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To the Reader:

On behalf of *the International Journal of Law, Ethics, and Technology* Board and my colleagues, I am delighted to announce the publication of the inaugural issue of *the International Journal of Law, Ethics, and Technology.*

The first issue was born in the age of unrest. Nowadays, a widespread sentiment is that the United States must "push back" against raising Chinese strength and influence, focusing the relationship on strategic competition if not open rivalry. Yet, an across-the-board consensus is that a "hot war" with China should be avoided. "The 'forever war' in Afghanistan is over, but the 'forever competition' [with China] has started," said SR. Colonel Zhou Bo, Director of Center for Intl. Security Cooperation, Chinese National Defense Ministry.

In 2021-2022, the other possible watershed of 21th-century geopolitical history is Europe's energy crisis. Europe's electricity and gas costs have risen enormously, with the risk of the annexation of eastern Ukraine growing as global tensions have soared. Meanwhile, nuclear power company Electricite de France SA's stock fell to a record low when the government mandated that it sell electricity at a severe discount, and many reactors had prolonged outages.

From a legal scholarship perspective, our authors found that Law has played a critical role in framing and shaping responses to crises at domestic, regional, international, and transnational levels. For example, the US Justice Department established a judicial precedent on Meng Wanzhou's case, creating a recent page of the new Cold War playbook. **Juncheng Cao** examined the case from a legal perspective and outlined how the Supreme Court of British Columbia legalized the political agenda (Page 21). Meanwhile, **Ge Zheng** reviewed China's scheme to develop the nation into a highly effective participant strategically in rare earth, a group of 17 minerals required to manufacture smartphones, electric cars, military missile systems, and a plethora of other innovative technology (Page 1). Today, Beijing has established China as the world's leading supplier of the vital sector. **Qianye Zhang** proactively investigated privacy practices during the XXIV Olympic Winter Games (Beijing 2022; Page 63). **Shurui Cao** employed feminism to probe China's open government information implementation in action with NLP algorithms (Page 47). Meanwhile, **Bingxuan Wu** and **Xiying Li** reevaluated the legal institution of the energy market (Page 72). Finally, **Xilin Wang** thought of the future. Hence, he studied validation of Medical AI's wearable applications in line with the FDA's advancement of regulations (Page 94). Medical AI is a forthcoming trillion-dollar industry.

The planet is in a state of crises and opportunities. As a result, a legal scholarship empirically focusing on current conditions is essential more than ever. *The International Journal of Law, Ethics, and Technology* has devoted itself to publishing legal studies on critical global issues. I hope the current edition provides our readers with some fresh legal perspectives.

Ever faithfully yours,

L. Ben, on behalf of the team.

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Table of Contents

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RECONSIDERING ECONOMIC DEVELOPMENT AND FREE TRADE

TAKING CHINA'S RARE EARTH INDUSTRY AS AN EXAMPLE

Ge Zheng; trans., by Yan Pan*

Abstract: Free Trade is shaped by a system of rules made by WTO and other international organizations initially dominated by the United States and other developed countries. The seemingly fair rules are based on the status quo and designed to consolidate it, in which the "trade barriers" for the developing countries to export their raw materials and cheap labor should be removed and the high added-value manufactured goods should be free to enter the domestic markets of every country. After China joined the WTO, it emerged as a game-changer by following the rules. How China escaped the "resource curse" experienced by many developing countries and became an industrialized developing country capable of competing with the developed countries on fair terms? This paper uses China's rare earth industry and related industrial policy and law as an example to formulate a narrative in which relationship between law and development can be reconsbidered from the perspective of the developing world.

Keywords: Rare Earth; Free Trade; Law and Development; Resource Curse; Industrial Policy

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Table of Contents

I. FREE TRADE AND DEVELOPMENT: FROM MUTUALLY RESTRICTING TO MUTUALLY REINFORCING

The concept of a "developing country" was the product of the Post-World War II international order, dominated by the United States and represented by the World Bank, the International Monetary Fund, and other international organizations. The series of development theories that evolved from this concept—from the earlier dependency theory to the later international division of labor theory and the global value chain theory—all assume that the main function of developing countries in the world market is to offer raw materials and cheap labor, with the developed countries completing the high value-added production and processing activities and then selling the products to developing countries. The underlying mainstream theoretical basis is the theory of "comparative advantage" attributed to David Ricardo, wherein a country's comparative advantage in the world economy lies with their efficacious utilization of the "peculiar powers bestowed by nature".[1] This unequal distribution of natural resources creates important opportunities for countries that trade with each other; each country focuses on using its unique combination of factor endowments to develop specific products and services, and the efficacious resource allocation is achieved through trade. Under this theoretical framework, as the first countries to industrialize have far more advanced manufacturing and processing technologies, higher production organization efficiency, and higher economies of scale than the latecomer countries, the industrialized countries have comparative advantage in raw materials processing. While in case of the processing of raw materials by developing countries with poor technologies, it is believed that it will result in a great deal of waste in the process. Therefore, developing countries should instead export raw materials directly to industrialized countries, or let industrialized countries invest in developing countries to build factories, which allows industrialized countries to utilize local raw materials and cheap labor immediately, and then put the high value-added finished products into the international market. Drawing support from the research result of McKinsey Global Institute, Paul Samuelsons introduced direct investment, learning/imitation, and fair competition factors, and pointed out that the foreign direct investments made by the countries with the highest productivity (such as Japan's car production transferred to the United States) contributes to a dramatic increase in productivity by introducing advanced technology and stimulating competition. The inevitable path leading up to high productivity and, thus, a high standard of living is to open the developing market to trade, capital, and ideas from the most advanced countries, and allow strong competition with the companies that use the most advanced technologies.[2] This theory's conclusion is based on the empirical study of the respective comparative advantages of the United States and Japan, both industrialized countries, therefore completely ignores the inescapable defeat dooming developing countries if they participate in international competition with absolutely no industrial basis. Samuelson specifically warned that the government should refrain from using industrial policy to foster a domestic market of everything:

Government must play a leading role in investments in social overhead capital—in education, health, communications, energy, and transportation—but it should look to the private sector where it has no comparative advantage. Government should resist

[1] See David Ricardo, On the Principles of Political Economy, and Taxation 93 (3rd ed. 1821).
[2] Paul A Samuelson & Willian D Nordhaus, Economics 341–348 (19th ed. 2010).

the temptation to produce everything at home. A firm commitment to openness to trade and foreign investment will help ensure that a country moves quickly toward the best world practices in different sectors.[3]

Of course, the development model of the Post-World War II international order also emphasizes the assistance provided by international organizations and developed countries to developing countries, and increasingly emphasizes that the countries receiving assistance should carry out institutional reforms and introduce the system of trade liberalization, privatization, and judicial independence, which reflect the European and American ideological value of liberalism. Therefore, development projects come with very obvious political and economic intentions- trying to incorporate the aided developing countries into the US-dominated world order, wherein developing countries are unable to maintain their own unique political and legal systems, nor can they grasp the pace and rhythm of their own development. Under this international development model, only a few developing countries can develop to a level where they are able to compete with developed countries on an equal footing. China's development experience is an exception. It was not swayed by this "international order". In order to not become a permanent supplier of raw materials and cheap labor by entering the world trading system dominated by the industrialized countries when the country's own industrial foundation was weak, China deliberately adopted the closed-door policy and refused to join the world trading system for a period of time after the founding of the People's Republic of China. Meanwhile, China focused on building its own industrial foundation and controlling its own rhythm of development. It was not until China had the basic ability to learn advanced technology that it began to gradually open up and join the world economic system. At the beginning, it focused on the introducing foreign direct investment, then it gradually allowed technology transfer of the enterprises investing in China, and, lastly, it officially accessioned to the World Trade Organization (WTO) in 2001. President Xi Jinping stated in his speech at the G20 summit meeting in Osaka: all kinds of challenges facing the world today are related to development gap and development deficit, when tracing back to their root causes."[4] The model of free trade plus development assistance failed to solve the problems of developing countries- in eliminating poverty and achieving sustainable development. But China has provided the world with a proven successful development model by neither jumping into the world trading system when its industrial foundation was weak, nor relying on foreign aid. Thus, it was able to independently control its development rhythm and reform pace.

In fact, Mr. Sun Yat-sen was one of the pioneers in incorporating development into the domain of international relations. In February 1919, when "the Armistice was declared recently", Sun Yat-sen, as the Prime Minister of the Chinese Nationalist Party, sent a letter to the US Secretary of Commerce, William C. Redfield, the United States Minister to China, Paul S. Reinsch, and other US dignitaries. The letter was accompanied by a six-and-a-half-page document in English titled "Sketch Project for the International Development of China", which was intended to call on the Post-World War I world system established under the leadership of the United States, of which the

[3] Id. at 533.
[4] Xinhua News Agency, Xi Jinping's Speech on the World Economic Situation and Trade Issues at the G20 Leaders' Summit (full text), June 28, 2019, http://www.xinhuanet.com/politics/leaders/2019-06/28/c_1124684186.htm. (last visited Feb 15, 2022).

organizational mechanism was the League of Nations, to provide funds and technical assistance to help China develop modern industries. This document held that this would be beneficial to world peace and also in the interests of European and American countries.[5] It read: "Since President Wilson has proposed a League of Nations to end military war in the future, I desire to propose to end the trade war by cooperation and mutual help in the Development of China. This will root out probably the greatest cause of future wars."[6] Confronted by a cold response from the United States, Sun Yat-sen further expanded this outline into the book "The International Development of China", which was published in China as a strategy to guide the country's industrialization. A hundred years post, an American scholar commented that the concept of industrialized countries aiding developing countries that have not yet achieved industrialization, put forward by Sun Yat-sen during World War I, finally became an international consensus after World War II. "The extent to which the post–World War II expansion of development assistance actually did improve the world is open to debate, but it is impossible to deny that that assistance has played and continues to play a vital role in international relations. There is no better example of this than China. The nation that in the first half of the twentieth century played a leading role in the effort to convince the international community of the necessity of embracing development in the hope of getting aid became in the twenty-first century one of the world's most influential aid donors."[7]

Objectively speaking, China's accession conditions to the WTO were extremely unfair. China agreed to many WTO-plus obligations that neither the developed countries nor many developing countries had promised when they joined the WTO. For instance, in terms of the export trade of raw materials associated with Article 11.3 of *Protocol on the Accession of the People's Republic of China,* China commits to eliminate all export duties, while the GATT rules only prohibit quantitative restrictions on exports, but permit the use of export tariffs.[8] As for the European and American countries that dominate the design of the WTO rules, out of lack of natural resources or for the purpose of protecting their own exhaustible natural resources have, on one hand, passed legislations to restrict the exploitation of their own resources, but have also imported large amounts of natural resources needed by their domestic industries through international trade on the other. Therefore, they had certainly hoped that China, as a major natural resource supplier, would not impose any restrictions on resource exports. However, even if the accession conditions to the WTO were as unfair as this, China still earnestly fulfills its obligations under the Protocol. China has abolished and revised a significant number of laws, regulations and policies that conflict with the Protocol and the WTO rules, trained a large group of professionals specializing in WTO-related matters, and made full use of the free trade system established by the WTO to realize the take-off of China's import and export trade. In the first decade after joining WTO, China's foreign trade volume grew at a high rate of 22% per year,

[5] Sun Yat-sen, The International Development of China xi, 8–9 (2nd ed. 1929); C. Martin Wilbur, Sun Yat-sen: Frustrated Patriot 96–111 (1976).
[6] Sun Yat-sen, The International Development of China (En-Cn Version) xv (2011). Bold added by the author of this article.
[7] Amanda Kay McVety, Wealth and Nations: The Origins of International Development Assistance, in The Development Century 21–39, 39 (Stephen J. Macekura & Erez Manela eds., 1 ed. 2018).
[8] J. Y. Qin, The Predicament of China's "WTO-Plus" Obligation to Eliminate Export Duties: A Commentary on the China-Raw Materials Case, 11 Chinese Journal of International Law 237–246, 238 (2012).

increasing from USD 474.3 billion in 2000 to USD 2.97276 trillion by the end of 2010.[9] By 2013, China's total volume of import and export of goods was USD 4.16 trillion, of which export volume was USD 2.21 trillion and import volume USD 1.95 trillion, making China the world's largest trader in goods.[10] Though China was overtaken by the United States in 2016, it returned to the number one position in 2017.[11]

In this regard, an international trade law scholar commented: "In the WTO context, the U.S. and E.U. dominated the design and drafting of the WTO and its rules. China was not accepted into the WTO until seven years later, and, when it was, it appeared to get a terrible deal. China had to agree to China-specific rules that granted other WTO members greater rights against China, and China fewer rights against them, compared to the standard provisions of the WTO treaties. And yet, through China's investment in legal capacity, it was able to become a legal rival to the U.S. and Europe, who now suggest that the rules favor China. China successfully moved from being a 'rule taker' to a 'rule shaker' to a 'rule maker'."[12] Nowadays, China is an active advocate of free trade and a rule-based multilateral trading system. As President Xi Jinping stated at the opening ceremony of the 1st China International Import Expo (CIIE): "Multilateralism is an effective way to maintain peace and promote development. The world needs multilateralism more than ever. China should firmly safeguard free trade and a rule-based multilateral trade system, and support necessary reforms to the WTO."[13] In the process of actively participating in the promotion and creation of WTO reforms and multilateral trade rules, China is committed to representing developing countries and taking the responsibility of narrowing the development gap.

Multiple factors cause the widening of the development gap. One of them is that the current international trade rules, dominated by developed countries, fail to fully consider the reality that countries are in different stages of development and require different development conditions. Yet, more consideration is given to developed countries, for their steady stream of demand for raw materials without damaging their domestic environment. On one hand, developed countries restrict resource extraction in order to protect their own environment, and at the same time take measures to reserve strategic resources for themselves. On the other hand, developed countries oppose developing countries' restriction measures on resource export. In fact, many developing countries with abundant natural resources "got into trouble because of its [their] wealth". Under the hijacking of the "right to trade" by developed countries, these developing countries are permanently fixed in the status of resource exporting countries, and cannot achieve industrial upgrading. This is what scholars call the "resource curse". In 1970, 80.4% of the export trade income of the developing world came from the export of raw materials, which dropped to 34.2% in 1993. However, this was mainly attributed to the

[9] Xiaofu Wu, Sun Zhenyu, the First Chinese Ambassador to the WTO, on the Tenth Anniversary of China's Accession to the WTO, China Economic and Trade 16–17, 16 (2011).
[10] Ministry of Commerce, China Became the World's Largest Trader of Goods in 2013, March 1, 2014, http://www.mofcom.gov.cn/article/ae/ai/201403/20140300504001.shtml (last visited Feb 16, 2022).
[11] Shanshan Luo, China's Status as a Major Trading Country Has Been Consolidated, People's Daily Overseas Edition, December 4, 2018, at 03.
[12] Gregory Shaffer & Henry Gao, China's Rise: How it Took on the U.S. at the WTO, 2018 UNIVERSITY OF ILLINOIS LAW REVIEW 115, 118–119 (2018).
[13] Jinping Xi, Building an Innovative and Inclusive Open World Economy--Keynote Speech at the Opening Ceremony of the First China International Import Expo, People's Daily, November 6, 2018.

development of manufacturing in East Asia and a few Latin American countries. Other resource-rich developing countries are still relying on exporting raw materials to obtain foreign exchange income.[14] Among the thirty-six countries of the World Bank's "most troubled" countries category (i.e., highly indebted low-income countries), twenty-seven are exporters of raw materials.[15]

As a latecomer to industrialization, It was possible for China to fall prey to the "resource curse" as well. In 2014, the European Union released the revised *List of Critical Raw Materials for the EU*. 20 raw materials were identified as critical for modern industries out of 54 candidate materials. China is the main global supplier of 14 out of 20 of these critical raw materials, specifically rare earths. China supplies 99% of the heavy rare earth elements and 87% of the light rare earth elements for the global industry. However, by 2018, China imported 98,400 tons of various rare earth products, among which, the total imported amount of rare earth compounds (including mixed rare earth carbonates) and rare earth metals was 69,400 tons, with a year-on-year growth of 102%. One particular concern is the fact that the import volume of rare earths is far greater than the export volume (53,000 tons exported during the same period). Meanwhile, the import volume of rare earth concentrates and mixed rare earth carbonates has increased significantly, accounting for about 60% of import volume of rare earths. China has become a major importer of rare earth resource products for the first time.[16] How did China get rid of the fate of relying on raw material exports to maintain economic operations and become a major manufacturing country that processes rare earths and uses rare earth raw materials as important raw materials? How do current international trade rules and trade war beyond these rules affect China's policies and laws on rare earth import and export? What inspiration can the story of China's rare earth industry give to other developing countries? How should China's experience be reflected in the new international trade order establishment that China is participating in? Through rare earths, we can catch sight of the changes that the world economic order is currently undergoing or will undergo, in the face of the fact that China is rising.

[14] United Nations Conference on Trade and Development (UNCTAD), Commodity Yearbook 1995 (1995).
[15] See Michael L. Ross, The Political Economy of the Resource Curse, 51 World Pol. 297–322, 297–322 (1999).
[16] China Rare Earth Industry Association, Baotou Research Institute of Rare Earths, & Editorial Department of Rare Earth Information, Ten Major Events in China's Rare Earth Industry in 2018, Rare Earth Information 4–5, 5 (2019).

Raw materials	**Main producers (2010, 2011, 2012)**	**Main sources of imports into the EU (mainly 2012)**	**Substitutability index***	**End-of-life recycling input rate****
Antimony (Stibium)	China 86%	China 92% (unwrought and powdered)	0.62	11%
	Bolivia 3%	Vietnam (unwrought and powdered) 3%		
	Tajikistan 3%	Kyrgyzstan 2% (unwrought and powdered); Russia 2% (unwrought and powdered)		
Beryllium	USA 90%	USA, China and Mozambique	0.85	19%
	China 9%			
	Mozambique 1%			
Borates	Turkey 41%	Turkey 98% (natural borates) and 86% (refined borates)	0.88	0%
	USA 33%	USA 6%, Peru 2% (refined borates); Argentina 2% (natural borates)		
Chromium	South Africa 43%	South Africa 80%	0.96	13%
	Kazakhstan 20%	Turkey 16%		
	India 13%	Others 4%		
Cobalt (Cobaltum)	DRC 56% ↑	Russia 96% (cobalt ores and concentrates)	0.71	16%
	China 6%; Russia 6%; Zambia 6%	USA 3% (cobalt ores and concentrates)		
Coking coal	China 53%	USA 41%	0.68	0%
	Australia 18%	Australia 37%		

	Russia 8%; USA 8%	Russia 9%		
Fluorspar (Fluorite)	China 56%	Mexico 48% ↑	0.80	0%
	Mexico 18%	China 13% ↓		
	Mongolia 7%	South Africa 12% ↓		
Gallium	China 69% (refined)	USA 49%	0.60	0%
	Germany 10% (refined)	China 39%		
	Kazakhstan 6% (refined)	Hong Kong 8%		
Germanium	China 59% ↓	China 47% ↓	0.86	0%
	Canada 17%	USA 35%		
	USA 15%	Russia 14%		
Indium	China 58%	China 24% ↓	0.82	0%
	Japan 10%	Hong Kong 19% ↑		
	Korea 10%	Canada 13%		
	Canada 10%	Japan 11%		
Magnesite	China 69%	Turkey 91%	0.72	0%
	Russia 6%; Slovakia 6%	China 8%		
Magnesium	China 86% ↑	China 91% ↓	0.64	14%
	Russia 5%	Israel 5%		
	Israel 4%	Russia 2%		
Natural graphite	China 68%	China 57% ↓	0.72	0%
	India 14%	Brazil 15%		
	Brazil 7%	Norway 9%		
Niobium	Brazil 92%	Brazil 86% (Ferro-Niobium)	0.69	11%
	Canada 7%	Canada 14% (Ferro-Niobium)		
Phosphate rock	China 38%	Morocco 33%	0.98	0%
	USA 17%	Algeria 13%		

	Morocco 15%	Russia 11%		
Platinum Group Metals	South Africa 61% ↓	South Africa 32% ↓	0.83	35%
	Russia 27% ↑	USA, 22% ↑		
	Zimbabwe 5%	Russia 19% ↓		
Heavy Rare Earth Elements	China 99%	China 41% (all REEs) Russia 35% (all REEs) USA 17% (all REEs)	0.77	0%
	Australia 1%			
Light Rare Earth Elements	China 87%		0.67	0%
	USA 7%			
	Australia 3%			
Silicon metal (Silicium)	China 56%	Norway 38%	0.81	0%
	Brazil 11%	Brazil 24%		
	USA 8%; Norway 8%	China 8%		
	France 6%	Russia 7%		
Tungsten (Wolframium)	China 85%	Russia 98%↑	0.70	37%
	Russia 4%	Bolivia 2%		
	Bolivia 2%			

Figure 1: The Distribution Map of the Global Supply Sources of the 20 Critical Raw Materials for the EU[17]

II. CHANGES IN THE GLOBAL RARE EARTH INDUSTRY PATTERN AND THE WORLD TRADE ORDER

"Rare Earth" is the general term of a set of 17 metallic elements in the periodic table, including lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, scandium and yttrium. Among them, the group of 15 chemical elements running from lanthanide to lutetium, with atomic numbers 57 through 71 of the periodic table are collectively referred to as lanthanide element. Rare earth is relatively abundant in the Earth's crust, but the rare earth ores minable for enrichment that have been discovered are relatively fewer than most other ores. Rare earth resources primarily exist in four geological environments: carbonatites, alkaline igneous systems, ion-adsorption clay deposits, and monazite-xenotime-bearing placer deposits. Carbonatites and placer deposits are the primary sources of light rare earths, while ion-adsorption clay deposits are the primary sources of heavy rare earths. Rare

[17] Ad Hoc Working Group on Defining Critical Raw Materials, Report on Critical Raw Materials for the EU, 5 (2014).

earth ores mining technology is very demanding. India is rich in monazite reserves, which contain abundant radioactive metal-thorium, but the rare earth industry in India has failed to progress rapidly because it cannot solve the problem of clean production technologically.

Rare earths play a vital role in modern industry. They are essential materials for renewable energy and green energy technologies (such as wind turbines, solar panels and energy efficient lighting), high-tech products (such as computers, smartphones and energy efficient lighting), and defense industry (such as missile guidance systems, smart bombs, and submarines, including Tomahawk cruise missiles and Abrams tanks of the United States).[18] So, without rare earths, the new energy industry, high-tech industry, and defense industry will be unable to make any progress. For instance, permanent magnet technology is one of the primary application areas of rare earths currently. Different from electromagnetism, permanent magnets can independently produce strong magnetic fields without relying on power supply systems. The neodymium iron boron (NdFeB) magnet is the strongest permanent magnet in the world, so it is vital to multiple weapon systems, such as the power generation equipment in jet fighter engines and parts, missile cruise systems, precision-guided weapons and smart bombs, mine detection systems, antimissile defense systems, laser, satellite and communication systems, and radar systems. Permanent magnet technology can produce strong fields in small parts and at ultra-high temperature without external power supplies. This attribute of permanent magnet allows computers, smartphones, and weapons to be smaller and more efficient. At present, there are only five NdFeB companies outside of China in the world. They are Vacuum Schmelze (VAC) of Germany, Hitachi Metals, TDK, Shin-Etsu Chemical, and the joint venture established jointly by Molybdenum Corporation of America and Mitsubishi in Japan. On the other hand, China has more than 200 NdFeB companies, which contribute almost 80% of the global NdFeB production.[19]

Several major changes have occurred in the pattern of the global rare earth industry, having impacted the global value chain each time. At the time when the industrial value of rare earths was first realized, India was the world's largest supplier of rare earths. In 1941, India supplied 80% of the rare earths used by the US industry. By 1943, it supplied 100%. In 1946, the nascent Indian government restricted the export of rare earths for the sake of its own industrial development, forcing the United States to seek alternative solutions. In 1947, the Ames Laboratory was established at Iowa State University by the Atomic Energy Commission of the United States, with chemist Frank Spedding, specializing in rare earth research, appointed as its director. This laboratory developed ion exchange chromatography to separate and extract high-purity single rare earth metals. It is therefore called the "cradle of the modern rare earth industry" and the "Mecca of rare earths". With the support and encouragement of the United States government, the Ames Laboratory transferred related patents to enterprises, which promoted the rapid development of rare earths in the United States. By the early 1980s, an American company called Molycorp supplied 70% of rare earths in the global market. However, unlike the petroleum industry, the rare earth industry of the United States has not achieved a comprehensive breakthrough in research and development, nor has it achieved vertical integration in industrial organization. Even in

[18] See Marc Humphries, Rare Earth Elements: The Global Supply Chain, Rare Earth Elements 31, 2–4.
[19] Id. at 4.

its prime, the United States' exports were mainly to sell raw materials such as ores. "The U.S. rare earth industry remained relatively diffused during its lifetime. Molycorp's operation concentrated on the mining and production of raw materials rather than extending its reach to encompass higher-level manufacturing. The expanded supply of rare earth stocks certainly stimulated and supported advancements in domestic rare earth technologies, but it left Molycorp itself vulnerable to the discovery of "the next lucrative source" of rare earths (just as the United States had grown dependent on India's supply in the 1940s and China in the 2000s). One can argue that by vertically integrating, it might have had more options to pursue once China entered the picture. China has deliberately avoided such dependence as much as it ultimately intended to use its own rare earth reserves to produce finished goods rather than sell raw materials to the international market."[20] Due to this competitive disadvantage, Molycorp's rare earth mining operations plummeted after a mining accident at the Mountain Pass mine in the 1990s, which resulted in a leak of radioactive liquid, and it ceased operations completely in 2002. In 2017, Shenghe Resources, a Chinese A-share listed company headquartered in Chengdu, successfully acquired the Mountain Pass mine for USD 20.5 million. This mine resumed production in 2018.

