International Telecommunication Union (ITU) in Geneva in May 2019.

3) Japan: actively promoting China-Japan cooperation

Japan only joined the AI competition at a later stage and faces serious population aging. Therefore, it sees relatively slow AI development. However, Japan has developed rather mature AI applications, particularly, in medical, automobile and security areas, it has captured tangible achievements and devised a well-defined development plan. Despite the huge potential for AI-related industries, Japan’s success very much relies on China’s manufacturing capability. Therefore, Japan intends to cooperate with China in this respect. Japan provides China with its experience in AI application, and China offers its manufacturing capabilities in this partnership, thus achieving mutually beneficial and win-win development. Recently, Japan has taken several measures to establish stable cooperation

with China. For example, AI Expo Tokyo, Japan's largest and top AI platform, plans to invite Alibaba, Huawei, iFlytek and other Chinese AI companies to partake in the expo to be held in April 2020, where the two sides could explore the directions, opportunities and procedures of bilateral AI cooperation.³²

4) Russia: mapping out a blueprint for AI cooperation with China

On April 27, 2019, the Second Belt and Road Forum for International Cooperation (BRF) was successfully concluded. The Putin government expressed straightforward support for China. During the BRF, Russia and China jointly issued several AI-related statements including the "Joint Statement on Pragmatic Cooperation in the Field of Intellectual Property among Countries along the Belt and Road".³³ During the second BRF, Putin pointed out that Russia strongly supports China in safeguarding globalization and defending free trade among BRI partner countries. He emphasized that the BRI and Russia's efforts to establish a Eurasian partnership should be matched, which will help Eurasia achieve harmonious and sustainable development. He said that "only by working together can we tackle various urgent challenges".³⁴ Given Putin's order on January 15, 2019 which urged the Russian government to formulate an overarching AI strategy, it is safe to say that Russia might have mapped out a preliminary blueprint for AI cooperation with China.

32 2020 AI EXPO, Herostart.com, April 12, 2019, <http://info.china.herostart.com/163079.html>.

33 Ministry of Foreign Affairs, "List of Deliverables of the Second Belt and Road Forum for International Cooperation", April 27, 2019, <https://www.fmprc.gov.cn/web/zyxw/t1658760.shtml?from=groupmessage&isappinstalled=0>.

34 <http://www.chinaru.info/News/zhongekuaixun/56902.shtml>.

5) Policy outlook

China's rapid AI development has been obvious to all and has come to claim a leading position in certain areas. The *Development Plan* and the *Action Plan* issued in 2017 mean that the AI industry has been elevated to national strategy. In recent years, the AI industry in China has been gathering momentum under the guidance of all-round national strategy. China has independently developed many internationally advanced products such as RFID electronic tags and smart cards, IoT chips, 5G AI mobile communications, ORC and biometric recognition systems. However, China faces certain challenges in developing AI technology. According to the Development Plan, overall, China still lags behind developed countries in several fields: it lacks groundbreaking proprietary achievements; it sees big gaps in basic theories, core algorithms and key equipment, high-end chips, major products and systems, basic materials, electronic components, software, and interfaces; scientific research institutes and enterprises have yet formed any ecological system or industrial chain with international influence; it lacks systematic forward-looking R&D layout; high-end talents are too scarce to meet the demands for future development; and relevant infrastructure, policies, laws and regulations, standard systems still need future improvement.³⁵ China should participate in international AI basic research with a more open attitude, attach great importance to the abuse of AI technologies, promote the development of international AI governance rules and actively participate in the building a community of shared future for mankind.

³⁵ State Council, "Circular of the State Council on Printing and Issuing the Plan for Development of the New Generation of Artificial Intelligence", July 20, 2017, http://www.gov.cn/zhengce/content/2017-07/20/content_5211996.htm.

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