Though China entered the world's rare earth trade industry relatively late, its speed of development is astonishing. In 1927, the famous Chinese geologist Ding Daoheng discovered rich metallic deposits in Bayan Obo, Inner Mongolia, China. In 1935, Professor Zuolin He studied the fluorite specimens collected by Professor Daoheng, and discovered two rare earth minerals, "Bayan ore" and "Obo ore". Later, through analysis and identification, they turned out to be "bastnaesite" and "monazite".[21] Bayan Obo iron ore began its mine building in 1956. From 1957, the main mine started temporary mining. In 1958 and 1959, both the main mine and the east mine started mechanized mining as large-scale open-pit iron ores. In 1963, the Baotou Research Institute of Metallurgy, specializing in rare earths research, was established and affiliated to the Ministry of Metallurgical Industry. Since then, China's rare earth resource mining has been steadily proceeding. Large-scale rare earth deposits have been discovered in Weishan County, Shandong (in the 1960s) and Mianning County, Sichuan (in the 1980s). From 1978 to 1989, China's rare earth production increased at an annual rate of more than 40%. By the 1990s, China had become the world's largest rare earth producer. Bayan Obo is the world's largest rare earth ore vein. Its iron ore reserves are estimated to be 1.4 billion tons, with 35% iron content; and its industrial reserves of rare earth ore are estimated to be 48 million tons, accounting for 45% of the world's rare earth production and 47% of China's in 2005. [22]

In the middle of the 1970s, the world became aware that China has the world's largest rare earth reserves for the first time, which was then estimated to be 36 million tons or 50% of the world's reserves, followed by the United States, with 17% of the world's reserves. However, at that time, China had neither exploited rare earth deposits on a large scale, nor had it developed related processing industries. From the 1980s,

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[20] Joanne Abel Goldman, The U.S. Rare Earth Industry: Its Growth and Decline, 26 J. POLICY HIST. 139–166, 164 (2014).
[21] Changyou Zhao, Discovery and Deposit Mining in the Bayan Obo Mining Area, Metal Mines 55–56, 55 (1982).
[22] U.S. Geological Survey, 2005 Minerals Yearbook: Rare Earths, http://minerals.usgs.gov/minerals/pubs/commodity/rare_earths/rareemyb05/pdf.

China started to develop its own rare earth industry in a planned and systematic manner, and created corresponding knowledge innovation and industrial structures. "The father of rare earths in China", Professor Guangxian Xu founded the State Key Laboratory of Rare Earth Materials Chemistry and Application at Peking University. Through unified deployment on a national level, the layout of the rare earth industry, with the integration of industry, academia, and research, came into being in a very short time. By 2010, more than 90% of the world's rare earths came from China. Meanwhile, the rare earth industry in the United States had declined to near nothing, and the United States depended entirely on rare earths imports. Monopoly on rare earth supply has reinforced China's right to speak on international affairs. For example, in the morning of September 7, 2010, a patrol boat of Japan Coast Guard collided with a Chinese fishing boat in the waters near the Diaoyu Islands and seized the captain of the fishing boat. In the course of the negotiations, China at one time exerted pressure on the Japanese government by restricting the total amount of rare earths exported to Japan. In the meantime, the then U.S. Secretary of State Hillary Clinton visited Japan, and rare earths were also an important topic in her talks with the Japanese Foreign Minister.

Due to the upgrading and transformation of China's industry, the domestic demand for rare earths has increased gradually. Therefore, China had implemented quotas on exporting rare earth elements since 2006. This measure had led to a surge in rare earth prices on the international market. On March 13, 2012, the United States (which later requested the European Union and Japan to join on March 22, 2012) requested consultations with China with respect to "the restrictions on the export of three forms of raw materials—rare earths, tungsten and molybdenum". Having failed to reach any settlement amicably, these three parties requested the DSB of WTO to compose a panel on June 27, 2012, to officially charge China's restriction measures on exports of rare earths and other raw materials (export duties, export quotas and trading rights restrictions) with breaching the "*General Agreement on Tariffs and Trade* (GATT)" and the special commitments made by China in the "*Protocol on the Accession of the People's Republic of China*" and "*Report of the Working Party on the Accession of China* ". Both the panel report and the Appellate Body's final report were unfavorable to China. The main reason for the findings is that the rare earth export quota mechanism adopted by China had not reduced the total amount of domestic rare earth mining and utilization, so it did not fall into the exception as agreed in Article 20 of the GATT for certain specific purposes (supposing the exception is applicable in the China—Rare Earths case, but the DSB of WTO considered not applicable in the first place). These purposes include the protection of human, animal or plant life or health mentioned in *Article XX (b)*, and the conservation of exhaustible natural resources mentioned in *Article XX (g)*.[23] China objected to the findings of the DSB of WTO in this case, so did many international trade law experts in China and abroad, who believes that the findings were questionable. But China still obeyed the findings and canceled the export quotas in 2015.

To mitigate the tension between the increasing domestic demand for raw materials and trade compliance is challenging. According to the Constitution of China, natural resources like rare earths are owned by the State (i.e., by the whole people), and the development and utilization of these resources is part of the socialist state-owned

[23] Appellate Body Report, China – Measures Related to the Exportation of Rare Earths, Tungsten, and Molybdenum, WTO Doc. WT/DS431, 432, 433/AB/R (Adopted August 29, 2014)

economy. Therefore, it is constitutional for the State to promote the vertical integration between upstream and downstream enterprises in the development and utilization of natural resources through industrial policies and administrative measures. What the international trade rules focus on is the raw materials that enter the market, but the market mechanism is not the sole way to effectively allocate resources. As early as in 1937, Coase had stated in the article "The Nature of the Firm", which later earned him the Nobel Memorial Prize in Economic Sciences, that operation of the market is not costless, which is the main reason why firm exists. If the administrative cost of the effective allocation of resources within the firm is lower than the market cost, then the firm will replace the market. The most obvious cost of organizing production through market "price mechanism" is the information cost, followed by negotiation cost and contract signing cost. The characteristic of a firm is to replace the price mechanism with internal organization and management.[24] In the 1980s and 1990s, China's rare earth industry was diffused and insufficiently scaled. "Digging and selling the soil" was the main business model of upstream mining companies. But in recent years, the vertical integration of China's rare earth companies has been completed generally, with six major group companies coming into existence, including China Minmetals, Chinalco, Northern Rare Earth, Xiamen Tungsten, Guangsheng Nonferrous, and Southern Rare Earth. Each group company has the full chain production capacity from mining to downstream high-end product manufacturing. And the supply of raw materials has become a division of labor between different departments of the group company, with no need to rely on the market price mechanism any longer. The so-called vertical integration refers to the strategic actions of firms in the same industry chain to expand existing businesses along the upstream and downstream of the industry chain, through mergers and reorganizations, equity swaps, capital injections, etc., to internalize external market transactions. There is forward integration (upstream control downstream) and backward integration (downstream control upstream).[25] Vertical integration allows mining companies not to throw rare earth ore into the market cursorily. Rather, the full-chain production is completed within the firm, including the stage of mining, smelting, and separation, the stage of material processing, such as rare earth permanent magnet, laser, hydrogen storage, fluorescent, and catalysts superconducting material processing, and further stage of manufacturing of the high-end products, such as smart phone accessories, new energy auto parts, wind turbine parts, aircraft and spacecraft parts, and defense industry product parts. The firms have turned rare earths into high value-added products before selling them to the market. In this way, the firms participate in international competition.

As a socialist country, the Chinese government does not aim to serve the market or capitalists, but to actively guide and regulate the market to make it serve the whole people. Therefore, the government is capable of applying various policies and legal instruments in a comprehensive manner to promote industrial upgrading. As for the relationship between economics and politics, Mr. Shuming Liang had stated clearly in the Expansion Meeting of the CPPCC on September 11, 1953, "I have such a thought about the transformation of society: China's political reform must be done with economic reform; once the economy has one step forward, the politics should have one

[24] R. H. Coase, The Nature of the Firm, 4 Economica 386–405 (1937).
[25] Yujia Wang, Energy Industry Chain Integration and Enterprise Production Efficiency: Taking the Vertical Integration of Coal Power as an Example, 21 Journal of Beijing Institute of Technology (Social Science Edition) 29–38, 30 (2019).

step forward too, and so on in a circular manner."[26] To adjust the industrial policies in time according to the industrial development level and the national economic development status, and apply the policies and legal instruments from various governance perspectives in a comprehensive manner, including regional planning, urban planning, finance, taxation, environmental protection, corporate governance, etc. to facilitate industrial upgrading and economic restructuring, is China's successful experience, which an American scholar called "economic statecraft".[27] In the book "China and the Geopolitics of Rare Earths", this scholar summarized the international political landscape surrounding rare earths as follows: first, with the steady increase of world population (estimated to grow to 9 billion by 2050), especially the countries with large populations, including Brazil, Russia, India, and China (BRICS), joining the ranks of the middle-income countries, more and more people will want a high-quality style of life (also means energy intensive). Second, as shown by the growing resource nationalism, developing countries are no longer satisfied with being the exporters of cheap raw materials and labors. For one thing, they seek to achieve higher prices for their raw materials; for another thing, they are developing downstream high value-added industries at home. Third, the emergence of nanotechnologies and other new technologies makes the utilization of materials at an unprecedentedly extensive level, which also increases the demand for rare earth elements. Fourth, a few countries hold an exclusive position in production of certain vital raw materials. This can be most obviously reflected in China's absolute advantage in rare earth resources.[28]

The effects of combining vertical integration of enterprises and national and regional development strategies are clearly demonstrated in the examples of the Northern Rare Earth Group and Baotou. In 2017, China's rare earth production volume was 160,000 tons, accounting for 89.79% of the world's production (178,200 tons). Among them, the rare earth production in the Bayan Obo mining area of Baotou, Inner Mongolia was 85,000-90,000 tons, accounting for about half of the world's production.[29] Baotou is therefore known as the "rare earth capital" of the world. In 2015, Baotou was determined to be the pilot city for national rare earth industry transformation and upgrading. In the following three years, Baotou successfully obtained a total of RMB 0.7 billion fund for the national rare earth industry transformation and upgrading pilot, and brought along RMB 14 billion investments from enterprises. Under the guidance of policy funds, Baotou has implemented about one hundred rare earth industry transformation and upgrading projects, to promote the continuous extension of the industrial chain of functional materials, such as permanent magnets, hydrogen storage, polishing, and catalysts. Significant quantities of rare earth application products with independent intellectual property rights have been created in the fields of aerospace, magnetic refrigeration, permanent magnet motor, hydrogen batteries, and energy saving and environmental protection. The local conversion rate of rare earth raw materials has increased from less than 40% to 85%; the proportion of

[26] Shuming Liang, Draft speech at the enlarged meeting of the Chinese People's Political Consultative Conference on September 11, 1935, VII in Liang Shuming's Complete Works, 3.
[27] SOPHIA KALANTZAKOS, CHINA AND THE GEOPOLITICS OF RARE EARTHS 4 (2018).
[28] Id. at 7.
[29] Side Liu, World supply of rare earth minerals in 2018, Rare Earth Information, 28 (2018), https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CJFD&dbname=CJFDLAST2019&filename=XTXX201901010&uniplatform=NZKPT&v=UyYUuvvJdsbEaw4g39kl8bb8rf-nngbcUlNPsk5GzjnzjPl22WUQijkZX4yoOGsG (last visited Feb 11, 2022).

rare earth functional materials and application industry to the city's rare earth industry has increased from 20% to 51.2%, accounting for more than half for the first time.[30] Northern Rare Earth Group operates the entire rare earth industrial chain in Baotou, it has established a complete rare earth industrial system, including rare earth beneficiation, smelting and separation, deep processing, applied products, scientific research, etc., and is capable of producing a complete range of rare earth products including rare earth raw materials (concentrates, rare earth carbonates, oxides, salts, metals), rare earth functional materials (polishing materials, hydrogen storage materials, magnetic materials, luminescent materials), and rare earth application products (nickel-hydrogen power batteries, rare earth permanent magnetic resonance instruments). This model of in-depth cooperation between local government and enterprises, with the government providing policy and financial support, and enterprises leveraging to achieve industrial upgrading and system integration, is a unique element of China's economic development model.

In addition, a new model of not relying on the market has emerged among the six major rare earth group companies, giving way to cooperation between them. For example, on November 1, 2017, Northern Rare Earth and Xiamen Tungsten announced that the two parties had entered into a strategic cooperation framework agreement which would involve rare earth products supply security, hydrogen storage materials industrial cooperation, lanthanum, cerium, praseodymium, neodymium metal production cooperation, research and development cooperation, and rare earth group general cooperation. As shown by the content of the agreement publicized, Northern Rare Earth would guarantee Changting Jinlong, a subsidiary of Xiamen Tungsten, a monthly procurement of 30-50 tons of neodymium praseodymium oxide and 10-30 tons of neodymium oxide, which could be increased gradually in the future; Northern Rare Earth would guarantee Xiamen Tungsten a monthly procurement of 40-50 tons of lanthanum and 30-40 tons of lanthanum-cerium for hydrogen storage alloy powder, which could be increased gradually in the future; Northern Rare Earth would guarantee Xiamen Tungsten procurement of 40-60 tons/month praseodymium-neodymium metals or 30-80 tons per month of alloy strips, which would be adjusted based on the increase in production capacity and the adjustment of the national rare earth total amount control scheme. At the same time, Changting Jinlong, a subsidiary of Xiamen Tungsten, wouldguarantee Northern Rare Earth's procurement needs of medium and heavy rare earth products (such as dysprosium iron metal, terbium metal, gadolinium iron metal, holmium iron metal, and special rare earth metals) for magnetic materials. Xiamen Tungsten lacked praseodymium and neodymium, and Northern Rare Earth lacked heavy rare earths. The two parties complemented each other with their advantages.[31]

The abovementioned developments have created a major demand for rare earth raw materials in China. In 2018, China imported 98,400 tons of various rare earth products, of which the total amount of imported rare earth compounds (including mixed rare earth carbonates) and rare earth metals was 69,400 tons, with a year-on-year growth of 102%. One particular concern is that China's import volume of rare earths is far greater than the export volume (53,000 tons exported in 2018). Meanwhile, the import

[30] Baotou Economic and Information Commission, Ten "New Deals" to Help the Development of Baotou Rare Earth New Material Industrial Park, Rare Earth Information 7, 7 (2018).
[31] China Securities Journal, Two Rare Earth Groups, Northern Rare Earth and Xiamen Tungsten Industry, Join Forces to Complement Each Other's Advantages, Rare Earth Information 7, 7 (2017).

volume of rare earth concentrates and mixed rare earth carbonates has increased significantly, accounting for about 60% of import volume of rare earths. China has become a major importer of rare earth resource products for the first time.[32] It can be seen that although China has the largest rare earth reserves in the world, it still has huge demand for rare earth raw materials because it is also a major producer of rare earth functional materials and finished products. The rumors that China can utilize the rare earth embargo to stifle the throats of countries that have trade frictions with China are incredibly simplified and whimsical. What the story of China's rare earths tells us is not how a country with an absolute advantage in a certain resource makes use of this advantage to take unilateral actions to seek benefits for itself, but how this country grasps the pace of its own development, transforms its resource advantages into technological and industrial advantages, and after gaining the ability to dominate its own destiny, actively participates in the shaping of a new multilateralist free trade order.

III. THE CHRONOLOGICAL ORDER BETWEEN DEVELOPMENT AND FREE TRADE

Historically, the advocates of free trade initially were those who benefited from it first, i.e., the capitalists of those countries that were the first to realize industrialization. By virtue of their comparative advantages in capital and technology, they forced the undeveloped countries to open up markets by claiming the "right to trade". So, they could obtain raw materials and cheap labor, as well as move high-polluting manufacturing plants to these countries, thereby circumventing the home country's increasingly high environmental standards. The GATT and the subsequent WTO were international organizations established by these first-mover countries to safeguard their right to trade. As China entered the rank of industrialized countries through self-reliance efforts, on the basis of which, it actively participates in the existing world trade system and engages in fair competition in accordance with its rules. However, the creators and rule-setters of this system feel threatened, and do not spare efforts to destroy the rules established by them to maintain their own interests. The story of rare earth helps us understand the following:

First of all, only when a country grasps its own development rhythm and gets rid of the fate of being deliberately misled by external mechanisms, such as the world trading system, can it truly achieve development. Because these seemingly fair and reciprocal international rules serve the interests of their creators, the established system of legal rules has a conservative character, with its premise being that the existing imbalanced development between developed and developing countries is part of the world order, developing countries should respect the rules of the market, letting the resources move to the place where they can be more effectively utilized (such as developed countries), and developed countries complete the high value-added manufacturing and processing, and then buy the finished products at high price. This set of rules does not take into account the domestic industrial policies demand for developing countries to achieve development and thus become capable of completing effective processing of raw materials, in other words, the need for developing countries to grasp their own development pace and dominate their own destiny. The development of China's rare earth industry fully illustrates this point: in the early stages of

[32] China Rare Earth Industry Association, Baotou Research Institute of Rare Earths, and Editorial Department of Rare Earth Information, supra note 16 at 5.

developing rare earth resources and rare earth processing technologies, China had not joined the WTO and was not subject to the unfair international trade rules. Therefore, it can adopt domestic industrial policies and corresponding law arrangements to ensure the all-round development of China's rare earth industry, from mining, refining to finished product processing, until China becomes the world's most important producer of rare earth ores and rare earth products.

Second, a clear understanding of the substantive factors under the form does not mean to belittle and abandon the form, or even abandon the rules and procedures. As Thucydides narrated through the mouth of the Athenians, justice only exists between equal powers. In case of disparity in power, the basic fact is: the stronger does what they can, and the weaker will accept what they receive.[33] When a country has the power to participate in shaping and interpreting rules, its choice becomes very important, whether to join hegemonic alliance to bully the weak, or to defeat other strong powers to dominate the world, or to unite the weak to shape a fairer global order. These are the choices that China is currently confronting. Yet, China has made its own choice, which is to adhere to the stance of multilateralism where all countries can participate equally, whether strong or weak. In this regard, President Xi Jinping made a very clear statement, "The G20 should continue to play a leading role to ensure that the world economy is open, inclusive, balanced, and beneficial for all. We must strengthen the multilateral trading system and carry out necessary reforms to the WTO. The purpose of the reform is to keep pace with the times, enabling the WTO to realize its purpose of opening markets and promoting development more effectively. The results of the reform should be conducive to maintaining free trade and multilateralism, and narrowing the development gap."[34] With the backdrop of the construction of an innovative country, domestic industrial upgrading, and the construction of an ecological civilization having been determined as national tasks by the Constitution, China's domestic demand for rare earths has gradually increased, while the production of rare earths remains stable. Therefore, the arrangements with regard to the export of rare earths needs to be made through bilateral or multilateral agreements, on the basis of mutual benefit and equal consultation.

Third, setting out from Marxist internationalism, after achieving independent development, China still positions itself as a developing country and is committed to participating in the construction of a fairer global order together with other developing countries. In recent years, on the basis of the defensive foreign policy built on "Five Principles of Peaceful Coexistence", China has put forward an active initiative to "build a community with a shared future for mankind", which manifests China's courage to assume the responsibility as a great power. With respect to the supply of rare earths, China did not continue to restrict the export of rare earths out of the growing domestic demand and increasing environmental protection standards. Instead, in compliance with WTO rules and findings, China canceled the export quotas that had been implemented for several years in 2015. However, if the United States continues to impose various duties, embargoes, and sanctions on China recklessly in order to maintain its hegemony, China will not rule out the possibility of imposing a rare earth embargo on the United States. As Confucius replied, "requite evil with good, with what will you requite good? Requite evil with fairness and honesty, requite virtue with virtue." The formation of

[33] Thucydides, The War of the Peloponnesians and the Athenians 380 (Jeremy Mynott ed & tran., 2013).
[34] Xinhua News Agency, supra note 4.

rules in international relations depends on mutual reciprocity on the premise of abiding by the rules. It is absolutely impossible to rely on hegemonic unilateral actions. In the face of the United States' constant threats of "retreating", leading to the disintegration of the existing world trading system, for one thing, China may cooperate with other member states sharing the same intent to "save" the dispute settlement mechanism of WTO, and in the process of which, facilitate WTO to realize reforms and enhance its impartiality and efficiency; for another thing, China may also seek to establish alternative bilateral and multilateral trade agreements and related dispute settlement mechanisms to reshape the world trade order.

China is "one country, multiple worlds" in itself. Huge regional divergences exist in resource reserves, economic development levels, technological development levels, and industrial structures among different regions. So, China can sustain differentiated inter-regional division of labor and domestic trade. To a certain extent, international trade is no longer a matter of survival for China, which is significantly different from the resource-poor EU countries. For example, Germany, with a developed manufacturing industry, is almost completely dependent on imports for critical raw materials. Although to a certain extent, the United States can achieve resource self-sufficiency as well, the inertia cultivated by the long-term dividends of the Post-World War II international order has made it a must to leave the comfort zone and adjust the industrial policies in order to achieve this. In 2017, Michael Nathan Silver, the CEO of American Elements, met with Trump's strategic advisor Steve Bannon and proposed to nationalize the only rare-earth mine in the United States.[35] On December 20, 2017, US President Trump signed an executive order, requesting an increase in the local production of critical mineral raw materials in the United States. These minerals are mainly used in high-end manufacturing, including 23 critical minerals such as platinum, manganese, rare earths, etc. The impact covers high-end manufacturing fields ranging from smartphones to aero engines.[36] The "Raw Materials Initiative" (RMI) launched by the European Commission in 2008 embodies three principles: (1) ensure a fair competition environment to obtain raw materials from third-party countries; (2) cultivate raw material sources for the Europe and ensure sustainable supplies; (3) improve the material utilization efficiency and promote recycling use.[37] These developments all show that as China enters the rank of industrialized countries and actively participates in the shaping of fairer international trade on behalf of developing countries, European and American countries have to adjust their industrial policies, pick up the raw materials mining industry that they have given up for long, and bear the corresponding environmental consequences on their own, rather than passing such consequences to developing countries altogether. This fact in itself is an important step towards a fair world order. The establishment of the new order necessarily means the disintegration of the old order, and will inevitably touch the interests of those with vested interests. Conflicts and struggles are unavoidable. However, as can be seen from the story of rare earths, it is impossible for any country to take unilateral actions to

[35] Bloomberg, This CEO Wants Trump to Nationalize the Only Rare-Earth Mine in the United States (2017), https://www.bloomberg.com/news/articles/2017-07-18/trump-urged-by-ceo-to-nationalize-the-only-u-s-rare-earths-mine (last visited Feb 15, 2022).
[36] White House, Presidential Executive Order on a Federal Strategy to Ensure Secure and Reliable Supplies of Critical Minerals (2017), https://www.govinfo.gov/content/pkg/FR-2017-12-26/pdf/2017-27899.pdf (last visited Feb 15, 2022).
[37] Ad Hoc Working Group on Defining Critical Raw Materials, supra note 17 at 9.

protect its own interests and seek unfair terms of trade by relying on its superiority in resources or technology. Because it is impossible for any country to take the lead in all resources or technologies, and a temporary lead does not mean that it can lead forever. The long-term solution is the mutual benefit and win-win approach of "one who wants to stand up and others, and one who wants to achieve them".

A CASE STUDY OF EXTRADITION: UNITED STATES V. MENG WANZHOU

Juncheng Cao*

Abstract: This article's ultimate purposes are to answer the heated-discussed questions in the Meng Wanzhou case and provide a brief introduction to extradition, especially essential sections such as double criminality. The article focuses mainly on the facts of the Meng Wanzhou case and the necessary procedures concerned. First, the investigation abstracted from the Extradition Act of Canada, applying principles and theories in the extradition practice to fully explain the case in detail. Then, the study explored two critical terms: extraditable offenses, double criminality, and their primary coverages. Next, the research provided two main arguments: the abuse of procedure and the acknowledgment of double criminality. Finally, the analysis added another extradition case to compare the Meng Wanzhou case. Overall, the study analyzed the procedural law and law ideologies in the case. The consideration of national values is the cornerstone of the case.

Keywords: Double Criminality; Extradition Practice; Procedural Law; Law Ideologies; National Values; Meng Wanzhou

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Table of Contents

INTRODUCTION

Ms. Meng Wanzhou, Huawei's Chief Financial Officer, was escorted and detained by Canadian officials at the Vancouver Airport in December 2018 while flying to Mexico through Canada.[1] Meng Wanzhou's detention became publicized as the trade battle between China and the United States heated up. Since then, every material on the extradition case "United States v. Meng," whether publicly revealed or not, has piqued the public's interest. Consequently, a number of people believed that Ms. Meng's detention was an effort by the United States to interfere with Huawei's emergence as a Chinese telecommunications behemoth.[2]

Ms. Meng was detained in Canada for over 1000 days before the Deferred Prosecution Agreement.[3] It was on December 11th, that Ms. Meng was freed from prison a few days after her detention at the Vancouver Airport on the condition that she strictly follow Mr. Justice W.F. Ehrcke's 16 instructions. Despite her later release from prison, the bail terms mandated her to be monitored by a security detail that would last 24 hours a day, seven days a week at her expense.[4]

It is far from an exaggeration to say that the general public emphasizes the political motivations for the US's request that Canada extradite Ms. Meng. The same can be said regarding the question of whether the Canadian government improperly interfere with the administration of justice while ignoring the legal implications of the Extradition Act of Canada. However, from the first arrest to the finally signed DPA, the whole procedure must take place inside a legal framework. As a result, this essay will examine the Meng Wanzhou case to explain extradition practice, focusing mainly on the court procedure, i.e., the legal part of the claim, rather than the element of the geopolitical event.

During the whole process from the arrest to Ms. Meng's release, a number of civil or official groups will play their roles. The United States Department of Justice and Eastern District Court of New York launched the prosecution of fraud against Meng and requested the Canadian authority to extradite the person sought to Canada. The CBSA and RCMP mainly executed the Warrant of Arrest issued by Justice

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[1] The Courts of British Columbia: United States v. Meng, 2019 BCSC 2137 – 2019/12/09, https://www.bccourts.ca/jdb-txt/sc/19/21/2019BCSC2137.htm (last visited Nov. 21, 2021)
On December, 1, 2018, the flight arrived a bit early. When it did, CBSA officers met Ms. Meng near the arrival gate as she emerged from the jetway into the airport building. This was at about 11:21a.m. After identifying Ms. Meng as the person of interest to them, the CBSA officers began their dealings with her by seizing her cellular telephones and placing them in mylar bags to prevent any remote alteration of those devices or their data. It is common ground that US authorities had asked that electronic devices in Ms. Meng's possession at the time of her arrest be handled in this way. After so seizing the telephones, the CBSA officers then escorted Ms. Meng and her travelling companion to the secondary immigration screening area.

[2] Dan Bilefsky, What You Need to Know About the Huawei Court Case in Canada 5.

[3] United States of America against MENG WANZHOU Deferred Prosecution Agreement Cr. No. 18-457(S-3)(AMD), https://www.justice.gov/opa/press-release/file/1436211/download (last visited Jan. 14,2021)

[4] The Courts of British Columbia: United States v. Meng, 2018 BCSC 2255 – 2018/12/11, https://www.bccourts.ca/jdb-txt/sc/18/22/2018BCSC2255.htm (last visited Nov. 21, 2021)

Fleming, which later aroused the debate of the abuse of procedure. The whole legal procedure was carried out in the Supreme Court of British Columbia before Madam Justice Holmes accepted the first hearing concerning the Oral Reasons for Judgment. The Attorney General of Canada participated in the proceedings on behalf of the United States of America. A third-party HSBC provided the PowerPoint as an issue to the US Justice Authorities.

Meng Wanzhou's case fully serves the purpose of examining the identification of double criminality (also called dual criminality). The Double Criminality rule is a basic composition of extradition law. It is used in many countries, regional domestic extradition legislation, and bilateral treaties.[5] As Oppenheim succinctly stated: "No person may be extradited whose deed is not a crime according to the criminal law of the state which is asked to extradite as well as the state which demands extradition".[6] Generally speaking, the Double Criminality rules demonstrates the judicial cooperation between the requesting states and the requested states. At the same time, the Double Criminality rules arouses the argument of whether it violates the principle of "no punishment without law". Therefore, the identification of double criminality is crucial in the extradition process. In greater detail, the modern practice of identifying double criminality will be examined in this note by comparing the judgement of the Meng Wanzhou Case and past extradition cases.

In Part I of the note, the background information of Ms. Meng, Huawei and the case she was involved in will be provided. Mostly, the information about the case is abstracted from the court verdicts released by the Supreme Court of British Columbia. The facts themselves won't cause an argument, and their validity was confirmed by both parties. In Part II of this note, I will discuss part of the theories and practices concerning modern extradition cases. More specifically, this part is divided into three sections: extraditable offenses, double criminality, and a brief analysis of the most recent Canadian Extradition Act. In part III, the Meng Wanzhou Case will be discussed more carefully. This part will focus mostly on two arguments concerning the arresting procedure and the identification of double criminality respectively. In addition, the legal ideology will be paid sufficient attention to in the note, especially the similarities of legal ideology concerning financial crimes. Part IV is composed of another extradition case:THE MINISTER OF JUSTICE v HENRY C. FISCHBACHER. In this part, excluding the content analysis of the case, the details of the evidence standard and the division of phases in modern extradition practice will be looked into. More specifically, the judgements will be compared with that of the Meng Wanzhou case. In the last part of this note, I'll give my conclusions based on the discussions.[7]

I. BACKGROUND

Ms. Meng Wanzhou is the Chief Financial Officer of HUAWEI TECHNOLOGIES CO., LTD, a Shenzhen based technology giant founded in 1987. To date, this company has enrolled approximately 197,000 employees and it has been operating in more than 170 countries and regions worldwide. Its services have covered

[5] Sharon A. Williams, The Double Criminality Rule Revisited, 27 Isr. Law Rev. 297–309 (1993).
[6] Id. citing L. Oppenheim, International Law (8th ed., 1955) 701.
[7] Daniela J Restrepo, Modern Day Extradition Practice: A Case Analysis of Julian Assange 22.

more than 3 billion people around the world.[8] Ms. Meng is the daughter of Huawei CEO Mr. Ren Zhengfei. She has become a member of the board and CFO of Huawei since 2011, making great contributions to the development of the company.[9]

The very beginning of the case was that days before Ms. Meng's arrival at the YVR Airport, on Aug. 22, 2018, a United States district court (Eastern District of New York) issued a warrant, requesting Canada to arrest Meng Wanzhou on behalf of the United States. Simultaneously, Ms. Meng's flight information and her travel plan indicating that she would be on Cathay Pacific flight CX838 and would land in Mexico via Vancouver were submitted to the Canadian justice authorities. Madam Justice Fleming then issued a provisional arrest warrant on November 30, 2018, ordering "All peace officers having jurisdiction in Canada" to "immediately arrest" Ms. Meng[10]."

Ms. Meng was arrested on Dec.1, 2018, at Vancouver Airport, therefore, the arrest and the procedures before the arrest were generally classified as a YVR event. At the airport, when she disembarked her flight, she was controlled by Canada Border Services Agency (CBSA) officers instantly after the confirmation that Ms. Meng was the person of interest. Her mobile devices were seized and kept in mylar bags to avoid possible remote control of them. Shortly afterwards, Ms. Meng was requested to submit her passwords and was questioned about the charges she would confront before she was finally arrested by Royal Canadian Mounted Police (RCMP) officers.[11] The arrest of Ms. Meng may have involved the abuse of procedure and it was one of the important sources of argument in the hearings. The arguments will be fully discussed in Part III of this note.

Ms. Meng was detained at the Alouette Correctional Centre for women before she was released from custody. In the hearing, the application of judicial interim release of Ms. Meng held on Dec. 11, 2018, the Attorney General objected to her release and sought an order for her detention[12] by claiming that there were a number of passports under Ms. Meng's control. This indicated that there was a great chance

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[8] About HUAWEI, https://www.huawei.com/cn/corporate-information (Last visited on Nov. 21, 2021)

[9] The Courts of British Columbia: United States v. Meng, 2018 BCSC 2255 – 2018/12/11, https://www.bccourts.ca/jdb-txt/sc/18/22/2018BCSC2255.htm (last visited Nov. 21, 2021)
Ms. Meng has significant financial resources which would enable her to flee Canada should she choose to do so. She is a senior executive at one of the world's largest telecommunications companies and the daughter of its founder. Her father has an approximate net worth of U.S. $3.2 billion. Ms. Meng is a Chinese national. China has no extradition agreement with the U.S. Should Ms. Meng want, she has the means to flee and remain outside Canada and the United States indefinitely. As held by the Court in United States of America v. Baratov, 2017 ONSC 2212, "if you have infinite sources, the value of the pledge diminishes.": para. 40.

[10] The Courts of British Columbia: United States v. Meng, 2019 BCSC 2137 – 2019/12/09, https://www.bccourts.ca/jdb-txt/sc/19/21/2019BCSC2137.htm (last visited Nov. 21, 2021)
The events were set in motion when the USA submitted a Request For Provisional Arrest to Canada asking Canada to seek a warrant for Ms. Meng's arrest on the USA's behalf. Based on information in that document, an application was made to this Court under s. 13 of the Extradition Act for a provisional warrant for Ms. Meng's arrest. Madam Justice Fleming issued a provisional arrest warrant on November 30, 2018, ordering "all peace officers having jurisdiction in Canada" to "immediately arrest" Ms. Meng.

[11] Id. at Undisputed Events Relating to Ms. Meng's Arrest.

[12] The Courts of British Columbia: United States v. Meng, 2018 BCSC 2255 – 2018/12/11, https://www.bccourts.ca/jdb-txt/sc/18/22/2018BCSC2255.htm (last visited Nov. 21, 2021) ("Ms. Meng now applies for judicial interim release under s. 18 of the Extradition Act, S.C. 1999, c. 18 (the "Act"). The Requesting State opposes her release and seeks an order for her detention. ")

that she would flee Canada without the permission of Canadian authorities. Furthermore, the Attorney General mentioned that Ms. Meng had not travelled to the United States since 2017. While on Ms. Meng's side, she defended the fact that there are only two currently valid passports, one issued by the People's Republic of China, and the other by Hong Kong SAR. The reason given by the judge was that there exists no relevance between "not entering the US" and posing threat to society because "Ms. Meng may have myriad good reasons for choosing not to travel to the United States during the past two years"[13]. On these grounds, the application of judicial interim release was approved.

In the years that followed, Ms. Meng attended several hearings concerning the issues of double criminality, evidence adducing, media release, etc. and part of these problems will be discussed in detail in Part II & III of this note. Eventually, on September 24, the US Department of Justice withdrew their request for Canada to extradite Meng Wanzhou to the United States. (In the form of DPA) As a result, there is no basis for the extradition proceedings to continue and the Minister of Justice's delegate has withdrawn the Authority to Proceed, ending the extradition proceedings. The judge released Meng Wanzhou from all of her bail conditions. Meng Wanzhou is free to leave Canada[14].

Another important party, in this case, is HSBC (The Hongkong and Shanghai Banking Corporation Limited). HSBC, a Hongkong based bank, is one of the largest banks and monetary facilities in the world. It entered into a deferred prosecution agreement (DPA) with the US Department of Justice in December 2012, in which it agreed not to commit further sanctions violations.[15] That is to say, on condition that HSBC violates the US sanctions, chances stand that HSBC will be prosecuted and penalties will be imposed.

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[13] Id.

I put very little weight on the suggested inference that Ms. Meng's failure to travel to the United States since March 2017 is evidence of an intent to evade apprehension there. That inference is entirely speculative and without any reliable foundation. Residents of countries other than the United States, including Ms. Meng, may have myriad good reasons for choosing not to travel to the United States during the past two years.

[14] Government of Canada: Statement from the Department of Justice Canada, https://www.canada.ca/en/department-justice/news/2021/09/statement-from-the-department-of-justice-canada.html (last visited Nov. 21, 2021)

The Department of Justice Canada issued today the following statement: Today, counsel for the Department of Justice attended a case management conference regarding the extradition proceedings for Meng Wanzhou. We informed the Court that on September 24 the US Department of Justice withdrew their request for Canada to extradite Meng Wanzhou to the United States. As a result, there is no basis for the extradition proceedings to continue and the Minister of Justice's delegate has withdrawn the Authority to Proceed, ending the extradition proceedings. The judge released Meng Wanzhou from all of her bail conditions. Meng Wanzhou is free to leave Canada. Canada is a rule of law country. Meng Wanzhou was afforded a fair process before the courts under Canadian law. This speaks to the independence of Canada's judicial system.

[15] The Courts of British Columbia: United States v. Meng, 2020 BCSC 785 – 2020/05/27, https://www.bccourts.ca/jdb-txt/sc/20/07/2020BCSC0785.htm (last updated Nov. 21, 2021)

HSBC had run afoul of the US sanctions relating to Iran and other countries before the events relating to the allegations against Ms. Meng. It entered into a deferred prosecution agreement (DPA) with the US Department of Justice in December 2012, in which it agreed not to commit further sanctions violations, as well as to undertake various remedial measures and to pay forfeitures and penalties amounting to well over a billion dollars.

Then Reuters, a mainstream British media outlet, respectively published two articles associating Huawei with Skycom's US-related business dealings in Iran on December 2012 and January 2013. These two articles captured the attention of HSBC regarding the existing financial relationship between the bank and Huawei. More specifically, HSBC was coordinating a syndicated loan worthy of 1.5 billion USD to Huawei. If providing such a loan to Huawei, then HSBC violated the US sanction. In order to avoid possible risks, the loan might not be provided[16]. Therefore, the relationship between Huawei and Skycom is what HSBC concerned for, and it is directly linked to the final decision of providing loans.

In this situation, Ms. Meng, the CFO of Huawei gave a presentation to elaborate how vital the relationship was.[17] After her meeting with the bank executives, the PowerPoint was translated and submitted to HSBC.

For certain purposes, the United States Department of Justice requested that HSBC submit the PowerPoint while proposing that Ms. Meng's presentation conceal the real relationship between Huawei and Skycom, which might ultimately lead to HSBC's violating US sanctions and being prosecuted according to the DPA. Ms. Meng was therefore involved in this case and was accused of fraud, namely making false presentation to lead the bank to continue banking services.

II. EXTRADITION PRACTICE

A. Double Criminality

Double criminality refers to the characterization of the relator's conduct as criminal under the laws of both the requesting and requested states. "It is a reciprocal characterization of criminality that is considered a substantive requirement for granting extradition."[18] To put it more simply, if a person sought is to be extradited to another

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[16] Id.
The banking relationship between Huawei (and its subsidiaries and affiliates) and HSBC (and its US subsidiary) ran from at least 2007 to 2017, and involved very significant transactions, including the following. HSBC's US subsidiary cleared very substantial dollar transactions for various Huawei entities between 2010 and 2014. In August 2013, HSBC coordinated a syndicated loan to Huawei in an amount equivalent to USD 1.5 billion, and was one of the principal lenders. In April 2014, HSBC sent Huawei a signed letter describing negotiated terms for a USD 900 million credit facility. HSBC was also part of a syndicate of banks that loaned Huawei USD 1.5 billion in July 2015. HSBC had run afoul of the US sanctions relating to Iran and other countries before the events relating to the allegations against Ms. Meng. It entered into a deferred prosecution agreement (DPA) with the US Department of Justice in December 2012, in which it agreed not to commit further sanctions violations, as well as to undertake various remedial measures and to pay forfeitures and penalties amounting to well over a billion dollars.

[17] The Courts of British Columbia: United States v. Meng, 2020 BCSC 1607 – 2020/10/28, https://www.bccourts.ca/jdb-txt/sc/20/16/2020BCSC1607.htm (last visited Nov. 21, 2021) at Para 25.
The allegations against Ms. Meng, who is the Chief Financial Officer of Huawei Technologies Co. Ltd., are based at their foundation on a PowerPoint presentation she delivered when she met with a senior HSBC executive on August 22, 2013 in the back room of a Hong Kong restaurant. Ms. Meng had requested the meeting after various inquiries from HSBC management to Huawei executives about allegations in two Reuters articles associating Huawei with Skycom Tech. Co. Ltd., a company said to have engaged in sanctions-violating business conduct in Iran. As I will discuss below, Ms. Meng is alleged to have falsely denied that Huawei controlled Skycom.

18 Id. at 500.

country, it is a principle that the person's conduct must reach the level of criminality in both nations.

Consider the situation in which a person's conduct doesn't meet the threshold of crime in the requested state, but he is still extradited to the requesting state, it can be concluded that the law of the foreign nation comes into effect beyond its territory and the judicial sovereignty of other countries is therefore violated, whether it is for or against the willingness of the requested countries. In an extradition case, the absence of double criminality is in disregard of "nulling crimes in legality" principle. It is certainly against the Charter rights to arrest a person merely for the interest of another country.

It should be noted that more or less, there exist differences in constituent elements between similar offenses in the criminal law of the requested and requesting nation. For the sake of international cooperation in the field of criminality, double criminality does not require that absolute identity is present between the crime charged and the counterpart crime in the other nation. So long as the crimes are “substantially analogous” in both nations, the requirements of double criminality can be met. Besides, the punishment need not be identical as well.[19]

To be more specific, in this article, the extradition practice of the United States will be quoted to explain the matter:

"1. It does not require that the crime charged be the same crime contained in federal or state law; it is sufficient that it be the same type of crime.

What matters is whether the facts giving rise to the criminal charges would also give rise to a similar criminal charge in the requested state.

The same facts can give rise to multiple criminal charges in one or both systems, but that is not a dual criminality issue; rather it may be an issue of ne bis in idem (double jeopardy)."[20]

The three statements of the identification of double criminality above eradicated the possibility of the person sought claiming that due to different sentencing and types of crime, the requirements of double criminality should not be met. Take the example of International Extradition, for example, the crime the person sought committed constituted simple homicide in Mexico, while in the United States, it should constitute felony murder.[21] Clearly, the person sought, claimed that requirements of double criminality aren't satisfied since the type of crimes in Mexico and the United States are different, or at least the severity of the crime is not the same. If we make a judgement

[19] Id. at 505.
[20] Id. at 506. See Ch. VIII, Sec. 4.3.
[21] Id. at 503–504. Dual criminality requires that an accused be extradited only if the alleged criminal conduct is considered criminal under the laws of both the surrendering and requesting nations. United States v. Saccoccia, 18 F.3d 795, 800 n.6 (9th Cir. 1994). Th e doctrine is incorporated into the Extradition Treaty Between the United States and Mexico at Article II, §§ 1, 3. Both the magistrate judge and district court found that the requirement of dual criminality is met in this case because Clarey’s acts, which constitute simple homicide in Mexico, would constitute felony murder in the United States. Felony murder is “murder . . . committed in the perpetration of, or attempt to perpetrate, any arson, rape, burglary, or robbery.”

under the three statements above, even though the crime charged is not exactly the same, they both belong to the type of murder. In addition, it is apparent that the conduct will give rise to criminal charges both in Mexico and the United States. Therefore, the requirements of double criminality are met and Clarey's argument stand no ground.

The standard of "substantially analogous" provides much space for the judge to explain the judging reasons and the approach accepted in the matter of ruling on double criminality. It has been widely accepted that a conduct-based approach is adapted in the procedure of extradition. This approach is also accepted in Canadian extradition practice and the alternative offense-based approach, "expressly rejected in Canada, looks for a match between the elements of the foreign offense and those of an equivalent Canadian offense"[22].

As can be learned above, the key factor deciding whether the requirements of double criminality can be met is that the person sought can be prosecuted for a similar crime in the requesting state. Therefore, the purpose of extradition is partly to punish those who are found guilty of crimes in a microscope. On the contrary, if the extradition is manifest that the request is like a subterfuge for achieving non-penological purposes. In this case, the requested state will not be bound to adhere to the proposed formulation and the extradition request will be denied.

Double criminality is closely linked to extraditable offenses. As is mentioned in Part II. A of this note, the extraditable offenses can be agreed on between nations either with a treaty or without a treaty. Under the circumstances where the treaties are absent (i.e., there isn't any definition or method of designating extraditable offenses), the identification of double criminality is possibly the substantial requirement of extradition according to the legislation of the nation. While in other cases where there exist treaties, the identification of double criminality is commonly a constitution of the formula defining the offenses. Whichever method is adopted, double criminality is deemed essential in modern extradition.

B. Extradition Act of Canada

The latest edition of the Canadian Extradition Act (S.C. 1999, c. 18) was last amended in 2005, and the judgement of the Meng Wanzhou Case was also made under the legal framework of this act. In this section, an analysis of the contents concerning the Meng Wanzhou case will be provided but the legal practice of the act will be left for Part III.[23] The general principle of extraditable conduct is regulated as follows:

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[22] The Courts of British Columbia: United States v. Meng, 2020 BCSC 785 – 2020/05/27, https://www.bccourts.ca/jdb-txt/sc/20/07/2020BCSC0785.htm (last visited Nov. 21, 2021)
Canada and most other jurisdictions internationally have opted to implement the double criminality principle through the conduct-based approach that asks whether the conduct in the foreign jurisdiction could amount to an offence under domestic law: Fischbacher at para. 29. The alternative offence based approach, expressly rejected in Canada, looks for a match between the elements of the foreign offence and those of an equivalent Canadian offence. Because Canada has rejected that approach in favor of the conduct-based approach, it is not necessary that the foreign offence have an exactly corresponding Canadian offence identified in the Minister's authority to proceed. It is the "essence of the offence" that is important: Fischbacher at paras. 28-29."

[23] Restrepo, supra note 7.

(1) A person may be extradited from Canada in accordance with this Act and a relevant extradition agreement on the request of an extradition partner for the purpose of prosecuting the person or imposing a sentence on — or enforcing a sentence imposed on — the person if

(a) subject to a relevant extradition agreement, the offense in respect of which the extradition is requested is punishable by the extradition partner, by imprisoning or otherwise depriving the person of their liberty for a maximum term of two years or more, or by a more severe punishment; and

(b) the conduct of the person, had it occurred in Canada, would have constituted an offense that is punishable in Canada,

(i) in the case of a request based on a specific agreement, by imprisonment for a maximum term of five years or more, or by a more severe punishment, and

(ii) in any other case, by imprisonment for a maximum term of two years or more, or by a more severe punishment, subject to a relevant extradition agreement.[24]

As can be concluded from the leading part of s3(1), decisions of surrendering the people sought are made based on the Extradition Act and relevant extradition agreements (treaties), and the purpose of an extradition request is limited to prosecution. Generally speaking, the approach Canadian justice authorities adopt is mainstream. Besides, the procedure of extradition is started passively for the request of an extradition partner is essential in starting the procedure.

S3(1)(a) and (b) constitute the interpretation of double criminality rules in the Extradition Act of Canada. S3(1)(a) requires that the offense should be punishable by the extradition partner and the crime should be of a certain degree of severity (a maxim term of imprisonment for two years or more). While S3(1)(b) requires that the offense should be punishable as well in Canada and the maximized sentencing of this offense should either reach the level of a two-year imprisonment or more and a five-year imprisonment or more, depending on the types of agreements. S3(1) fully demonstrates the requirements of double criminality and sets a limit of extraditable offenses. More specifically, minor offenses are excluded, the offense should not only be considered a serious one in the requesting state, but also the requested state (Canada).

The extraditable offenses are not listed in the Extradition Act of Canada, but the designation of the formula is included. Before 1999 when the Extradition Act of Canada was amended, "Section 2 of the Canadian Extradition Act provides that an "extradition crime" is one that if committed in Canada or within Canadian jurisdiction would be one of the crimes listed in Schedule I of the Act"[25].

S13(2) of the Extradition Act of Canada regulates the contents of provisional arrest warrants.

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[24] Extradition Act of Canada, R.S.C. 1999, c. 18.

[25] Williams, supra note 5 at 4 citing Professor of Public International Law and International Criminal Law, Osgoode Hall Law School, Canada.

13 (2) A provisional arrest warrant must

(a) name or describe the person to be arrested;

(b) set out briefly the offense in respect of which the provisional arrest was requested; and

(c) order that the person be arrested without delay and brought before the judge who issued the warrant or before another judge in Canada[26].

S13(2)(c) states that it is deemed essential that the arrest procedure be executed "without delay" and this requirement is further clarified in the provisional arrest warrant issued by Justice Fleming to arrest Ms. Meng by noting: all peace officers having jurisdiction in Canada" to "immediately arrest" Ms. Meng[27]. The arrest procedure was later questioned by the defendants because it might well violated Ms. Meng's Charter rights and the procedure was abused.

The admissibility of evidence is another important matter in extradition practice. Subsections concerning evidence in the Extradition Act are listed as follows:

32 (1) Subject to subsection (2), evidence that would otherwise be admissible under Canadian law shall be admitted as evidence at an extradition hearing. The following shall also be admitted as evidence, even if it would not otherwise be admissible under Canadian law:

(a) the contents of the documents contained in the record of the case certified under subsection 33(3);

(b) the contents of the documents that are submitted in conformity with the terms of an extradition agreement; and

(c) evidence adduced by the person sought for extradition that is relevant to the tests set out in subsection 29(1) if the judge considers it reliable.

(2) Evidence gathered in Canada must satisfy the rules of evidence under Canadian law in order to be admitted[28].

"The question of admissibility of evidence goes to the issue of determining what type of evidence can be presented at a Hearing. It does not go to the weight or sufficiency of the evidence presented."[29] According to S32, the admissible types of evidence in extradition practice should surmount those in Canadian domestic justice practice for three other sources of evidence are admissible. However, as far as Meng Wanzhou Case is concerned, although much effort was made by Ms. Meng and her

[26] supra note 27.
[27] he Courts of British Columbia: United States v. Meng, 2019 BCSC 2137 – 2019/12/09, https://www.bccourts.ca/jdb-txt/sc/19/21/2019BCSC2137.htm (last visited Nov. 21, 2021)
Madam Justice Fleming issued a provisional arrest warrant on November 30, 2018, ordering "all peace officers having jurisdiction in Canada" to "immediately arrest" Ms. Meng. The application for the warrant was supported by an affidavit of an RCMP officer.
[28] supra note 27.
[29] M Cherif Bassiouni, International Extradition: United States Law and Practice at 901.

team to try to adduce evidence in her favor, very limited evidence was accepted by the court. One of the most important reasons lies in S32(1)(c): the standards of tests required are rather high and the admissibility is limited. Canada is a common law country, the circumstances in which the judges should consider reliable have already been strictly controlled. In brief, the evidence admissible should be reliable and relevant.

To meet the relevance requirement, the person sought must generally establish that the evidence, taken at its highest, is realistically capable of satisfying the exact standard required to justify refusing committal on the basis that the requesting state's evidence is unreliable. In M.M. at para. 78, Cromwell J. described the standard as follows:" I conclude that in order to admit evidence from the person sought, directed against the reliability of the evidence of the requesting state, the judge must be persuaded that the proposed evidence, considered in light of the entire record, could support the conclusion that the evidence essential to committal is so unreliable or defective that it should be disregarded. "[30]

More specifically, Justice Fitch delivered his explanation of Subsection S32(1)(c) by concluding that three types of evidence are inadmissible: evidence inviting the extradition judge to consider "alternative explanations for the certified evidence; evidence that would only "supplement the evidence of the requesting state with an innocent exculpatory explanation"; evidence of an innocent explanation or evidence that might found an inference inconsistent with guilt[31].

In this procedure of evidence admission, the proposed evidence should serve the purpose of challenging the evidence raised by the requesting state directly. New evidence should prove that the contents of the Record of Case (ROC) are unreliable to such an extent that they should be removed from the case. This requirement puts the person sought in a disadvantaged position for in the extradition practice, the evidence raised by the requesting state listed in ROC is not challenged but they are presumed to be solid. Neither can the person sought adduce evidence to provide other possible explanations nor can he prove directly that he is innocent of the allegations.

Judging the Extradition Act of Canada, I hold the point of view that the act itself put the person sought at a disadvantaged situation improperly, making the person sought facing jeopardy exceeding the normal level of being extradited to the requesting state. The most typical factor, lies in the issue of evidence admission. S32(1)(a) and S32(1)(c) list two situations in which the evidence is admissible, the former one is aimed at the requesting states while the latter one is aimed at the person sought.

The evidence admissible under in the two situations share the similarity that they are both exceptions of Canadian law, namely they may not be admissible in cases that aren't classified as extradition cases. However, they differ greatly in the matter of relevance and accuracy. If a Record of Case is to be admitted, it needs to satisfy the

[30] The Courts of British Columbia: United States v. Meng, 2020 BCSC 1607 – 2020/10/28, https://www.bccourts.ca/jdb-txt/sc/20/16/2020BCSC1607.htm (last visited Nov. 21, 2021) at Para 19.
[31] Extradition Act of Canada, R.S.C. 1999, c. 18.

requirement of available for trial or so called accurate. In S32(1)(a), no requirements of relevance and the subjective evaluation of the judge were mentioned.

However, when it comes to the person sought, two requirements should be met if the evidence adduced by the person sought is to be accepted. On one hand, it has to satisfy the requirements of the test set out in subsection 29(1) to be relevant to the case. While on the other hand, the judge has to be convinced that the evidence is reliable.

The conclusion drawn from the analysis above is that: the level of requirements of accuracy, relevance and reliability the evidence to be adduced by the person sought is much higher than that of the requesting state. The person sought has to ensure that the evidence is reliable, relevant simultaneously and the judge has the freedom of deciding on the reliability. But if the evidence to be adduced comes from the side of requesting states, even though the evidence is not accurate and fails to meet the requirements of S33(3)(b), as long as it is capable of starting a trial and is collected under the law of extradition partner or able to justify prosecution, it should be admitted, in regardless of the judge's opinion on the evidence to be adduced.[32]

Therefore, I proposed that the part of Extradition Act concerning evidence admission deprived the person sought of the chance of defense against the requesting state by setting differed standards of evidence admission. The statement is mainly supported by two indications: 1) the lack of accuracy of evidence from the requesting state can be compensated by the probability of being prosecuted in the partner state; 2) the judge possesses the right to deny the evidence to be adduced by the person sought by claiming the reliability is in question and no further regulation is imposed on these decisions by the Extradition Act.

III. EXTRADITION PRACTICE I: A CASE STUDY OF MENG WANZHOU

Although the judgement whether Meng Wanzhou would be surrendered from Canada to the United States wasn't made by the Supreme Court of British Columbia and the whole extradition procedure came to a stop with the existence of Deferred Prosecution Agreement, some conclusions can be made directly through the analysis of court verdicts released. In this part, two arguments that aroused heated debate will be paid due attention to. The two arguments are concerned with the arresting procedure (YVR Event) and the ruling on double criminality respectively. To ensure the credibility of this note, all the facts mentioned in the paragraphs below are cited from the court verdicts. Besides, law ideology, another important factor having an effect on the identification of double criminality in Meng Wanzhou Case, will be discussed in this part of analysis. Law ideologies reflects a judge or even a nation's attitudes towards a certain type of crime and ultimately play a role in deciding the extent to which two extradition partners cooperate in combating criminality. As is abstracted from the court verdict ruling on the double criminality, the requirements of double criminality identification in financial crimes are less demanding than those dealing with human rights. This is an excellent indication of Canadian law ideology. The present literatures mostly focus on the ideology itself, for instance, "the relationship between ideology,

[32] Extradition Act of Canada, R.S.C. 1999, c. 18 at S33.

consensus and decisions made in the Supreme Court"[33]. However, in this note, more attention will be paid to the issue of what effects ideology have on the identification of double criminality, a process calling for the comparisons between the law values adopted by different nations.

A. Argument 1: Whether the Arrestment (YVR Event) Was in Violation of Meng Wanzhou's Charter Rights?

The most important question to answer in this framework is whether or not Ms. Meng's Charter rights were deprived of due to the possible delay of arrestment. According to S.10 of the Canadian Charter of Rights and Freedoms, everyone has the right to arrest or detention:

"(a) to be informed promptly of the reasons therefor;

(b) to retain and instruct counsel without delay and to be informed of that right; and

(c) to have the validity of the detention determined by way of habeas corpus and to be released if the detention is not lawful."[34]

However, Ms. Meng claimed that she was unlawfully detained for she had been detained for hours in the name of customs and immigration screening process before she was finally arrested by RCMP officers at Vancouver Airport.[35] Before her arrest, she was escorted by CBSA, and it was during this period that her mobile devices were seized and the passwords were collected and copied. Since Ms. Meng hadn't been arrested then, she wasn't informed of the offense and her rights. Therefore, on this ground, Ms. Meng proposed that the process was abused and her Charter rights were violated.

To fully settle this argument, a more detailed description of the YVR Event should be provided. On Nov. 30, 2018, Madam Justice Fleming issued a provisional arrest warrant, ordering “all peace officers having jurisdiction in Canada” to “immediately arrest” Ms. Meng. When she disembarked her flight, as is introduced before, her cellular telephones and other mobile devices were seized and kept in mylar bags to prevent any remote alteration (which is the common method taken by US authorities). During this period, RCMP officers, with the arrest warrant in possession, stood by. Neither did they arrest Meng and show the arrest warrant, nor did they identify themselves. When the CBSA officers concluded their process and the immigration examination was suspended, Ms. Meng was escorted to the secondary

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[33] Paul H. Edelman, David E. Klein & Stefanie A. Lindquist, Consensus, Disorder, and Ideology on the Supreme Court: Consensus, Disorder, and Ideology on the Supreme Court, 9 J. EMPIR. LEG. STUD. 129–148 (2012).

[34] Canadian Charter of Rights and Freedoms, Part I of the Constitution Act,1982(U.K.).

[35] The Courts of British Columbia: United States v. Meng, 2019 BCSC 2137 – 2019/12/09, https://www.bccourts.ca/jdb-txt/sc/19/21/2019BCSC2137.htm (last visited Nov. 21, 2021)
Ms. Meng contends that the RCMP’s original plan was to execute the provisional warrant by going onto the plane and keeping Ms. Meng back while other passengers disembarked. This plan, she submits, would have conformed to the warrant’s requirement that peace officers “immediately arrest” her. However, the plan changed, Ms. Meng contends, to delay the arrest and the corresponding implementation of her Charter rights.

screening area and was arrested by the RCMP officers. Meanwhile, Ms. Meng was informed of the reason for her arrest, and of her right to counsel, as required by s. 10(b) of the Canadian Charter of Rights and Freedoms. [36]

One detail emphasized in the court verdict is that when CBSA officers were dealing with Ms. Meng, the passwords were recorded and copied. Ms. Meng and her team questioned that the conduct of copying is the sign of an early intention to provide the passwords to a third party unlawfully.[37] In response, the Attorney General on behalf of the United States clarified that members of the RCMP and the FBI communicated about what Canadian law required for the transfer of evidence to the USA[38]. To support this explanation, the Attorney General submitted that CBSA had just declined an FBI request concerning Meng Wanzhou's Case. However, this evidence submitted had nothing to do with the conduct in question and the detailed information was not noted in the court verdict either.[39] The Attorney General did admit that the CBSA's turning over passwords to RCMP was a mistake, but it was a simple one and led to no consequence.

This detail serves as a simple indication of the Canadian authorities' abuse of process. However, compared with the possible violation of Ms. Meng's Charter rights and delayed arrestment, the latter one deserves more attention, for it is suffused with more undisputed facts. Since no official judgment concerning this issue was made by the Canadian judge in the whole process, it makes no sense in giving more detailed discussion. Therefore, in this note, the analysis of this detail comes to a pause here.

In the argument of whether the arrestment was delayed or not, Ms. Meng contended that according to the provisional arrest warrant, peace officers should have arrested her immediately. In the screening process, CBSA officers would covertly use their powers, not for true customs and immigration purposes, but rather to improperly gather evidence to help the US investigation and prosecution[40]. On the Attorney General's side, he proposed that the examination carried out by CBSA is essential and CBSA officers are not peace officers themselves. Therefore, they were not in the position to execute the arrest warrant and the arrest procedure was not delayed.

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[36] Id.

[37] Id. at Para. 14

Ms. Meng contends that the RCMP's original plan was to execute the provisional warrant by going onto the plane and keeping Ms. Meng back while other passengers disembarked. This plan, she submits, would have conformed to the warrant's requirement that peace officers "immediately arrest" her. However, the plan changed, Ms. Meng contends, to delay the arrest and the corresponding implementation of her Charter rights.

[38] Id.

[39] Id. Para. 29

The Attorney General also denies that Canadian authorities planned to give, or actually gave, covert assistance to US authorities by unlawful means. On the contrary, members of the RCMP and the FBI communicated about what Canadian law required for the transfer of evidence to the USA and acted following the requirements. The Attorney General submits that this can be seen in, for example, the exchange by which the CBSA declined to comply with an FBI request for the substance of Ms. Meng's secondary customs and immigration examination, and instead referred the FBI to the formal mutual legal assistance process.

[40] Id. at Para. 22

Justice Holmes didn't rule on this issue directly, for the hearing held on Dec. 9, 2019, was to decide whether the Defense Application for Disclosure proposed by Ms. Meng should be granted or denied. The information given above is abstracted from the "undisputed facts" part of the court verdict. The credibility can be guaranteed in that, both Ms. Meng and the Attorney General cast no doubt on these facts.

From the point of view of the author, whether or not CBSA officers are "peace officers" makes no sense in the judgement of whether the arrestment was delayed in the YVR Event. Consider the presumption that CBSA officers can be defined as peace officers; as the first Canadian authority dealing with Meng after she arrives in Vancouver, they kept Ms. Meng under their control for hours, in the name of customs and immigration screening process but took no arrestment action. It is beyond doubt that the arrestment was delayed under this presumption.

If the other presumption is to be accepted, that is, CBSA has no authority to execute the arrest warrant, In that case, only RCMP officers were in a position to arrest Meng then. As is mentioned in the court verdict, RCMP officers stood by when CBSA officers dealt with Ms. Meng. They knew for sure that Ms. Meng was the person of interest and the provisional arrest warrant required an immediate arrestment. However, they didn't take any action until the immigration examination came to an end. Their witness and standing by is the direct proof of their delaying the arrestment.[41]

In conclusion, the arrestment procedure was delayed due to subjective factors. With this conclusion, Ms. Meng's Charter rights were partly deprived of in the YVR Event and there stands the chance of process abuse.

B. Argument 2: Whether the Requirements of Double Criminality Should Be Satisfied?

In the hearing and ruling on the matter of double criminality, the requesting state and the person sought disagreed fundamentally about whether the conduct alleged in this case is capable of amounting to fraud, as the double criminality principle requires[42]. The requesting state, the United States of America, made the allegation that Meng Wanzhou had made a false presentation to HSBC, resulting in HSBC's risk of civil and criminal penalties due to its violation of DPA with the United States Department of Justice. While Ms. Meng contended that due to the absence of sanctions on Iran in Canada, Ms. Meng's conduct wouldn't put HSBC at any risk in Canada. Therefore, fraud couldn't be amounted to and the requirements of double criminality couldn't be met either.

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[41] Id. at Para. 12
RCMP officers had been nearby, observing the proceedings at the arrival gate. When the proceedings moved to the secondary immigration screening area, the RCMP officers went as well. However, they did not identify themselves to Ms. Meng or take steps to arrest her until nearly three hours later, when the CBSA officers concluded their process, as I will outline. Nor did the CBSA officers, or anyone else, tell Ms. Meng before that point about the provisional warrant or the fact that RCMP officers were waiting to arrest her.

[42] The Courts of British Columbia: United States v. Meng, 2020 BCSC 785 – 2020/05/27, https://www.bccourts.ca/jdb-txt/sc/20/07/2020BCSC0785.htm (last updated Nov. 21, 2021)
The parties disagree fundamentally about whether the conduct alleged in this case is capable of amounting to fraud, as the double criminality principle requires.

The allegations of the US were made in ROC (Record of the Case) and SROC (Supplemental Record of the Case). "These allegations were unproven, but they were presumed to be true" and were admitted by the court in the proceedings unless solid evidence was adduced by the defendant to prove that the allegation is false.[43]

The requesting state alleged that Ms. Meng Wanzhou had lied on the relationship between Huawei and Skycom, an Iran-based company, during her presentation. According to ROC and SROC, the requesting state claimed that Huawei in reality continued to control Skycom and its banking and business operations in Iran after selling the share of Skycom and Ms. Meng's resignation from the board of Skycom[44]. In Ms. Meng's presentation, she mentioned that she was once a member of the board but she resigned from Skycom's board later and Huawei had ceased the financial communications with Skycom. However, the US denied the explanation by contending "Skycom employees had Huawei email addresses and badges, and some used Huawei stationery. Skycom's directors, and the signatories to its bank accounts, were Huawei employees. The company that had purchased Huawei's shareholding in Skycom did so with financing from Huawei, and its banking and business operations were under Huawei's control."[45]. On this ground, the United States accused Ms. Meng of fraud.

The key problem in deciding whether the requirements of double criminality are met was: whether Ms. Meng's conduct amounts to fraud in Canada. s. 380(1)(a) of the Criminal Code reads as follows:

"380 (1) Ever one who, by deceit, falsehood or other fraudulent means, whether or not it is a false pretense within the meaning of this Act, defrauds the public or any person, whether ascertained or not, of any property, money or valuable security or any service,

(a) is guilty of an indictable offence and liable to a term of imprisonment not exceeding fourteen years, where the subject matter of the offence is a testamentary instrument or the value of the subject-matter of the offence exceeds five thousand dollars:[46]

Therefore, dishonest conduct with a corresponding deprivation is an essential and primary condition of fraud in the Canadian Criminal Code. It should be noted that there existed no Canadian sanctions on Iran when the case took place and the only risk

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[43] Id. at Para. 8,
It is important to note that these allegations are unproven but must be taken as true for the purpose of this application. Ms. Meng intends to dispute the allegations, but accepts that this application must be argued as though they were unchallenged.

[44] Id. at Para. 17,
Although Huawei had sold its shareholding in Skycom some years before the August 2013 meeting, and Ms. Meng had resigned from Skycom's board, Huawei in reality continued to control Skycom and its banking and business operations in Iran. Skycom employees had Huawei email addresses and badges, and some used Huawei stationery. Skycom's directors, and the signatories to its bank accounts, were Huawei employees. The company that had purchased Huawei's shareholding in Skycom did so with financing from Huawei, and its banking and business operations were under Huawei's control.

[45] Id.

[46] The Courts of British Columbia: United States v. Meng, 2020 BCSC 785 – 2020/05/27, https://www.bccourts.ca/jdb-txt/sc/20/07/2020BCSC0785.htm (last updated Nov. 21, 2021) at Para. 24.

HSBC might face derived from the US sanctions. There were two approaches to decide on the existence of "corresponding deprivation": Firstly, HSBC would not be prosecuted in Canada and no deprivation would be caused accordingly. Secondly, there's no need to consider the source of deprivation, since HSBC might be prosecuted by USDOJ, the corresponding deprivation should be deemed as existential. Justice Holmes was in favor of the latter explanation, which was also held by the Attorney General.

In Meng Wanzhou's case, the issue of double criminality is in essence a matter of what role can foreign laws or regulations play in the extradition practice. As the statements, Meng cited, "the extradition judge is not concerned with foreign law at all[47]". Ms. Meng contended that the reference to US sanctions was in essence the quotation of foreign laws and this could be offensive to Canadian values. In brief, the lack of sanctions on Iran in Canada led to no deprivation and the charge of fraud couldn't be amounted to.

However, Justice Holmes disagreed with Ms. Meng and dismissed her application. In the matter of the admissibility of US sanctions in this case, she proposed that "Ms. Meng's approach to the double criminality analysis would seriously limit Canada's ability to fulfill its international obligations in the extradition context for fraud and other economic crimes[48]". That is, as long as there doesn't exist restrictions on other nations in Canada, the person involved in the case stands no chance of being successfully extradited on condition that no Canadian interest is infringed, since no deprivation can be caused in Canada. Justice Holmes maintained that this approach is unacceptable, for it would limit the extension of Canadian jurisdiction in the field of economic crime and the intended purpose of strengthening international legal cooperation might fail.[49] More specifically, Justice Holmes emphasized in the judgement that fraudsters making false statements in the interest of unlawful benefits are always completed through international approaches and only by taking the conduct-based method in the analysis of double criminality can Canada play its role in combating criminality of this type, namely, how the victim of fraud is confronted with risk doesn't make sense in the identification of double criminality.

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[47] Id. at Para.55,
In support of this position, Ms. Meng cites the statement of La Forest J. in R. v. McVey at 529, that "the extradition judge is not concerned with foreign law at all"; as well as that of Charron J. in Fischbacher at para. 35, that "the role of the extradition judge does not include any review of the foreign law"; and similar source or derivative statements in other governing authorities. See, for example, Norris v. Government of the United States of America, the Secretary of State of the Home Department, Bow Street Magistrates' Court, [2008] UKHL 16 at paras. 65 and 78-80.

[48] Id. at Para. 82.
Ms. Meng's approach to the double criminality analysis would seriously limit Canada's ability to fulfill its international obligations in the extradition context for fraud and other economic crimes. The offence of fraud has a vast potential scope. It may encompass a very wide range of conduct, a large expanse of time, and acts, people, and consequences in multiple places or jurisdictions. Experience shows that many fraudsters benefit in particular from international dealings through which they can obscure their identity and the location of their fraudulent gains. For the double criminality principle to be applied in the manner Ms. Meng suggests would give fraud an artificially narrow scope in the extradition context. It would entirely eliminate, in many cases, consideration of the reason for the alleged false statements, and of how the false statements caused the victim(s) loss or risk of loss. By that approach, Wilson, described above, would, it seems, require a different result.

[49] Id.

In addition, Ms. Meng's contention that if foreign laws play a part in the double criminality analysis, the extradition process may, in some cases, indirectly help to enforce laws based on policy offensive to Canadian values,[50] but Justice Holmes voiced her disagreement on this contention. In the paper of judgement, she didn't deny the possibility of Canadian values' being offended by the enforcement of foreign laws on the whole, but she argued that the application of foreign laws concerning economic crimes aren't "fundamentally contrary" to Canadian values. She noted that laws concerning economic criminalities and slavery differed greatly that they should be distinguished when the issue is discussed.[51] Except for the type of crime that can determine the identification of double criminality, the Minister of Justice's final decision of extradition is also a barrier against value offense. Even though in the extradition hearing, the judge released the judgement in favor of requesting state, on condition that the values are invaded, the Minister of Justice should refuse to surrender.

On these grounds, accepting the conduct-based analysis and taking the aim of international cooperation in combating criminality into consideration, Ms. Meng's application was dismissed and the requirements of double criminality were met.

C. The Analysis of Law Ideology on the Basis of Meng Wanzhou Case

As is suggested in Article written by Perino: Law, Ideology, and Strategy in Judicial Decision making: Evidence from Securities Fraud Actions, "Empirical studies have repeatedly shown that ideology matters, although it is not outcome determinative; as a result, the attitudinal model largely dominates judicial politics."[52] Furthermore, the attitudinal model has received great challenges recently and the factors of law ideology carry more weight.

In many situations where conflicted interpretation of regulations exists, an intermediate standard stands more chance of being widely accepted.[53] The trend can be deemed as the proof of the role law ideology plays in practice. In the face of vague laws or regulations, the conservative or liberal attitudes towards the law from a judge is determined by the ideology he or her holds and it is the uncertainty and unclarity of the law itself that evokes possible disputes and drive judges from lower-level courts to choose intermediate methods. As is mentioned in the literatures, the avoidance of reversal by the court of appeal is one of the contributing factors due to differed ideologies.[54]

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[50] Id. at Para. 83.
Finally, I will address the concern raised by Ms. Meng that if foreign laws play a part in the double criminality analysis, the extradition process may, in some cases, indirectly help to enforce laws based on policy offensive to Canadian values. The 1860 decision of the majority of the Court of Queen's Bench of Upper Canada in Anderson, Re (1860), 20 U.C.Q.B. 124 (U.C.C.A.) provides a good example, where the double criminality analysis in relation to an alleged murder in Missouri relied in part on US laws concerning slavery. Even today, one could construct a scenario in which hypothetical foreign slavery laws could lead to conduct for which the equivalent Canadian offence would be fraud. Should the offensive character of the foreign laws play no part in the double criminality analysis?
[51] Id.
[52] Michael A Perino, Law, Ideology, and Strategy in Judicial Decisonmaking: Evidence from Securities Fraud Actions 29, 498.
[53] Id. at 500.
[54] Perino, supra note 56.

In Meng Wanzhou's case, the influence of ideology, from the author's point of view, appears mainly in the identification of double criminality. Justice Holmes believed that the extradition decision of approval concerning human right offenses should have higher threshold than mere financial crimes.[55] Since according to the Extradition Act of Canada, as long as the offense reaches a certain level of severity and is punishable in Canada, the person sought can be extradited to the requesting state, there leaves much room for the extradition judge to decide on the identification of double criminality under the influence of ideology. The requirements of identification test the similarities of law ideology between nations. The ruling of Meng Wanzhou's case demonstrates that Justice Holmes holds the view that between Canada and the United States, they share more common values or ideologies in the matter of financial crimes than other types of criminality.

As far as the long-term influence of the judgment is concerned, since the previous judgements may be the legal basis of subsequent judgements in Canada, it is plausible that the lower extradition threshold for financial crimes eventually be a trend in Canadian legal practice. Meanwhile, the legal cooperation between nations, namely Canada and the US, gradually gets strengthened with the frequent admission of extraditing the person in charge. The analysis above provides an example of how law ideology makes sense in the international legal aspects, but it doesn't mean that law ideology only has an effect on the threshold of extradition.

Apart from the different levels of caution paid in different types of extradition cases, the law ideology gets into every aspect where the personal reasoning of the judge is required. For example, if the person sought is to adduce evidence, the judge will be in the position of deciding on the reliability of the evidence, which will ultimately lead to the admission or denial of the evidence. In Meng Wanzhou's case, she and her counsel put forward four applications requesting to adduce evidence but most of which were denied by Justice Holmes for lack of relevance. Since the reasons for judgement were given according to the judge's personal recognition, law ideology once again determines the critical issues of extradition cases. However, since no sufficient evidence points to the close relationship between Justice Holmes's ideology and her judgements, the discussion concerning law ideology will come to a stop here.

IV. EXTRADITION PRACTICE II: A CASE TO BE COMPARED WITH IN THE FIELD OF EXTRADITION——THE MINISTER OF JUSTICE V HENRY C. FISCHBACHER

A. Facts and Comparisons

Henry Fischbacher was the respondent in this case. In the extradition case, he was alleged of murder and was about to be extradited to the US. In this case, the Minister of Justice intended to extradite him for the offense of first degree murder. In the Court of Appeal For Ontario, it held that "it was unreasonable to order F's surrender for first degree murder in the absence of evidence of the essential element of

[55] See The Courts of British Columbia: United States v. Meng, 2020 BCSC 785 – 2020/05/27, https://www.bccourts.ca/jdb-txt/sc/20/07/2020BCSC0785.htm (last updated Nov. 21, 2021)

premeditation at the committal proceeding"[56]. Although in this case, the requirements of double criminality were met, the ruling on the type of crime and the level of offense are what should be paid attention to.

Fischbacher was alleged to have struck his wife on the head during a heated debate which led to his wife's unconsciousness. Later on, he dragged his wife's body to the swimming pool in the backyard. The facts stated above can be proved by the evidence listed in the Amended Record of the Case. After murdering his wife, Fischbacher fled America and entered Canada, where he was arrested.[57]

Fischbacher himself accepted to face the trial in Arizona, deciding whether he was guilty of second degree murder. However, the Minister of Justice insisted on extraditing him for the offence of first degree murder. Although both first and second degree of murder belongs to the type of crime, murder, they differed greatly in moral blameworthiness and the composition of first degree of murder includes "planning and deliberation". [58] For lack of evidence proving the planning and deliberation, the extradition judge of The Court Of Appeal For Ontario refused the application of the Minister of Justice, surrendering Fischbacher for the offence of first degree murder.

Considering the purpose of the extradition procedure and the conclusion reached in the former part of this note, it is apparent that the detailed decision of types of crime is not the focus of this process. However, much effort, including the hearings between the respondent and the Minister of Justice has been made in deciding whether the offense should be first or second degree murder in the case. Although this procedure is different from the ruling on double criminality in Meng Wanzhou's case, it still proved that the types of crime are not that unimportant and irrelevant as is mentioned in Meng's case. Besides, in the matter of evidence, the judge of SCC didn't support the Minister of Justice on the grounds that there's no sufficient evidence proving the "planning and deliberation" necessary for composing the first degree murder. In this period, the judge played a most important role in the decision and Fischbacher himself didn't provide evidence to contend that he didn't plan to murder his wife and the deliberation didn't exist. Compared with the allegations made by the requesting state

[56] SUPREME COURT OF CANADA-Supreme Court Judgments: Canada (Justice) v. Fischbacher, 2009 SCC 46, https://decisions.scc-csc.ca/scc-csc/scc-csc/en/item/7821/index.do?q=henry+fischbacher (last visited Jan. 15, 2022) F was indicted of first degree murder in Arizona in relation to the death of his wife. The United States requested his extradition. The Minister of Justice authorized the request, identifying the corresponding Canadian offence in the authority to proceed as “murder, contrary to s. 231 of the Criminal Code” without particularizing the crime as first or second degree murder. The Attorney General proceeded to a committal hearing and the extradition judge committed F for the offence of second degree murder, finding no evidence of planning and deliberation to justify committal for first degree murder under Canadian law. No appeal was taken from the committal order. The Minister subsequently ordered F’s surrender to face trial for first degree murder in the United States. F sought judicial review of the Minister’s decision. The Court of Appeal held that the principle of double criminality was met but, applying the “misalignment test”, it held that it was unreasonable to order F’s surrender for first degree murder in the absence of evidence of the essential element of premeditation at the committal proceeding. The court allowed the application for judicial review and remitted the matter to the Minister for reconsideration.

[57] Id.

[58] Id.

in Meng Wanzhou's case, the Attorney General also failed to provide evidence proving that Huawei and Ms. Meng have financial communications with Skycom, enough to put HSBC at risk, but this allegation was taken as true. In addition, although Ms. Meng tried to adduce critical evidence that may well prove that HSBC knew the relationship in question clearly, the application was denied, for the relevance is not acceptable according to Justice Holmes. Furthermore, summarizing the judgement of the Meng Wanzhou's case, the sentencing and decision of crime are left for the requesting state, in the requested state, whether a similar type of crime can be established is of primary importance. While in the Fischbacher's case, it is clear that the crime can be established, but only the degree of crime aroused argument, however, this argument managed to lead the procedure of extradition to a pause.

On the whole, the ruling on the Fischbacher's case and that on Meng Wanzhou's case differed in the following aspects as far as legal procedure is concerned:

1) the role the types of crimes play in the extradition practice

2) the allocation of the burden of proof

3) the admissibility of evidence in the hearings

B. Discussion

It should be clarified here that the key procedural difference between the Meng Wanzhou's case and Fischbacher's case is that: in the former case, the parties attending the hearing are the respondent and Attorney General on behalf of the requesting state, while in the latter one, the parties are the Minister of Justice (Appellant) and the respondent. Therefore, a detailed comparison between corresponding phases cannot be made in this part of the note, but it makes no difference in comparing the general principles of extradition practice shown in these cases.

1) Judicial phases and the influence of political factors

The final surrendering of the person sought from Canada, according to the Extradition Act, must go through two phases different in nature. The first, the judicial phase, encompasses the court proceedings which determine whether a factual and legal basis for extradition exists. If that process results in the issuance of a warrant of committal, then the second phase is activated. There, the Minister of Justice exercises his or her discretion in determining whether to issue a warrant of surrender. The first decision-making phase is certainly judicial in its nature and warrants the application of the full panoply of procedural safeguards. By contrast, the second decision-making process is political in its nature. "The Minister must weigh the representations of the fugitive against Canada’s international treaty obligations"[59].

The citation clarified that political factors serve as an integral part of extradition practice for the Order for Surrender to be made by the Minister of Justice is the final stage of the three-stage process. It is the discretion of the Minister to weigh the person's conduct and the purpose of extradition in each case. The Minister should also refuse

[59] Id. at Para. 44 citing " Idziak v. Canada (Minister of Justice), [1992] 3 S.C.R. 631."

to surrender if the extradition may be unjust or oppressive. Apparently, the weighing of international justice cooperation doesn't belong to the field of sheer justice at least, and the levels of cooperation are also determined on the basis of inter-relationship. Besides, as is mentioned in the verdict of the Meng Wanzhou's case, Justice Holmes held that it is the Minister's authority to decide whether the extradition is against the Canadian values. If so, the Minister has the authority to suspend the extradition. In essence, Holmes's ruling is a detailed explanation of so-called "unjust and oppressive". Therefore, the conclusion reached in this note is, the order of surrender is the combination of legal procedure and political factors and it is impossible to totally eradicate the effects of political factors in extradition practice.

2) In the matter of evidence that should be included in the ROC and SROC

In the Fischbacher's case, the United States made a formal diplomatic request for the extradition of the Respondent for "the offense of first degree murder.[60]" However, in the last stage, the order to surrender on the charge of first degree murder was denied by the court for lack of evidence proving the existence of "planning and deliberation" which is essential to compose a first degree murder. Instead, given the level of evidence provided, the court held that extraditing for a second degree murder is proper. It can be concluded that to extradite a person on the request, the requesting nation should at least provide a certain standard of evidence that is sufficient to enable the case to go to trial in Canada. In the Fischbacher's case, the United States provided evidence on the following list: the domestic argument and the killing, the leaving of the body in the pool[61]... Though not able to prove the deliberation of the respondent, they clearly proved the fact of murder.

In the Meng Wanzhou's case, the requesting state alleged that she should be prosecuted with fraud. Fraud in the Criminal Code of Canada is defined as:

"380 (1) Everyone who, by deceit, falsehood or other fraudulent means, whether or not it is a false pretense within the meaning of this Act, defrauds the public or any person, whether ascertained or not, of any property, money or valuable security or any service,

(a) is guilty of an indictable offence and liable to a term of imprisonment not exceeding fourteen years, where the subject-matter of the offence is a testamentary instrument or the value of the subject-matter of the offence exceeds five thousand dollars; or

(b) is guilty

(i) of an indictable offence and is liable to imprisonment for a term not exceeding two years, or

[60] *Id.* at Para. 9
[61] *Id.* at Para. 36.

(ii) of an offence punishable on summary conviction, where the value of the subject-matter of the offence does not exceed five thousand dollars. "[62]

The Supreme Court of British Columbia held that "fraud is established by proof of subjective knowledge of the prohibited act and subjective knowledge that the prohibited act could have as a consequence the deprivation of another"[63]. Similar to requirements of "planning and deliberation", the fraud requires "subjective knowledge of possible deprivation". The establishment of possible deprivation was clearly stated in the court verdict: HSBC's providing financial services to companies having business in Iran violates the DPA, leading to its risk of civil and criminal penalties. But the evidence in ROC didn't sufficiently prove that Ms. Meng had subjective knowledge. More importantly, the relationship between Huawei, Ms. Meng and Skycom wasn't clear enough to prove that there exists cause and effect relationship between Meng's presentation and possible deprivation.

In the hearing, the position of Ms. Meng was that she resigned from the board of Skycom years ago and Huawei had ceased the financial communications with Skycom. HSBC's providing loans to Huawei (the parent company) instead of the Huawei subsidiary will not lead to deprivation. On the other side, the Attorney General contended that "Ms. Meng's false statements about Huawei's relationship to Skycom prevented HSBC from taking into account all of the material facts when it was assessing the risk of maintaining the client relationship"[64].

In the hearing, the Attorney General only put forward the position, but no sufficient evidence was provided in the ROC to support his argument and it couldn't establish a case capable of going to trial in Canada. In this situation, Justice Holmes still decided that the requirements of double criminality be met in the absence of sufficient evidence, neglecting the problem: whether the relationship between Huawei and Skycom may lead to deprivation of HSBC. It should be noted that Holmes required this question to be determined at a later stage in the proceedings[65] and the question

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[62] See The Government of Canada: Criminal Code (R.S.C., 1985, c. C-46), https://laws.justice.gc.ca/eng/acts/C-46/page-51.html#h-122424 (last updated Nov. 17, 2021) ("PART IX Offences Against Rights of Property (continued)")

[63] See The Courts of British Columbia: United States v. Meng, 2020 BCSC 785 – 2020/05/27, https://www.bccourts.ca/jdb-txt/sc/20/07/2020BCSC0785.htm (last updated Nov. 21, 2021) ("Correspondingly, the mens rea of fraud is established by proof of:1. subjective knowledge of the prohibited act; and 2. subjective knowledge that the prohibited act could have as a consequence the deprivation of another (which deprivation may consist in the knowledge that the victim's pecuniary interests are put at risk).

[64] The Courts of British Columbia: United States v. Meng, 2020 BCSC 785 – 2020/05/27, https://www.bccourts.ca/jdb-txt/sc/20/07/2020BCSC0785.htm (last updated Nov. 21, 2021)
In support of the first basis, the AG says that deprivation can be established without reliance on US sanctions and their effects. Specifically, Ms. Meng's false statements about Huawei's relationship with Skycom prevented HSBC from taking into account all of the material facts when it was assessing the risk of maintaining the client relationship. He submits that this put HSBC at risk, whether or not there was any real possibility of loss in the circumstances. This basis of risk was entirely independent of US sanctions, and is sufficient on its own to satisfy the double criminality test about fraud, the AG submits.

[65] Id. at Para. 90.
I make no determination of the larger question under s. 29(1)(a) of the Act of whether there is evidence admissible under the Act that the alleged conduct would justify Ms. Meng's committal for trial in Canada on the offence of fraud under s. 380(1)(a) of the Criminal Code. This question will be determined at a later stage in the proceedings.

wouldn't affect the identification of double criminality. Therefore, the required level of evidence to make allegations in the aim of extradition varied greatly.

CONCLUSION

This note examined part of the substantial parts of extradition practice, looked into the details of Meng Wanzhou extradition case and compared this case to another typical case. I reached the conclusions listed as follows:

The arrestment procedure (i.e., YVR Event) didn't meet the requirements of a provisional arrest warrant issued by Justice Fleming, for the arrestment was delayed due to contrived factors. Meanwhile, Ms. Meng's Charter rights were deprived of partly due to the delay.

On the whole, the approach of double criminality analysis is conduct based, which is the trend in modern extradition practice for the sake of international cooperation in combating criminality. The types of crime don’t need to be exactly the same, similar crimes in both countries are sufficient to extradite.

In the matter of the sovereignty of justice, the threshold for foreign laws to enter the domestic legal system is lower when it comes to financial crimes such as fraud, in the Meng Wanzhou's case, than that of ethical crimes.

The standard of evidence required for the requesting state to make allegations in the extradition procedure is rather low than that of trial in the requesting state for evidence sufficient to go to trial in Canada will be enough to surrender the person sought.

There's no extradition case that can completely eradicate the influence of political factors, for in the second phase, the order of surrender is made by the Minister of Justice and the Minister should make the decision based on his(her) weighing of extradition purpose and the person's conduct. If the judgment is unjust or oppressive, the surrender procedure should be paused. Therefore, the Meng Wanzhou's case can partly be defined as a political incident due to the political factors involved in the case.

Justice Holmes didn't make any response in the matter of conflicting contentions on the relationship between Huawei, Ms. Meng and Skycom, which plays a very important role in deciding whether the requirement of "subjective knowledge of fraudulent" can be met, arousing my doubt on the impartiality of her ruling on double criminality.

The law ideology may have great effects on condition that the law is vague or leave room for explanation by the judge. In extradition cases, the general law ideology of a nation is directly associated with the chance of the person sought's being extradited. More specifically, the law ideology influences the scales of successful extradition of crimes of different types.

On these grounds, I propose that during the whole process, Ms. Meng was unfairly treated, her rights were violated and possibly, the procedure was abused. I cannot fully rule out the possibility of political interference due to the legal

particularity of extradition practice and the judgment made by Madam Justice Holmes is questionable through the comparison with other typical extradition cases.

A SENTIMENT ANALYSIS MODEL OF A CIVIL SERVICE PERFORMANCE EVALUATION USING A FEMINIST FRAMEWORK:

CASE STUDY OF OPEN GOVERNMENT INFOTMATION IN CHINA

Shurui Cao*

Abstract: This article aims to explore sentiment analysis, a text-analysis tool used to understand how customers feel about a particular piece of content. Through this method, we are able to assess the openness of governments by establishing a dynamic evaluation mechanism of supervision and, consequently, improving the administrative law on a feminist basis. The author of this research built a sentiment analysis model based on the communication between herself and governments, discussing the implication of the model and proposing potential improvements to the administrative law in China.

Keywords: Sentiment Analysis; Feminism; Administrative Law; Open Government Information; Text-analysis

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Table of Contents

INTRODUCTION

Ever since the birth of the Women's Suffrage Movement in the 20th century and nowadays' MeToo movement, feminism has sought to reshape how society functions and people view things. However, hidden and pervasive inequalities, stereotypes, and power relationships within technological transformation, have grown stronger due to the gendered tendency of digital media, automation, and broader technological research fields.[1] Feminists are faced with the challenge of having to reconnect feminist thinking practices with the regressively gendered political debates, social norms, and, most importantly, legal practices.[2] As emotion has remained one of the core conceptions of feminism,[3] incorporating emotion into both private and public law might serve as a legal foundation for feminism.

The author of this article, who identifies as a feminist thinker, sees new opportunities in sentiment analysis. It is a tool that can be considered feminist due to its focus on detecting the emotions in texts to improve administrative law for better communication between governments and citizens and ultimately establish a feminist jurisprudence. The field of law that they will focus on is the Open Government Information Regulations in China, as access to information has become a source of power in the age of big data.[4]

This project analyzes the communication content between citizens and government officials using the sentiment analysis model based on TensorFlow. In Section 2, the researcher will talk about their theories. Then, section 3 will explain the case study, present the model, evaluate the results, and discuss the implication. Finally, in Section 4, they will conclude and propose future directions.

I. THEORETIC BACKGROUND

A. Emotion in Feminism

In recent years, feminism has become a heated field saturated with countless feminist perspectives.[5] One of the feminist viewpoints is postmodernism feminism which is rooted in the works of Derrida[6] and Foucault[7] about postmodernism. During

[1] CATHERINE D'IGNAZIO & LAUREN F. KlEIN, DATA FEMINISM (2020).
[2] JUDITH A. BAER, FEMINIST THEORY AND THE LAW, The Oxford Handbook of Political Science (2011); Mary Jane Mossman, Feminism and Legal Method: The Difference It Makes, 3 Australian Journal of Law and Society (1986).
[3] Linda Ahall, Affect as Methodology: Feminism and the Politics of Emotion, 12 International Political Sociology 36 (2018).
[4] CATHERINE D'IGNAZIO & LAUREN F. KLEIN, DATA FEMINISM (2020).
[5] RORY DICKER & ALISON PIEPMEIER, CATCHING A WAVE: RECLAIMING FEMINISM FOR THE 21ST CENTURY (2016).
[6] JACQUES DERRIDA, STRUCTURE, SIGN, AND PLAY IN THE DISCOURSE OF THE SOCIAL SCIENCES (1972).
[7] MICHEL FOUCAULT, THE ORDER OF THINGS: AN ARCHEOLOGY OF THE HUMAN SCIENCES (1970); PRISON TALK (1980); STRUCTURALISM AND POST-STRUCTURALISM (1998).

the 1970s and 80s, feminist researchers such as Cixous,[8] Irigaray,[9] and Kristeva,[10] also led the postmodern theory to a critique of patriarchal culture. While their works vary, they share the assumption that language and meaning systems can structure experience. They agree on specific themes such as the rejection of dualism, focus on difference, interest in the role of discourse in constructing gendered relations of power and domination, and denial of normalization. Since language can shape the meaning of words in different contexts and discourses, the individual's subjectivity is then susceptible to construction through discourses. In particular, Irigaray rejected the binary oppositions in society such as "feminine" vs. "masculine"[11], stating that women's identity has become the mirror negation to men. In the 1970s, women who were neither white, middle class, nor western started questioning the unitary idea of "woman" as a category to unite women of different classes, nationalities, and races. Feminists like Hooks[12] criticized that traditional feminism was only representative of the white and middle-class women instead of englobing women universally. Such a narrow viewpoint only strengthened structure based on social classes since the needs of women of color and women in a state of poverty had been neglected. Intending to dismantle the man-woman dichotomy, postmodern feminists also seek to consider more variables such as nationality, class, and race.

The importance of emotion has long been neglected if one compares it to logicality. This is because emotion is usually associated with women and irrationality, which makes emotion a subjective concept and one of the focuses of feminist research.[13] Since the 1990s, there has been increasing research on emotions and subjective feelings. In Jaggar's early work,[14] she argued that emotion is essential for epistemology and constructing knowledge. Researchers such as Damasio[15] and Adolphs[16] add that decision-making depends on emotional processing. Reasoning is related to the state of the body as it uses biological information to make advantageous decisions based on past experiences.[17]

B. Emotion in Law

Recent studies have received attention on the presence and importance of affect in law.[18] For feminists, their research on emotions aims to promote women's inclusion

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[8] HÉLÈNE CIXOUS, THE LAUGH OF THE MEDUSA (1976); CASTRATION OR DECAPITATION?, 7 Signs (1981).
[9] LUCE IRIGARAY, THIS SEX WHICH IS NOT ONE (1985).
[10] JULIA KRISTEVA, NEW MALADIES OF THE SOUL (1997).
[11] LUCE IRIGARY, THIS SEX WHICH IS NOT ONE (1985).
[12] BELL HOOKS, AIN'T I A WOMAN? (1981).
[13] Linda Ahall, Affect as Methodology: Feminism and the Politics of Emotion, 12 International Political Sociology 36 (2018).
[14] Alison M. Jaggar, Love and knowledge: Emotion in feminist epistemology, 32 Inquiry 151 (1989).
[15] ANTÓNIO DAMÁSIO, DESCARTES' ERROR: EMOTION, REASON, AND THE HUMAN BRAIN (1995).
[16] Ralph Adolphs et al., Cortical systems for the recognition of emotion in facial expressions, 16 The Journal of Neuroscience : the Official Journal of the Society For Neuroscience 7678 (1996).

[17] Ralph Adolphs et al., Cortical systems for the recognition of emotion in facial expressions, 16 The Journal of Neuroscience : the Official Journal of the Society For Neuroscience 7678 (1996).
[18] Susan A. Bandes & Jeremy A. Blumenthal, Emotion and the Law, 8 Annual Review of Law and Social Science 161 (2012).

in the legal system.[19] By narrating her emotional experience resulting from rape and a confusing episode with the criminal justice system, Estrich argued that the law should take emotions into account. [20] More specifically, she proposed that physical or verbal resistance alone was insufficient to prove the lack of consent and that victims' emotions should also be considered. Feminist scholars also questioned the dichotomy of reason and emotion in law.[21] Researchers like Bender[22] and Menkel-Meadow[23] promoted the combination of reasoning and affective perceptions to improve the quality of legal decision-making.

Researchers from other fields, including legal theory, psychology, and philosophy, also joined the discussion and focused on the complex role of affect within the law. [24] Nussbaum and Kahan insisted that emotions should not be simple physiological and mechanical processes. Instead, they should be seen as authentic cognitivist and evaluative conception.[25] They believed that the evaluative notion of emotions allows studying the relationship between affect and the norms; this enables people to understand how individuals are socialized in this context. They maintained that current institutional practices should also consider how the norms reflect individuals' emotional experiences. In the Passions of Law, the author established that cognitive emotions lead to more moral, accurate, and just decisions. [26]

After exploring the complex relationship between emotion and law, many researchers have come forward and proposed new goals for the law, to reform the current institutional practices.[27]

Below, the author of this work addresses several aspects where the law – such as criminal and tort law – fails to consider emotions in its nature.

Two Conceptions of Emotion in Criminal Law discussed the necessity of applying the evaluative conception of emotions in criminal law doctrines such as voluntary manslaughter and self-defense. [28]

Voluntary manslaughter—The law admits the presence of emotion when assessing the offender's state of mind at the moment of committing the crime. In

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[19] JUDITH A. BAER, FEMINIST THEORY AND THE LAW, The Oxford Handbook of Political Science (2011).
[20] Susan Estrich, Rape, 95 The Yale Law Journal 1087 (1986).
[21] JUDITH A. BAER, FEMINIST THEORY AND THE LAW, The Oxford Handbook of Political Science (2011).
[22] Leslie Bender, From Gender Difference to Feminist Solidarity: Using Carol Gilligan and an Ethic of Care in Law, 15 Vermont Law Review 19 (1990).
[23] Carrie J. Menkel-Meadow, Portia in a Different Voice: Speculations on a Women's Lawyering Process, 1 Berkeley Journal of Gender, Law and Justice 39 (1985).
[24] Terry A. Maroney, Law and Emotion: A Proposed Taxonomy Of an Emerging Field, 30 Law Human Behavior 119 (2006).
[25] Martha Craven Nussbaum & Dan M. Kahan, Two Conceptions of Emotion in Criminal Law, 96 Columbia Law Review (1996).
[26] SUSAN A. BANDES, THE PASSIONS OF LAW (2000).
[27] Susan A. Bandes & Jeremy A. Blumenthal, Emotion and the Law, 8 Annual Review of Law and Social Science 161 (2012).
[28] Martha Craven Nussbaum & Dan M. Kahan, Two Conceptions of Emotion in Criminal Law, 96 Columbia Law Review (1996).

criminal law, emotions like fear, anger, and hate are considered when the court decides the legal category of the offense. The "heat of passion" defense is an example of how a murder crime is downgraded to voluntary manslaughter, as the defendant may have acted on affective reactions following an adequate provocation instead of the malice usually required for murder classification.[29] Even the distinction between adequate and non-adequate provocation is vague, remaining too underinclusive to be categorized in current criminal law.[30] Modern authorities also find it difficult to specify rigid legal categories in advance since an individual's provoked emotions are too diverse. They instead believe that the jury can decide the adequacy of a provocation more accurately than a judge since they come from diverse backgrounds.[31]

Nevertheless, it is also possible that decision-makers like judges and jury members determine the adequacy of the provocation based on whether the law should encourage or not particular actions.[32] Moreover, Nussbaum and Kahan argued that it is difficult to distinguish between justification and excuse for voluntary manslaughter. [33] But the evaluative conception of emotions allows the law to track the appropriateness of the emotional motivations behind the intentional killers'.

Self-defense—Although the law permits citizens to use deadly force when they are faced with an imminent threat to their life, Nussbaum and Kahan further claimed that the affective reactions behind self-defense are more complex than merely instinctive fear or conflict of rights. [34] Apart from life, people also value honor and dignity as they refuse to be subordinate to other people's wrongful acts or will. Therefore, Nussbaum and Kahan believed that the law should include endorsing the evaluation of morally appropriate emotions like dignity.[35]

According to Nussbaum and Kahan, the law should respond to shifting social norms and reforms in current practices, which would allow making better judicial decisions. [36]

While performances of repentance serve as a condition for the application of commutation and parole, the assessment of criminals' repentance also remains problematic in criminal law. [37] For example, in China, criminals' performances of repentance can be objectively shown in their actions and behaviors, such as completed labor tasks and disciplined performances in prison.[38] Although the decline of criminals'

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[29] Deborah E. Milgate, The Flame Flickers, but Burns On: Modern Judicial Application of the Ancient Heat of Passion Defense, 51 Rutgers Law Review 193 (1998).
[30] Martha Craven Nussbaum & Dan M. Kahan, Two Conceptions of Emotion in Criminal Law, 96 Columbia Law Review (1996).
[31] Sanford H. Kadish et al., Criminal Law and Its Processes: Cases And Materials (1995).
Sanford H. Kadish et al., Criminal Law and Its Processes: Cases And Materials (1995).
rovocation, 80 California Law Review 133 (1992).
[33] Martha Craven Nussbaum & Dan M. Kahan, Two Conceptions of Emotion in Criminal Law, 96 Columbia Law Review (1996).
[34] Martha Craven Nussbaum & Dan M. Mahan, Two Conceptions of Emotion in Criminal Law, 96 Columbia Law Review (1996)
[35] Id.
[36] Id.
[37] Liang Geng & Yongqiang Zhang, Determination of Criminals' " True Repentance Performance", 181 Journal of Southwest Petroleum University (Social Science Edition) 68 (2016).
[38] Id.

threat to society can be indeed shown in their personal feelings of regret, it isn't easy to assess their subjective emotions regarding repentance. For this purpose, researchers proposed that it is necessary to have an assessment system to meticulously evaluate criminals' repentance, such as a psychological evaluation mechanism or a questionnaire mode. [39]

Similarly, in the tort of infliction of emotional distress, the assessment of emotion remains an issue of dispute. In the workplace, it is not uncommon for employees to suffer from anguish, fright, or grief, which directly results from their employers' intentional or reckless actions such as discrimination or verbal abuse.[40] However, the real challenge linked to emotional damages is distinguishing where the defendant exceeds the limit and discerning the plaintiff's emotional distress on a unitary standard. For example, elusive and vague terms defined in the Tort Law of the United States, such as "extreme emotional distress" and "the defendant's conduct was outrageous" lead to "entirely different things to different judges"[41] which results in diverse decisions in different contexts.

C. Feminism and Law

In Feminism and the Power of Law,[42] author Carol Smart argues that the power of the law only disqualifies women's experience and knowledge while ignoring their concerns only because the law reflects a predominantly masculine culture. MacKinnon held similar views as she rejected the male view of sex in the rape law. She claimed that the rape law does not protect women because it is male-gendered.[43] She also promoted a feminist or ungendered jurisprudence to represent women and their experiences.[44] As discussed in the previous section, there is the need to establish a mechanism to assess or quantify emotions in the scope of the law. Law reforms associated with emotions can potentially push towards the construction of feminist jurisprudence, as emotion is one of the core conceptions of feminism.

D. Quantification of Emotions in the Private Sector

The private sector has already started quantifying emotions using technologies like sentiment analysis.[45] Sentiment analysis is a fast-developing technology that systematically identifies and quantifies affective information using natural language processing, content analysis, computational linguistics, and biometrics. The early 2000s saw an outbreak of sentiment analysis focused on product reviews published by

[39] Id.
[40] Regina Austin, Employer Abuse, Worker Resistance, and the Tort of Intentional Infliction of Emotional Distress, Faculty Scholarship at Penn Law (1988).
[41] Russell Fraker, Reformulating Outrage: A Critical Analysis of the Problematic Tort of IIED, 61 Vanderbilt Law Review (2008).
[42] CAROL SMART, FEMINISM AND THE POWER OF THE LAW (1989).
[43] CATHARINE A. MACKINNON, TOWARD A FEMINIST THEORY OF THE STATE (1991).
[44] Id.
[45] Kushal Dave et al., Mining the peanut gallery: opinion extraction and semantic classification of product reviews, the Twelfth International Conference (2003).

customers over the internet.[46] Nowadays, many companies employ this technology for various topics and purposes, such as customer reviews and social media content.

Companies like IBM, Intel, and Twitter started to use sentiment analysis in the 2010s on employees' internal blogs, posts on internal social networking sites, and surveys. The objective was to analyze the employees' sentiment and identify those topics that raised strong opinions.[47] By identifying and responding to these issues, these companies seek to maintain good communication with their employees and long-term retainment.

Unilever started tracking customers' reviews in 2018 and updated this approach in 2020 by incorporating sentiment analysis.[48] Thanks to the study of reviews and ratings found on different websites, Unilever can identify key words, common themes and create product scores. These insights enable Unilever to create higher-quality products and improve customer experience. For example, Unilever proceeded to redesign the packages of its home care products in China after noticing leakage issues.

In marketing, sentiment analysis is widely used to associate customers' emotions with customer satisfaction and potential future sales. For example, researchers have analyzed major topics, tourists' emotions, and hot spots in Disneyland with social media analytics and geographic information system analysis.[49] Such studies propose new frameworks for marketers to better understand their customers.

After seeing the success of sentiment analysis in the private sector, the author of this study suggests extending it to the public sector, such as the administrative law. For example, administrative law could benefit by focusing on the issues raised by bureaucracy and transparency when open government information is requested.

II. CASE STUDY

In this case study, the researcher uses sentiment analysis to detect emotions in communication between the Departments of Education of 34 Chinese municipalities and I. They then apply a TensorFlow-based model to dialogue data collected from our phone calls.

A. Background

Article 27 of the Open Government Information Regulation published on April 4, 2007, and effective on May 15, 2019,[50] states that citizens, legal persons, or other

[46] Id.
[47] Rachel King, How Do Employees Really Feel About Their Companies?, THE WALL STREET JOURNAL, (2015), https://www.wsj.com/articles/how-do-employees-really-feel-about-their-companies-1444788408.
[48] Unilever, How Your Product Reviews Are Shaping Out Brands (2020), https://www.unilever.com/news/news-and-features/Feature-article/2020/how-your-product-reviews-are-shaping-our-brands.html?utm_source=UI&utm_medium=Social&utm_campaign=AlwaysOn.
[49] Seunghyun "Brian" Park et al., Linking emotion and place on Twitter at Disneyland, 35 Journal of Travel & Tourism Marketing 664 (2018).
[50] Open Government Information Regulation of the People's Republic of China (promulgated by St. Council, Apr. 4, 2007, reviewed Apr. 3, 2019, effective May. 15, 2019), art. 711, 2019, P.R.C Laws (China).

organizations may request relevant government information from local people's governments at all levels. This additional clause applies to the information that was already voluntarily disclosed by governments, citizens, legal persons, or other organizations. According to Article 28, administrative agencies shall establish and improve channels that facilitate individuals and organizations in requesting government information.

According to this regulation, the process of requesting the information is twofold. Firstly, the person or entity submits a request for open government information by completing an application form via email, letter, fax, online website, or in person. These application forms require personal information (name, identity, contact information), the title, document number, or other specific description of the government information, and means and channels for accessing the data. Secondly, after receiving the request, the administrative agency provides guidance. For example, if the request contains ambiguous content, the agency may notify the requester to apply the necessary supplements or corrections within seven working days from submission. If the administrative agency can respond on the spot, it shall do so. If it cannot, it shall reply within 20 working days from the date of receipt of the request.

Administrative law clearly states that citizens can always request open government information. However, such information is not always easily accessible. In the author's personal experience with requesting government information from the Department of Education, several problems eventually hindered the obtention of such information. These problems might be universal to a lot of people.

Firstly, the application processes can be excessively complicated. The Department of Education usually accepts applications via email, mail, fax, or online forms. However, 6 out of the 34 municipalities in China do not accept applications submitted via online forms and one municipality only accepts applications via mail and fax. Even if an online application is available, the application form can be inconvenient. Application websites require the individual or entity to register an account. Sometimes there is a word limit in the application form, which makes it too short to allow the person or entity to fully explain their needs. Some municipalities even require citizens to provide specific documentation numbers linked to the information they need. This can be difficult to find for citizens that are not savvy or familiar with the open information government system. All such inconveniences cause citizens to spend unnecessary time on the application processes.

Furthermore, the communication between government officials and citizens can be discouraging. For example, after the researcher of this study submitted several application forms, government officials usually made phone calls to inform them of the application status. In their conversations, some officials were impatient and kept paltering with the author's questions. Some even asked them to cancel their application, which logically interfered with accessing the information. The official's irresponsible behaviors and negative attitudes made the researcher feel disrespected and ignored. These adverse emotional reactions greatly discouraged them from further requesting information. They also led to increasing distrust in the officials and governments' capabilities to serve the citizens.

Therefore, in this case study, the author explores how emotions can help governments better communicate with citizens and how administrative laws should improve this issue.

B. Data Collection

The methodology for collecting data was to request the same pre-specified information from the 34 provincial-level education departments in China. Using the benchmark of the U.S. Department of Education, the author chose 5 topics provided by the U.S. Department of Education but seldom provided by provincial education departments in China, including the following:

1. Campus security information refers to the number of cases of crimes which have happened on university campus during 2017 and 2020;

2. Student loan information refers to the total amount of loan offered by governments, annual repayment ratios, and demographics of students who have received such loans during 2017 and 2020;

3. Government funds distribution refers to the types of universities and projects that government funds have been allocated to during 2017 and 2020;

4. Teacher demographics refers to teachers' average salaries and benefits, educational backgrounds, and gender ratios in universities during 2017 and 2020;

5. Students demographics refers to students' ethnicity, race, disability, family income range, and gender during 2017 and 2020.

6. I recorded and transcribed the content of the phone calls between me and government officials and I during the process of requesting government information.

C. Model Setup

I will use Tensorflow to conduct sentiment analysis on the datasets, which are the responses given by the government officials during our phone calls.

Firstly, after I collect the responses, I divide the sentences into two groups (positive or negative) and label each sentence with a value from 1 or 0 (1 for positive or 0 for negative) according to my emotional reaction in response to government officials' communication. Positive sentences are defined to be responses that make me feel positive and that the responses are efficient and helpful during communication. They mainly include making explanations, asking questions or stating facts in a clear and polite manner with reference to specific articles from administrative law or government documentation. Sometimes the case is that the government officials refuse to disclose certain information but explain their reasoning clearly and provide the specific articles to support their arguments. I still label these sentences as positive as the officials' responses show their good attitudes which makes me feel respected, even if the result of the response is negative. On the contrary, negative responses are replies that influence my emotions negatively. Examples include the following:

- The officials' behavior is impolite, for example, interrupting me abruptly, sneering, speaking with an sarcastic or impatient tone, and so on;

- The officials are perfunctory in their responses and attitudes, such as not answering my questions directly, refusing to provide further explanation, or speaking without any support of government regulations or documentation;

- The officials make proposals that exploit loopholes in the administrative processes to reduce their workload, for example, asking me to withdraw my applications from my end so that they do not need to push forward my requests.

- The above responses make me feel disrespected and paltered with, and consequently discourage me from further requesting government information, which violates the ultimate purpose of communicating with government officials.

Secondly, cleaning sentences includes removing punctuation marks. As Chinese words typically consist of two or more characters, I use Jieba to divide sentences into lists of meaningful words and tokenize these lists. As the sentences vary in length, I set the length to be the mean token length plus two standard deviations. Under the assumption that the lengths of tokens follow normal distribution, the length that I use (75 in this case) covers approximately 95% of the samples. I build an embedding matrix which is [numwords, embeddingdim].[51] Numwords is the number of words that I use in the dataset and in this case I set it to 50000. Embeddingdim is 300. [52]

Finally, I split my dataset into train and test sets and use GRU to build my model. When the sentences are inputted, the model outputs the prediction of the sentiment of the sentence, which is a coefficient between 0 and 1. If the coefficient is between 0.5 and 1, the sentence is considered to be positive, and otherwise it is negative.

D. Evaluation

Out of the dataset of 248 sentences, I label 158 sentences to be positive whereas the model predicts 204 sentences to be positive. The following are examples where my opinions and predictions of the model differ:

['[Silence] I don't know what you think, but if you are in a hurry to write this paper [silence], is it necessary to get the thing in early August?', TRUE, 0.6262503]

In this response, the government official questions my need in an impatient manner and stops talking twice. In a way, he urges me to stop my application and just accept that no information will be provided. This response makes me feel forced, which negatively impacts my satisfaction with the communication. The model predicts a coefficient of 0.6262, which is considered to be positive. The erroneous prediction might result from the lack of negation in the response. Text wise the response seems

[51] Shen Li et al., Analogical Reasoning on Chinese Morphological and Semantic Relations, 2 Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics 138 (2018); Yuanyuan Qiu et al., Revisiting Correlations between Intrinsic and Extrinsic Evaluations of Word Embeddings, Springer Cham 209 (2018).

[52] Shen Li et al., Analogical Reasoning on Chinese Morphological and Semantic Relations, 2 Proceedings of the 56th Annual Meeting of the Association for Computational Linguistics 138 (2018).

that the official simply asks for my opinion but in the context it seems aggressive. Hence it is understandable for the model to give a positive prediction solely based on the text.

['The first question you asked is that the data on the total amount of state student loans received by Beijing college students provided each year, right? Firstly, because Beijing has two types of colleges and universities, one is ministry-affiliated colleges and the other is municipal colleges. There are more than 30 affiliated colleges and universities. They all cooperate with banks on their own. They are not under our supervision. Then we are only responsible for the national student loans of some municipal colleges, so we can't provide the data you mentioned, that is, the total amount of this loan, we don't have this data now.', False, 0.30860615]

In this response, the government official provides a detailed explanation of the types of colleges in Beijing, and explains the reason that the information cannot be provided. I consider this response to be positive as the official explains with patience and details, even if she is not able to provide the information. However, the model predicts a coefficient of 0.3086 which is negative. The decision might have been made because, text wise, the response is a negation. I also notice such errors in other long sentences which I consider positive but the model predicts to be negative. It might be due to the length of the sentences and the model might need more long sentences in its train dataset to offer a more accurate prediction.

E. Implication

1. Emotional Value

Emotional value, defined as people's perceived utility derived from a product's capacity to arouse feelings or affection.[53] Nowadays, to boost their competitiveness, companies have paid increasing attention to design and user experience, which can influence customers' behaviors and increase their emotional values.[54] The superiority of emotional value compared to functional value, the perceived utility derived from functional and utilitarian performance, has been discussed especially by the marketing and consumer goods industries.[55] Some research shows that functional superiority can be defeated by emotional values that appeal to customers' sensibilities.[56] Studies also show that emotional value can contribute more to corporate brand image than functional value.[57]

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[53] Jagdish N. Sheth et al., Why We Buy What We Buy: A Theory of Consumption Values, 22 Journal of Business Research 159 (1991).
[54] Id.
[55] Takumi Kato, Functional Value vs Emotional Value: A Comparative Study of the Values that Contribute to a Preference for a Corporate Brand, 1 International Journal of Information Management Data Insights 100024 (2021).
[56] Takumi Kato, Functional Value vs Emotional Value: A Comparative Study of the Values that Contribute to a Preference for a Corporate Brand, 1 International Journal of Information Management Data Insights 100024 (2021).
[57] Luis Hernan Contreras Pinochet et al., The Influence of the Attributes of “Internet of Things” Products on Functional and Emotional Experiences of Purchase Intention, 15 Innovation & Management Review (2018).

In the context of this case study, functional value can be viewed as citizens' perceived utility derived from governments' capabilities to fulfill their needs. Do governments disclose the information that I need? How timely can they do that? These are the questions that citizens concern in terms of functional value. In contrast, emotional value is citizens' perceived utility derived from governments' capabilities to arouse feelings. Do government officials show me respect? Do they really care about my needs? Citizens are concerned with their experience when they seek help from governments.

In the past, the time, method and content of government information disclosure were largely determined by governments unilaterally, which made citizens at the downstream of the information chain and passive receivers of decisions made by governments.[58] There was an information asymmetry between governments and citizens and consequently the communication between these two parties tended to be unidirectional. Hence, citizens were naturally inferior to governments in the power relationship. Since the 1990s, in China there have been a large number of conflicts and disputes between the society and governments, which have required governments to intervene.[59] However, passive intervention pervades as many studies have seen the inefficiency of government intervention.[60] Usually citizens need to petition several times and attract the attention of government leaders to solve their problems. Only when issues cause problems to governments are they taken seriously.[61] Moreover, when governments handle disputes, their ultimate aim is to get things settled. In order to solve the disputes, governments might use multiple methods in a mixed way instead of solely following the regulations.[62] For instance, when dealing with disputes of rural land contracts, it is possible for governments to follow the contracts and protect the interests of the contractors. It is also possible for governments to break contract rules in order to calm villagers' anger.[63] The above situations show that governments attach more importance to citizens' functional value, getting things done, than emotional value. When solving disputes, governments might intervene passively and waste time due to inefficiencies, or they might use rough methods to solve issues as quickly as possible. Either way they neglect citizens' emotions during the process.

However in recent years, the emergence and development of omni media has led to changes in the way that information is produced, disseminated and received, which add new characteristics to the current process of government information disclosure.[64] Information dissemination becomes decentralized, feedback-focused, multi-directional

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[58] Wai Man Kuong, On Chinese Government Information Disclosure in the Omnimedia Era, 10 Social Science of Beijing 100 (2019).
[59] LIPING SUN, CLEAVAGE: CHINESE SOCIETY SINCE 1990s (2003).
[60] Xianhong Tian, Governing Grass-roots China: Qiaozhen's Case,1995-2009 (2012); YI WU, THE HUSTLE AND BUSTLE OF A SMALL TOWN: DEDUCTION AND INTERPRETATION OF THE POLITICAL OPERATION OF A TOWNSHIP (2007).
[61] Xing Ying, The "Problemization" Process in Collective Petitions——The Story of the Immigrants from A Hydroelectric Power Station in Southwest China, Tsinghua Sociology Review (2000).
[62] Id; XIAOLI ZHAO, NARRATIVE OF RELATIONSHIP/EVENT, ACTION STRATEGY AND LAW (1997).
[63] Jing Zhang, Uncertainty of Land Use Rules: An Interpretation Framework, 4 Social Sciences in China (2003).
[64] Wai Man Kuong, On Chinese Government Information Disclosure in the Omnimedia Era, 10 Social Science of Beijing 100 (2019).

and interactive and governments attach importance to citizens' feedback.[65] At the same time, citizens become more eager to obtain access to government information and they tend to demand that governments should disclose information in an efficient and timely manner, especially in cases of emergent public events.[66] If governments lack capabilities in responding to citizens' demand, which are manifested in irrational strategies like perfunctory prevarication, selective responses, and direct avoidance, citizens are likely to question and criticize such behaviors.[67] Such phenomena demonstrate that citizens do not only care about getting needs fulfilled but also how governments fulfill their needs.

2. Gap Between Regulations and Implementation

Although the purpose of Open Government Information Regulation is to promote citizens' access to government information and transparency in governments, cases are that government officials might abuse or misuse the regulation. According to Article 37 of Open Government Information Regulation, when part of the information requested contains content that shall be withheld, the administrative agency shall provide the rest of it which may be disclosed to the public. According to Article 38, if the information requested needs to be processed or analyzed based on the existing government information, the administrative agency may withhold such information.[68] In my communication with government officials, some have stated that they cannot provide the information requested because they need to do calculation with their data, which is allowed by the regulation. Statistics also show that the percentage of total disclosures out of the total number of applications have decreased from 80% in 2004 to 40% in 2013 in Shanghai.[69] The proportion of partial disclosures has been low with an average of 3.06% from 2004 to 2013 and the proportion shows a downward trend by year even though the government of Shanghai has paid increasing attention in government information disclosure in this time interval.[70] These phenomena show that when implementing the regulation, government officials might abuse the regulation to reduce their workload or they misuse the regulation by applying them in an extremely strict manner without flexibility.

Moreover, the current supervision mechanism is that administrative agencies need to release annual reports on their open government information work, which is stated in Article 49 of the regulation. However, in my communication with government officials, some have encouraged me to cancel applications or to ask other administrative agencies so that they do not need to further process my applications and my applications will not be recorded in the annual reports.

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[65] ZHENG XU, THE GAME OF COMMUNICATION-RESEARCH ON PUBLIC OPINION GUIDANCE IN THE DIGITAL MEDIA ENVIRONMENT (2011).
[66] Wai Man Kuong, On Chinese Government Information Disclosure in the Omnimedia Era, 10 Social Science of Beijing 100 (2019).
[67] Id.
[68] Open Government Information Regulation of the People's Republic of China (promulgated by St. Council, Apr. 4, 2007, rev'd Apr. 3, 2019, effective May.15, 2019), art. 711, 2019, P.R.C Laws (China).
[69] Weibing Xiao, Ten Years of Shanghai Government Information Disclosure: Achievements, Challenges, and Prospects, 10 E-GOVERNMENT (2014).
[70] Id.

Hence, it is necessary for the regulation to make improvements to address these issues. For instance, administrative agencies should convert the non-existent information into existence or internally process existing data to promote total disclosures.[71] It is also necessary to promote internal communication between different administrative agencies and simplify internal processes to reduce the possibility of shirking responsibilities.[72]

Conclusion and Future Directions

This paper explores the use of sentiment analysis to analyze communication between governments and citizens and presents a possibility of assessing government officials' emotional reactions as a mechanism to supervise governments' services.

There are already cases where natural language processing and deep learning are applied to citizen service hotlines in China. But the applications are mainly automatic responses to questions, categorizing questions and automatically dispatching cases.[73] There remains space for more advanced methods for governments to better serve and communicate with citizens. By adopting sentiment analysis models, there exists new opportunities for improved administrative regulations on a feminist basis. There is a possibility to establish an evaluation mechanism which collects data on communication between citizens and governments and assesses the extent to which government officials respond to citizens' needs. Such mechanism offers opportunities to evaluate the openness of governments on a dynamic basis and can provide evidence for citizens to supervise the work performed by governments.

Still there are issues to be studied further. The texts in this case study are conversational, and consequently, the linguistic results without the context of conversations can be different from the participants' own perception of the interaction. Participants' emotions influence each other to a large extent. It is also common for citizens to interact with several government officials at one time. Reinforcement learning in multi-agent networks will be my step of research to address the interactive and dependent nature of communication between citizens and governments. Studies have shown the effectiveness of reinforcement learning in deriving scalable algorithms in networked systems.[74]

Moreover, conversations are logically and sequentially connected where decisions made are naturally influenced by previous dialogues. I will also explore

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[71] Weibing Xiao, Ten Years of Shanghai Government Information Disclosure: Achievements, Challenges, and Prospects, 10 E-GOVERNMENT (2014).
[72] Id.
[73] Department of Big Data of China, AI Empowers A New Model of Government Public Services--The Exploration and Application of Artificial Intelligence Based on NLP in the Citizen Service Hotline, 2019, http://www.sic.gov.cn/News/610/10307.htm#:~:text=%E4%B8%89%E3%80%81%E5%9F%BA%E4%BA%8E%E8%87%AA%E7%84%B6%E8%AF%AD%E8%A8%80%E5%A4%84%E7%90%86,%E4%BA%A7%E7%94%9F%E4%BA%86%E8%89%AF%E5%A5%BD%E7%A4%BE%E4%BC%9A%E6%95%88%E5%BA%94%E3%80%82.
[74] YIHENG LIN ET AL., DISTRIBUTED REINFORCEMENT LEARNING IN MULTI-AGENT NETWORKED SYSTEMS (2020).

hierarchical reinforcement learning to find more efficient solutions for sequential decision making problems.[75]

[75] Wen Zheng et al., On Efficiency in Hierarchical Reinforcement Learning, NeurIPS 2020 (2020).

PRIVACY AND POWER AROUND THE BEIJING 2022 OLYMPICS: LEGAL AND POLITICAL PERSPECTIVES

Qianye Zhang*

Abstract: The Beijing 2022 Olympic Winter Games launched a smartphone application, MY2022, to monitor the health status of participants in order to control the spread of the SARS-CoV-2 virus. However, Citizen Lab, a Canadian research institute, found that the protections of the data storage and transmission process of this application were either weak or completely unencrypted, leading to users' privacy being at risk of potential leaks. In addition, the study found that the app's instant messaging feature contained a list of sensitive words that had not been activated. Although Citizen Lab's report pointed out that these security vulnerabilities might be unintentional failures by developers rather than an intentional arrangement by the Chinese government, the criticisms were still widely cited by international media, bringing pressure on the Chinese Olympic Committee and the Chinese authorities. Despite the fact that both the International Olympic Committee and the Chinese Olympic Committee declared the bugs had been fixed since the release of the initial research report, Beijing has much to learn beyond the scope of technical issues.

Keywords: SARS-CoV-2; MY2022; Privacy; Cybersecurity; Censorship

* World Bank, United States.

Table of Contents

I. BACKGROUND

The 2022 Beijing Winter Olympics will begin on February 4, 2022. China, the authoritarian state that will be the first to hold both summer and winter Olympics, is under scrutiny by international human rights watchers and liberal states, given its record of large-scale domestic surveillance[1] and the vulnerability of the West[2] .

As the world approaches three years of the COVID-19 pandemic, countries have begun to respond to the pandemic very differently. While North America and some nations in Europe have started to reopen the economy and loosen control over social distancing, lockdown, and contact tracing, other countries , such as China, are still treating coronavirus with strictly-enforced measures.

China has been boasting its capacity in controlling the spread of the virus to a limited scale despite its large population size and high population density. China's successful efforts in combatting the pandemic can be at least partially attributed to the development of digital technology. The "health code"[3] and contact tracing technology allow local authorities to track users' travel history, test results, body temperature and other health data and private information such as their phone and ID number. When a positive case is diagnosed and detected, the authorities can quickly target close contacts of the positive case and install strict quarantine measures to limit further spread of the coronavirus.

When the Winter Olympics approached, China extended its domestic experience of fighting the pandemic to its handling of the Olympics, designing a smartphone-based application, named "MY 2022", for all Olympics-related personnel.

According to the introduction on Apple Store and Google Play Store, My 2022 "consists of two sectors, namely the Beijing 2022 Games services and the city guide services."[4] MY2022 asks users to submit several types of private information, including passport ID number, phone numbers, and health data such as self-reported health status, COVID-19 vaccination status, and test results.

The International Olympic Committee (IOC) says the download of the app is not compulsory, yet according to the Beijing Winter Olympic Games playbook, before traveling to Beijing, participants will be "required to download the 'My 2022' mobile

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[1] Buckley, Wang and Bradsher, Living by the Code: In China, Covid-Era Controls May Outlast the Virus, The New York Times, Jan 30, 2022. Available at: https://www.nytimes.com/2022/01/30/world/asia/covid-restrictions-china-lockdown.html?_ga=2.80595031.1726735185.1643854743-442066510.1578563656

[2] Neary, Bryce (2022) "Tech and Authoritarianism: How the People's Republic of China is Using Data to Control Hong Kong and Why The U.S. is Vulnerable," Seattle Journal of Technology, Environmental & Innovation Law: Vol. 12 : Iss. 1 , Article 5. Available at: https://digitalcommons.law.seattleu.edu/sjteil/vol12/iss1/

[3] See the explanation given by the China Center for International Knowledge and Development (CIKD), available at: http://www.cikd.org/chinese/detail?leafId=212&docId=1339

[4] See the introduction of MY 2022 on Apple Store, available at: consists of two sectors, namely the Beijing 2022 Games services and the city guide services https://apps.apple.com/nz/app/my2022/id1548453616

application and use the Health Monitoring System (HMS) inside"[5] to monitor users' health prior to their departure.

The IOC stated that the 'MY 2022' "is an important tool in the toolbox of the COVID-19 countermeasures,"[6] aiming to mitigate the spread of the disease within the Olympic village and especially among athletes. It also contains other functions that provide information unrelated to COVID-19, such as game schedules, tourist and travel guidance, and can serve as an instant messaging tool.

II. CYBERSECURITY FLAWS OF MY2022

The Citizen Lab, a Canada-based technology research institute, revealed in a report the existence of several security vulnerabilities. According to the Citizen Lab, at least two security vulnerabilities were detected that could put users' privacy at risk of being leaked.

The lab claims that "MY2022 fails to validate SSL certificates, which are "digital infrastructure that uses encryption to secure apps and ensures no unauthorized people can access information as it is transmitted,"[7] which can be exploited by ill-intentioned third parties to trick users into visiting unintended servers and malicious sites.

It also discovered that MY2022 fails to encrypt sensitive data. These data "can be read by any passive eavesdropper, such as someone in range of an unsecured WiFi access point, someone operating a wifi hotspot, or an Internet Service Provider or other telecommunications company."[8]

Based on their previous research and analysis, the lab researchers concluded that the data security failures suffer from the generally-weakened Chinese app ecosystem, and are "less likely to be the result of a vast government conspiracy but rather the result of a simpler explanation such as differing priorities for software developers in China."[9] However, this conclusion is missing in most of the media coverage.

III. POTENTIAL CENSORSHIP

The lab report also claims it discovered a file titled "illegalwords.txt" containing a list of 2,442 sensitive words. The listed words can be divided into two groups: those that contain pornographic meaning, illegal goods, or swear words, and those deemed politically sensitive in China's political context.

The report said they were "unable to find any functionality" to activate the censorship on the keywords. The report made two assumptions explaining why the sensitive keywords are listed but remain inactive. One assumption is that it may result

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5 See Column "Answer Playbook" in Row #187, Beijing 2022 Playbook, available at: https://olympics.com/athlete365/app/uploads/2021/12/2021.12.13-Beijing-2022-Playbook-Version-2-QAs.pdf

6 The IOC's response to DW's media inquiry. Available at: https://www.dw.com/en/ioc-reacts-to-cybersecurity-concern-over-beijing-my-2022-phone-app/a-60466680

7 Jeffrey Knockel, Cross-Country Exposure Analysis of the MY2022 Olympics App, The Citizen Lab. Available at: https://citizenlab.ca/2022/01/cross-country-exposure-analysis-my2022-olympics-app/

8 Id 7.

9 Id 8.

from "the same kind of accident that may have produced the app's failure to validate SSL certificates."[10] The other assumption is that the censorship may have been intentionally disabled out of political concerns or compromises with the IOC.

The report was released on Jan 18, 2022, approximately two weeks before the opening ceremony of the Winter Olympics. International media quickly followed up and covered the concerns. The lab said they notified the Olympic Committee on Dec 3, 2021, of a 45-day period to resolve the issues, but the updated versions of MY2022 still contained the issues as of Jan 16, 2022.

On Jan 20, the Beijing 2022 Organizing Committee announced that all the security flaws had been fixed, without further mentioning whether the sensitive keywords list were removed from the app code. The IOC also responded that the app had been approved by Google Play and Apple Store and had no critical vulnerabilities.

IV. LEGAL ISSUES RELATED TO SECURITY FLAWS AND CENSORSHIP

Analyzing the security vulnerabilities of MY2022 per the Citizen Lab is complicated due to the diverse nationalities of its users and the different rules and regulations of the various platforms where it is displayed online.

A. Probable Violation of China's National Laws?

Since the promulgation of the Cybersecurity Law of the People's Republic of China in 2016, the legislative progress of cybersecurity, personal privacy protection, data protection, etc., has advanced at a faster pace.

The most applicable laws identified by the Lab's report are the Personal Information Protection Law (PIPL) and the Data Security Law (DSL).

Article 51 of the PIPL requires that personal information processors shall adopt "corresponding technical security measures such as encryption and de-identifi- cation" to "ensure that their personal information processing activities are in compliance with laws and administrative regulations."[11]

Article 27 of the DSL requires that processors of important data should specify the persons or organizations responsible for data security and protection.[12]

If the Beijing 2022 Organizing Committee did not fix the security issues, and should the flaws lead to severe consequences, it may violate the relevant articles of the PIPL and the DSL.

The PIPL states clearly the scenarios under which it could be a violation and be faced with penalties. In the Legal Liability part, Article 66 of the PIPL requires that, in the event of a violation of the law, responsible entities "shall order the violator to make

[10] Id 9
[11] The Personal Information Protection Law of the People's Republic of China, 2021. http://en.npc.gov.cn.cdurl.cn/2021-12/29/c_694559.htm
[12] The Data Security Law of the People's Republic of China, 2021.

corrections, give a warning, confiscate the illegal gains, and order the suspension or termination of provision of services by the applications that illegally process personal information."[13] A fine shall be imposed where the violator refuses to make corrections.

Article 6 of the PIPL provides remedial measures in the event of a violation of the law. Violators who fulfill their obligations and fix the security flaws can be exempted from penalties.

B. Censorship: Contradictory Articles in the Constitution

Although the sensitive keywords list is not activated to perform censorship in the MY2022, it is worth discussing the possibility of whether censorship could violate the Chinese Constitution in this context.

There are conflicting articles in the Chinese Constitution. Article 35 grants citizens the "freedom of speech, the press, assembly, association, procession and demonstration."[14] One can argue that Chinese participants can exert the rights promised by Article 35 and that it would be unconstitutional to activate the censorship and filter the sensitive keywords.

However, Article 28 of the Constitution also grants the state the right to "suppress treasonable and other criminal activities that endanger State security."[15]

In addition, Article 12 of the Cybersecurity Law of the People's Republic of China rules that users "must not incite subversion of national sovereignty, overturn the socialist system, incite separatism, break national unity, advocate terrorism or extremism, advocate ethnic hatred and ethnic discrimination, disseminate violent, obscene, or sexual information, create or disseminate false information to disrupt the economic or social order."[16]

The examples of the sensitive keywords given in the Lab report cover words and terms that could likely be deemed by the Chinese authorities as inciting, subversive, or advocating ethnic hatred. Hence, the app developer and the Beijing 2022 Organizing Committee could argue that the sensitive keywords list is legitimate according to Article 12 of the Cybersecurity Law and Article 28 of the Constitution.

C. Violating Online Platforms' Policies

The report further points out that the security bugs may also violate Google Play policy and Apple's app store policy. Violations of the policies could lead to the removal of the app.

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[13] Id 11.
[14] Constitution of the People's Republic of China, 2004.
[15] Id 14.
[16] Cybersecurity Law of the People's Republic of China, 2017.

- Google's Unwanted Software Policy recommends in its "Snooping" session that "software must not collect sensitive information such as banking details without proper encryption."[17]

- App Store Review Guidelines by Apple also require in its "Data Security" session that "apps should implement appropriate security measures to ensure proper handling of user information…and prevent its unauthorized use, disclosure, or access by third parties."[18]

If there are no severe consequences of privacy leakage, it is fairly unlikely that Google or Apple would remove the MY2022 from their platforms. Both online stores set the tolerance policy to allow the developers to update their apps and fix the bugs in a given period following the platform's notice. Google's Unwanted Software Policy mainly targets malware. MY2022 should not be categorized as "malware" due to the nature of its function, and neither platform had delisted the app prior to its submission of the updated version on Jan 29, 2022.

V. THE DILEMMA OF CONTACE TRACING

It has to be acknowledged that hosting the Olympics during the COVID-19 pandemic era is fundamentally different than it was for previous Winter Games. Broadly speaking, what Beijing faces today is not so much a technical problem as an ideological rivalry between individual freedom and state power. The rivalry poses a challenge to almost every country that has the capability to conduct contact tracing.

Since the beginning of the COVID-19 pandemic, contact tracing has been recommended by many professionals as one of the most effective methods to slow down the spread of the coronavirus, and it has been proven true in countries where obedience and compliance are social norms. However, contact tracing to speed up the detection of possible positive caseshas become a controversial measure in countries with liberal roots. Privacy issues aside, there are two major components of the public argument

A. Contact Tracing vs. Indicidualism

The goal of contact tracing is to uncover when a close contact might be a coronavirus-positive case, resulting in local authorities imposing quarantine measures or limiting the freedom to move. For liberal democratic countries, there is an ethical dilemma of conducting contact tracing. Health is considered a fundamental right of everyone.[19]To protect the right to health, state governments have to limit individual freedom, which in many cases led to lawsuits from citizens against their governments.[20]

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[17] Google's Unwanted Software Policy, available at https://www.google.com/about/unwanted-software-policy.html

[18] Apple's App Store Review Guidelines, available at: https://developer.apple.com/app-store/review/guidelines/

[19] International Covenant on Economic, Social and Cultural Rights, Article 12(1).

[20] Some of the examples of noteworthy lawsuits can be found here: https://ballotpedia.org/Lawsuits_about_state_actions_and_policies_in_response_to_the_coronavirus_(COVID-19)_pandemic,_2020-2021

B. Contace Tracing vs. Effectiveness

For some countries that have tried to leverage digital contact tracing by developing contact tracing apps, it often leads to underperformance of the app and a waste of budgetary resources.

Tokyo is the other city so far that has held the Olympic Games since the beginning of the pandemic. Tokyo also faced challenges from the app used by Japanese residents to monitor users' health conditions. Japan regarded privacy protection as its top priority. International media did not interrogate the Japanese Olympic Committee over the security issue on the app, COCOA. Instead, many members of the Japanese media questioned the effectiveness of the app. Local media reported that the encryption made it "all but impossible for the government to grasp the actual number of notifications sent via the app,"[21] not to mention that there weren't enough downloads and self-reports to hit the 60% uptake ratio[22] that would make the contact-tracing app work in theory.

VI. THE LESSONS FOR BEIJING

The Citizen Lab report rightly states that the security vulnerabilities of MY2022 are likely the resultof the Chinese software ecosystem which generally doesn't prioritize privacy protection. The ensuing media coverage focused on the security issues of the app and the keywords list, without including that the report also mentioned that the security bugs might not be intentional outcomes of the design. Olympic Committees of participating countries such as the US, Canada, Germany and the Netherlands have encouraged their teams to use disposable phones while in Beijing, reinforcing the impression to the public that these Olympics are not trustworthy.

The deep-seated distrust towards the Chinese government and government-backed international events can be traced back to 2008 when Beijing held the summer Olympics. A US senator claimed that several international chain hotels had reported being wiretapped by Beijing without giving the specific brand of the hotels in hopes of protecting the hotels from retaliation[23].

From Beijing's perspective, the international image crisis of their 2022 Winter Olympics is not so much a technical issue as it is a political and ideological standoff between China and the liberal West. Beijing can dismiss all the charges against itself on surveillance, and still be confident with its own "Chinese path." Still, it has to regain some trust if it is keen on bidding for and hosting future international sporting events

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[21] Tomohiro Osaki, Glitches and design flaws limit value of Japan's COVID-19 tracing app, The Japan Time, Feb 1, 2021. Available at: https://www.japantimes.co.jp/news/2021/02/01/national/science-health/cocoa-tracing-troubles/

[22] Research brief published on the Oxford University website. Available at: Digital contact tracing can slow or even stop coronavirus transmission and ease us out of lockdown (There needs to be a URL here for the website)

[23] Richard Cowan, China spying on Olympics hotel guests: U.S. senator, Reuters, Jul 30, 2008. Available at: https://www.reuters.com/article/us-olympics-china-spying/china-spying-on-olympics-hotel-guests-u-s-senator-idUSN2934051920080729

And technical correctness, rather than political correctness, should be the first step to regain global trust. The low-hanging fruit here is to promise better enforcement of privacy and data protection in a digital era.

Take the MY2022 as an example. According to Article 31 of the Government Procurement Law of the PRC, MY2022 is purchased from Beijing Financial Holding Group Co., Ltd., the authorized operator of the "Beijing Tong" app.

According to its introduction, the "Beijing Tong"[24] app has built a city-wide unified identity authentication system based on the concepts of identity access, data access, application access and people-to-people communications. The Beijing Tong app has 7 categories of practical functions, such as showing certificates, handling affairs, inquiries, payment, reservations, complaints, and communication.

Here lies reasonable speculation. MY2022 and Beijing Tong may be developed by the same team and MY2022 may have borrowed similar parts of codes from Beijing Tong. Data privacy might rank behind the priority on the developing team's agenda. Both the developing team and Beijing residents are used to neglecting privacy protection, which creates an ecosystem where sluggish privacy protection receives neither supervision nor punishment. With the Olympics, the situation can completely differ, as participants are used to different technology standards and privacy protocols.

The Beijing 2022 Organizing Committee also failed in proactively seeking to improve the function of the app. The Citizen Lab team said they had sent notice to the Organizing Committee in Dec 2021, and never received any response before the official release of the report, which created a public relations fiasco for Beijing.

The Lab report and the resulting media crisis provided a classic case study for China to learn how an honest mistake can lead to a major public image setback. It should be a warning sign to China's growing confidence.

China has become more confident and less patient in listening to the world, with its international status and economic power rising. As China gets deeply involved in the global agenda, "telling China stories well" is a reciprocal channel with the underlying requirements of listening to the world's needs as well. With privacy protection becoming an increasingly important issue globally, the state should improve their technology ecosystem's performance on data privacy-related policy and laws.

Although the IOC has insisted repeatedly that the Olympic Games are "politically neutral", the games are never short of politics. Athletes from across countries come not only to show their muscles, but to show the strengths of ideology as well. With China showing its interests and financial competitiveness in holding more sporting events, and becoming more stubborn and confident in its own path, the rest may have fewer choices other than "mitigating, or migrating"—either using a burner phone, or quitting the games held on this land.

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[24] Introduction on the App Store. Available at: https://apps.apple.com/cn/app/%E5%8C%97%E4%BA%AC%E9%80%9A/id1158919706

ENERGY LAW UNDER INCREDIBLE SHORTAGE:

REVIEW FROM THE PERSPECTIVE OF INSTITUTIONAL STRUCTURE

Bingxuan Wu & Xiying Li*

Abstract: In 2021, the global energy shortage affected nearly every country around the world, and it took place quite suddenly. Desperation spread among people suffering from COVID-19. Many were seeking a reasonable explanation for this puzzling circumstance. This led to increasing attention on the energy market, a topic now heatedly discussed by scholars, and legal regulation has become one of the most common aspects to examine. This article will present the current outcomes of the analysis of this aspect through a comprehensive perspective of institutional structure, drawing on thoughts from economics, politics, international law, and law doctrine. A deduction will be made from these ideas to help analyze the formation, developing tendencies, and ideal design of energy institutions, as well as the derivation of their structure. Paths from global transitions will be applied and will certainly address human rights concerns simultaneously.

Keywords: Energy Market; Legal Regulation; Institutional Structure

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Table of Contents

INTRODUCTION

Several reviews have mentioned that in 2021, an energy strike or even a crisis is coming. The questions therefore arise: (1) if there is certainly a negative effect caused by an energy lack; (2) if said lack is from a functional failure of the energy market; (3) if that failure is from an energy law system; and (4) what should constitute a contemporary perception for analysis of global legal institutions and structures of energy law.

When people start a brief or comprehensive and intensive discussion of the energy law system, perhaps the first idea that occurs to participants is undoubtedly that of climate change developments, accompanied by mentions of the Paris Agreement, or even the "Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy" in the EU and "Clean Power Plan" in the US.[1] Still, these policies merely relate to "legal regulation of the energy market"—if this article translates such a phrase as "a collection of state behavior by public actors, under a certain ideological identity, containing fundamental and secondary forms of legal texts, principles, or papers with legal force, through legislation and compliance with the law, to conduct a systematic exploration of the functional logic of the energy market and utilize it for the healthy development and increase of collective human benefits." Yet, from the beginning, it is difficult: previous energy goals set by "GNG net-zero emissions" could hardly be achieved by countries all over the world,[2] and problems will be tougher when first sketching the energy market system and then valuing it with laws. The latter will play a key role in this article, especially regulation "in a paper"—an institutional structure of any political decision could be a wise choice for scholars to build up a model to evaluate. Fortunately, a comprehensive presentation of that model is lacking around the world.

It can be ascertained that the winter of 2021 is coming. These days, we can see critics posing their aggressive opinions almost everywhere:

In the UK, British truck drivers went on strike, bothering Prime Minister Boris Johnson's government for some time. Without their loyal assistance, oil transportation was interrupted to a great extent. As the strike continued, the regions of the British Isles became trapped by a petrol shortage. This was a rather fair result as feedback for conservatives' "Brexit" because the Continent did not burden British people's living demands anymore. However, it was unfair to the British people themselves.

Turning to the EU, gaps exist between the West and East, whether they are geographic, political, or economic, the developed and developing, the ex-socialist and long-lasting capitalist ones, and even monarchy and republic states. The market, once quite stable with great functional expectations, is now experiencing trouble. Each

[1] *See* David·L.Schwartz, The Energy Regulation And Market Review 7 (Law Business Research Ltd., 5d ed. 2016).
[2] *See* Su Fuyou, Hu Hao, Wang Lei, Guo Wei, Ma Mingwei & Zhai Yu, White Paper On Global Energy Transition And Zero-Carbon Development 3 (Huawei Ltd., 2021).

sovereignty, guaranteed by expert research on international law jurisprudence,[3] perseveres on its laws and principles to regulate energy commerce and the production–consumption chain. However, the EU itself shall be, or ought to be, according to the Maastricht Treaty, a "supranational sovereignty," to control its internal regions and nations. This situation causes a dilemma for European governance: if the union is more powerful, regional authority will be affected, while supposing that states are more powerful with collective plans and actions, especially from constructive sovereignty, that are out of the question in reality.

In North America, the USMCA is another representative political entity The current of transferring energy commodities is certainly dominated by the trading system there, and a sudden change caused by COVID-19 or even severe weather could easily beat the institutional design of the USMCA.

Unfortunately, there is still no evidence to prove that, to a great extent, the legal system could decide human energy activities—production, distribution, and consumption—under crises. Human beings demand "economic theory as applied to energy," especially when it focuses successfully on "supply and demand in the context of scarce natural resources."[4] Additionally, rewarding research on such a subject shall never exclude critiques on the institutional structure of energy law comparing various state practices, "noting that energy policy has generally been resistant to political change."[5] Moreover, what if legislation from various states conflicts with each other, thus blocking the fluent movement of material commodities, cash flow, or overseas business participants?

The points above are what this article mainly addresses through an overview of the institutional structure of laws and regulation under "governmental agencies," such as "commissions," "organizations," "ministries," or "authorities."[6] Illustrating why "institutional structure" should be analyzed, through the arrangement of legal institutions, each state's purpose and considerations in energy transactions and entitlement would be clear. Also, as neo-liberal institutionalism certainly composes a branch of the theories on international relations, reflections from other theories shall come into use. Scholars always worry about the lack of models and methodology; in this article regarding energy law, questions arising, such as what the institutions for energy regulation do, could do, and are expected to do, will come to a rewarding observation.

I. IN-DEPTH RESEARCH ON EXISTING OUTCOMES

This research also desires a definition of the concept of a "system." As Robert Leeper claims, a system is of unit or part in interaction with each other[7]; . to search for

[3] See Niu Song, The Construction and Transition of Modern International System, 22 JOURNAL OF SYSTEMS SCIENCE 72, 72 (2014).
[4] See Joseph P. Tomain & Richard D. Cudahy, Energy Law in a Nutshell 1 (2d ed. 2011).
[5] Id. at 2..
[6] See DAVID·L.SCHWARTZ, supra note 1, at 241.
[7] See Liu Wanwen & Zheng Dandan, On Some Problems of the International System, 19 PACIFIC JOURNAL 26, 26 (2011).

such “interaction”, this article requires individual and comparative case studies for reference.

A. Case Analysis: Energy Strike in North China and Chinese Legal Regulation on Energy

1. Power Restriction in Northeast China

On September 23, 2021, the State Grid Jilin Power Supply Company and the State Grid Tonghua Power Supply Company issued a notice. To ensure the safe and stable operation of the power grid, Jilin Province Power Grid took power restriction measures at 16:37 on the same day and implemented power restrictions in nine urban areas of the province. Power rationing was implemented in the northeast and in many other parts of the country.

The causes of power rationing in Northeast China include both external and internal causes. In terms of external factors, there is a power gap in China. Thermal power generation is still the main source of electricity, and it has been affected by the pandemic; domestic coal prices generally show an upward trend. On the other hand, there is still no marketisation at the consumer end of the power market. The government limits prices in the field of power consumption. When the coal price rises and the power generation cost is higher than the electricity price, the production enthusiasm of power production enterprises will be hit, and the supply will decline. In terms of internal causes, the National Development and Reform Commission stressed in its notice that it would take effective measures to ensure the completion of the double-control goal of annual energy consumption, especially the goal of reducing energy intensity. However, China’s carbon emission pressure is still large, and the horizontal and vertical comparisons are high. Therefore, for the corresponding “dual control of energy consumption” plan, it is logical to switch off and limit power in Northeast China.

2. Energy Law of China

In the energy field, China’s energy law is still in the stage of soliciting opinions. At present, there are four major laws: the Power Law of the People’s Republic of China (PRC), the Coal Law of the PRC, the Energy Conservation Law, and the Renewable Energy Law. In addition, there are more than 30 energy-related laws, such as the Law of PRC on Environmental Impact Assessment, the Law of PRC on Safety of Special Equipment, the Law of PRC on Work Safety, the Environmental Protection Law of PRC, the Law of PRC on the Prevention and Control of Solid Waste Pollution, and the Law of PRC on the Prevention and Control of Cleaner Production. There are also more than 30 administrative regulations promulgated by the State Council and more than 200 departmental rules, such as regulations on electric power supervision.

According to the purpose of the law and the type of energy, there are two classification methods. First, according to the purpose of the law, energy-related laws can be divided into four categories: basic energy law, separate energy law, energy-related laws, and other normative documents. Second, according to the type of energy, energy-related laws can be divided into renewable energy law, nonrenewable energy law, conventional energy law, and new energy law.

However, a thorough study of the legislation reveals the following problems in China's energy legislation.

The administrative attribute of energy law is too high, which means that the legislation is too utilitarian. This is not difficult to see because, under Chinese law, resources belong to the state, and energy is a vital link in controlling the lifeline of the national economy. In practice, to deal with various problems encountered in the energy field during the transition from planned economy to market economy, the state has successively formulated several laws to solve these specific problems. This leads to the following consequences.

First, there is an absence of basic energy law. To deal with problems in specific fields, China has formulated several laws. For example, China's energy structure has long been dominated by coal consumption, while the utilization rate of renewable resources is relatively low. To promote the rapid development of renewable energy, save energy, reduce emissions, and resist global warming, China formulated a renewable energy law in 2005. However, this state lacks a comprehensive and basic energy law that comprehensively reflects its energy strategy and overall policy orientation. It is difficult to effectively adjust the comprehensive, overall strategic issues, such as energy security, energy efficiency, energy environment, energy structure, and energy market. At the same time, it is also unable to coordinate the relationship and conflict of laws between different singular laws.

Second, the internal systematics and coordination of energy-related legislation are poor. First, there is no separate law on oil, natural gas, and nuclear energy, and there is no separate legislation in important areas related to the national economy. Second, the relationship between different levels, energy-aimed and non-energy laws is uncoordinated. Conflicts exist between different levels of energy laws. For example, the Coal Law refers to the Coal Administration Department of the State Council and the Coal Administration Department above the county level. However, in practice, the Coal Management Department has been abolished, so there is a regulatory vacuum at the legal level. Other energy laws also have a regulatory vacuum caused by institutional changes. Also, there is a regulatory vacuum between energy-related and non-energy laws. For example, the Mineral Resources Law, as a resource allocation law, specifies the access conditions for mining but does not provide for environmental protection. The Coal Law only provides the "four Simultaneities" system for environmental protection, ignoring the system design of environmental impact assessment, environmental supervision and inspection, etc. At the same time, there are no legal consequences related to environmental protection.[8] The ownership of the development and utilization rights of marine energy resources is also unclear. The use of marine energy resources is not included in the scope of marine use rights in the Sea Area Management and Use Law, and the use of tidal energy is not regulated in the Renewable Energy Law. Finally, there are both substantive and procedural parts of the separate law. For example, the production safety law stipulates not only the safety guarantee of production and business units, the rights and obligations of employees, and the division of responsibilities of regulatory agencies, but also the emergency rescue, investigation, and handling of production safety accidents. Substantive law and procedural law create

[8] See Chen Zhe & Jiang Guangchang, Research on Environmental Protection Legislation of China's Coal Mines, 19 SAFETY AND ENVIRONMENTAL ENGINEERING 1, 2 (2012).

a considerable degree of logical confusion. The reason why these phenomena exist can be attributed to the fact that the energy problem involves multiple government departments and multiple central enterprises [9]. Specifically, the phenomena of regulation capture and government decentralization are determinants of this phenomenon.

Third, there is a lack of emergency laws on energy reserves, such as national oil reserve regulations, which have not yet taken shape. In principle, the collection, storage, and rotation of government oil reserves should be carried out openly through the trading market. If there are no substantive legal norms in the field of market trading, the transaction cost will increase.

However, in sharp contrast to the high administrative attributes of energy law, there is no organ commanding energy affairs, and the functions of each organ are unclear. Although China's Energy Commission is in charge of energy administrative law enforcement and supervision, this department has encountered many constraints in practical work.10 Coal is the most important primary energy source in China. Taking the coal industry as an example, there is an interesting situation of "nine dragons supervising mining" in China, that is, the Development and Reform Commission, the Bureau of Land and Resources, the State Administration of Coal Mine Safety, the State-owned Assets Supervision and Administration Commission, the State Environmental Protection Administration, the Ministry of Commerce, the Ministry of the Environment, and the State Energy Administration jointly supervise the coal industry. The most important factor in the field of coal supervision is safety supervision. In the field of Chinese safety supervision, there is a dual supervision mode of "central + local" and "industry + administration," that is, the function of safety supervision is under the command of the State Administration of coal mine safety. At the local level, the Provincial Coal Mine Safety Supervision Bureau was established to accept the dual leadership of the National Coal Mine Safety Supervision Bureau and the provincial government. Also, provinces with heavy management tasks in the coal industry can set up the Provincial Coal Industry Bureau to perform the function of industry management. It is worth mentioning that the Provincial Coal Industry Bureau has put up a brand under the Provincial Coal Mine Safety Supervision Bureau; that is, the governance mode of "one team, two brands" is implemented. It can be seen that industry supervision and administrative supervision personnel are mixed, and the separation of powers is unclear. The unclear functions of departments are also deeply reflected in other energy fields: the State Power Regulatory Commission is in charge of power supervision, but other departments are also decentralizing the functions of power supervision. For example, in the field of electricity, the National Development and Reform Commission handles long-term power planning, power pricing, power conservation and energy efficiency, and examination and approval of power investment. The Ministry of Environmental Protection is responsible for assessing the environmental impact of power planning and stipulating the emission standards of power enterprises; the State-owned Assets Supervision and Administration Commission appoints members of the board of supervisors of state-owned power enterprises and evaluates the performance of the

[9] See Xiao Guoxing, Confusion and Way Out of the System Design of Energy Law, LAW SCIENCE, Aug. 2012, at 7.

[10] See Xiao Guoxing, Energy Law and the Structure of China's Energy Legal System, ACADEMIC JOURNAL OF ZHONGZHOU, June 2012, at 80.

persons in charge.[11] In the field of oil and gas, there is also no professional regulatory body, and all departments supervise the oil and gas business in a decentralized manner. For example, when the industry enters the stage, the National Development and Reform Commission approves industry access and project investment. In mining and exploration, the land and resources department handles approving the acquisition procedures of land resources, the State Oceanic Administration oversees the approval of the acquisition of marine resources, and the Safety Supervision Department cares for the approval of safe mining. The National Development and Reform Commission shall be responsible for the price supervision of the sales link, and the Ministry of Commerce shall be responsible for the operation supervision of the oil wholesale market and the oil import and export operation supervision.

In addition, the Energy Conservation Law sets energy conservation as China's basic national policy, and the Environmental Resources Protection Law focuses on environmental protection at the energy production and utilization stage. However, the current legislative orientation overemphasizes environmental protection and resource conservation while ignoring the production and development of resources. Paying too much attention to environmental protection will lead to the result of neglecting the goal of developing resources.

B. Comparative Research: Energy Law of US, EU, and Other Representative Regions

There are two major changes in the field of global energy legislation and regulation. The first is that the demand for oil and other fossil fuels in industrialized countries has stopped growing, and the future growth of energy demand mainly comes from emerging market countries, especially China and India. The second change is that more attention is paid to the impact of energy use on the environment, especially carbon dioxide emissions.[12] Energy law of the US, EU, and Australia will be elaborated and discussed in the following section.

1. Energy Law of the US

Achieving energy independence has always been the primary goal of US energy legislation and policy. The US has achieved energy independence, the energy consumption structure has been continuously optimized, and carbon dioxide emissions have entered a downward channel. Energy can be divided into three categories: nuclear power was the cornerstone of the Reagan administration's energy policy; however, it suffered a great setback during 1982. At the same time, alternative energy sources received boosts. Conventional energy sources fall into the third category.[13] At present, oil and natural gas rank first and second in US energy consumption, and renewable energy, including hydropower, geothermal energy, solar energy, wind energy, and biofuels, ranks third. After President Biden takes office, the United States will return to

[11] See Tang Songling & Ren Yulong, Reform of Government Supervision System in Power Industry: Foreign Experience and China's Countermeasures, ENQUIRY INTO ECONOMIC ISSUES, Aug. 2008, at 163.
[12] See David G. Victor & Linda Yueh, The New Energy Order: Managing Insecurities in the Twenty-First Century, 89 FOREIGN AFFAIRS 61, 62 (2010).
[13] See Clifford A. Bob, Energy Law, 1983 ANN. SURV. AM. L. 621 (1983).

the Paris Agreement and address climate change as the starting point for US energy foreign policy.

The prominent feature of American energy law is market dominance. According to the provisions on land ownership in the common law of the US, most of the land and underground resources in the United States are private, except for the land and resources used by the federal government. Land ownership based on common law and ownership extended to private underground resources made the US energy market not dominated by the government from the beginning, but spontaneously participated and dominated by market subjects.

US energy legislation is divided into federal and state levels; thus, the complex system is complex. American energy legislation adopts the legislative model of "law and policy," which includes energy strategy, planning, and management and institutional legal norms. It can be further divided into three categories: comprehensive law, special law, and supporting law.

Comprehensive law includes the National Energy Law of 1978, the Energy Policy Law of 1992, and the Energy Policy Law of 2005[14]. Specifically, the National Energy Law of 1978 includes five parts: the National Energy Conservation Policy Law, the Natural Gas Policy Law, the Power Plant and Industrial Fuel Usage Law, the Public Utilities Regulatory Policy Law, and the Energy Tax Law of 1978, which are mainly aimed at conventional energy. The Energy Policy Law of 1992 promotes the development and use of renewable energy. The law opens the transmission network to non-public utility power generators, encourages new investors to enter the power market, encourages regulatory agencies to integrate cross-state resources, and provides financial and technical support for wind energy utilities. The Energy Policy Law of 2005 acts on traditional fossil energy and nuclear energy industries. The law expands the scope of applying of tax relief policies for renewable energy production. In addition to wind energy and bio-energy, geothermal energy, small-scale generator sets, landfill gas, and waste combustion facilities are also included in the scope of application. Government agencies, cooperative power enterprises, and other organizations are authorized to issue "clean renewable energy bonds" to finance the purchase of renewable energy facilities. Renewable fuel standards were formulated so that at least 7.5% of US government power consumption should come from renewable energy sources by 2013, and the special law includes the Clean Air Law, Clean Water Law, Solar, Wind and Geometric Power Production Incentives Law, and others. The supporting law includes the Energy Tax Incentives Law of 2003 and the Investment Law of 2009. The former law stipulates an energy tax and gives new energy tax incentives, while the latter expands the utilization of smart grid technology by investment and encouragement of new energy investment.

2. Energy Law of the EU

The EU energy policy is mainly composed of white paper and green paper on energy issues, which is the legal framework of national energy laws. Specifically, in 1995, the European executive committee issued the white paper for a community

[14] See Hou Jiaru, American Renewable Energy Legislation and Its Enlightenment, 42 JOURNAL OF ZHENGZHOU UNIVERSITY 79, 79-82 (2009).

strategy and action plan on renewable sources of energy, formulating the general policy on energy. And then it issued a sustainable, competitive and secure European energy strategy in its green paper in 2006, which stipulated a foreign consistent energy strategy, emphasizing the unity of EU countries in energy legislation. The EU energy law includes the primary law and the secondary law. The most important laws of the former include the Treaty of the European Coal and Steel Community and the Treaty of Amsterdam, which regulate the fields of coal, steel and power industries, respectively. The latter includes various regulations, directives, decisions and recommendations[15].

Forming a fully competitive market is an important goal orientation of the EU energy legislation and policy. According to the Gas Directive and the Electricity Directive, all parties undertake the obligation of non discrimination and fairness. According to the green paper issued in 2006, the fair competition mechanism should be unified to form a genuinely competitive power and natural gas market. According to the price transparency directive formulated by the Council of the European Community in 1990, transparent prices enable consumers to measure whether prices meet the conditions of fair competition. There are many examples which prove this. For example, under the EU energy law, enterprises are not allowed to control both the "downstream" natural gas pipeline system and the "upstream" natural gas production link to prevent leverage. The third party access prohibition of oil and gas pipelines shall be strictly controlled, and only special reasons such as technical reasons, emergency conditions and performance of public service obligations can be applied. Under the joint action of the EU competition law and antitrust law, price discrimination is prohibited in articles 101 and 102 of the Lisbon Treaty. Measures have been taken to prohibit different selling prices for the same commodity or service to several buyers without justifiable reasons, and Gazprom has been investigated for suspected price discrimination.

Energy supply under emergency conditions is also an essential consideration in the EU energy legislation and policies. According to the green paper published in 2006, the European Energy Supply Observatory should be established to monitor the primary energy supply modes of the EU, collect and analyze energy related information, and issue the Strategic EU Energy Review to formulate legal plans under energy emergencies.

3. Energy Law of Australia

Australia's energy law and policy adopted a nationalism position before 1983, emphasizing government intervention to realize national interests. From 1983 to the end of the 20th century, the energy industry gradually moved towards liberalization. The complete legal and policy system has promoted the development of the Australian energy industry[16]. Australian energy laws and policies can be divided into three levels: federal, state and local,which is overall coordinated by the Council of Australian government. Energy laws and policies are scattered throughout the Renewable Energy

[15] See Yang Zewei, EU Energy Law and Policy and Its Enlightenment to China, LAW SCIENCE, Dec. 2007, at 135-140.
[16] See Li Hua, New energy development in Australia: Law, policy and Its Enlightenment, THEORY MONTHLY, Dec. 2010, at 147-148.

(electricity) Act, Energy Efficiency Opportunities Act and National Framework for Energy Efficiency.

Australian energy law has two highlights:

First, in terms of renewable energy law, the Mandatory Renewable Energy Target is the basic law, and the Energy White Paper evaluates and reviews the effect of the operation of the law. In addition, fiscal and tax incentives and subsidies, energy innovation mechanism and renewable energy certificate system have all promoted the development of new energy development.

Second, in terms of energy security law, firstly, the energy security management system is complete. The Department of Resources, Energy and Tourism is in charge of overall legal work.Energy regulator, energy market commission established energy and security management systems to ensure energy production, operation and consumption.Second, the Liquid Fuel Emergency Act was enacted to ensure emergency energy supply. In 2004, the energy security working group was founded to fulfill the continuous responsibilities of the national liquid fuel emergency response plan and develop emergency response agreement. The National Oil Supplies Emergency committee is a national working group composed of representatives from state and local governments and industries. The National Oil Supplies Emergency committee formulates feasible and essential matters for the implementation of the liquid fuel emergency law. In 2021, the National Liquid Fuel Emergency Response Plan has been formulated. In the field of natural gas, in 2005, the national gas emergency response advisory Committee was established to integrate the representatives of the government, natural gas industry departments and users to provide suggestions to the council of ministers of energy on major natural gas supply shortages under multilateral jurisdiction.

II. "RECHTSDOGMATIK" FOR NATIONAL LEGISLATIVE MODELS: BENTHAMIST, CONSTRUCTIVE, REALISTIC(MIMETIC) AND INTERNATIONALIST

In recent years, when considering certain issues or to-be-made-certain issues in the perspective of the global market and participating market economy, there will be unavoidable heated debate by leading minds regarding research on ideology. What is important is that talking about the prevailing upper-structure of a single nation is so complicated, let alone that for a rather unpredictable and changeable international relationship. As that form of research is aimed at upper-structure between nations, for instance, the mentioned and discussed legal presence in Comparative Research(Part III) above, the feedback shall be much more rewarding: Through different vehicles of presence to the public, or reflection from the history, people could, or the philosophers, politicians and respected scholars could, prima facie, conclude the law-makers' methodology into the following several sorts: Benthamist, Constructivist, Realistic(Mimetic) and Internationalist.

This way of conclusion with deduction is by the way titled "Rechtsdogmatik" (in German) or "Law Doctrine Study"(in English), and earnestly may it help clarify background and future such a way owns. It could never be false that each law text has its "object and purpose"(a usage could be seen from Para 1, Article 31 of Vienna Convention on Law of the Treaties), and this is in accord with ideas in depth of a nation.

Ideas in this way decide energy laws. The four sorts of ideas are so representative that, nearly none of those mentioned types or models of energy law in the preceding parts will escape their reflection. So, it's wise to take a glimpse of them.

A. Energy Law Under Benthamist Perspective

The sort of law under Benthamism, or Benthamist law tendency aims to fix the law itself to a certain object(or purpose), for example, the establishment of the Constitution, on one hand, is just for the settlement of the government. Generally speaking, Benthamism advocates the value that any law should be born to accumulate people's feeling and experience of happiness or happiness itself.[17] For that pure wish legislation converts bloody, cruel rules into a touching expression of human wisdom and legacies of such a variety of interpretation and application of wisdom. In other words, it's rather a reflection of people's subjective minds, which in "jurischolars"' eyes they are desires from hope for a better and much better human social community. In this way of understanding objects of laws and principles, they are substantially "of no values" but "for the ultimate value"-terminal progression of the status of existence of we humans. Critiques focus on this core character of Benthamist Legislation. However, ways to achieve the so-called "ultimate value" are far from enough. Looking through currently existing(and rapidly developing) energy law texts, wide-scope observers convince themselves of the fact that, every text seemingly sticks to that value, but when it comes to the question how it sticks no two cases present the same answer.

Take EU regulations as a factual example, when in year 2003 the Regulation on Access to Electric Power Networks was put into effect(and it certainly suffered four main "troublemakers"-each territorial local authorities' mind of nationalization, the 2008 Global Financial Crisis, the 2016 De-globalization phenomenon and the sudden 2020 Covid-19 Event), all law makers(at least a majority of such a community-in congresses and commissions of the far too complicated EU political structure) hoped it shall assist in boosting the cross-border trade activities and the gross fruit of it, and this could give a birth to a better situation of law application and commerce fluency for Europeans' collectively benefit. This perspective was so prevailing in that period of time, especially evaluated through the professional identification of "integration" or "integrity"[18] practices proved by temporary success of the European Community. Positive thoughts were greatly produced, but in reality it functioned "not so well" and resulted in some negative reviews: A voice presented that the concept might trap itself by the lack of "appropriate theoretical flame", and a more satisfying analyzing method was to dissolve it into part of economies, politics and what for law for a rather detailed and accurate measure[19].

Just listing the regulation as a positive result shall no scholars deny its negative influences. The first of them is that, no matter how hard have the legislation workers

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[17] See Hu Yuhong, Studies on the Legal Thought of Jeremy Bentham, TRIBUNE OF POLITICAL SCIENCE AND LAW, May 2005, at 6.
[18] See Ding Zhigang, International System Interedependency Intergration International Order: Integration of Contemporary Western Theories of International Relations, WORLD ECONOMY AND POLITICS, July 1997, at 7.
[19] Id. 6. .

have attempted, the directions established by the regulation would to some extent betray the goal that cross-border trade could constructively benefit international exchange and consumption energy sources, for the reasons that in this way the trade would be: (1) much supervised by the most gathered varieties of European states energy laws for regulation, (2) subject to the order of the central power of EU community, and (3) resistant to the systematic risks caused by any accidents or unpredictable events or sudden political or diplomatic affairs which forms a hit to recycling of business activities. To someone's great disappointment, the positive proofs above were accompanied by negative reflections below: (1) varied standards of such supervision, for example, different understanding or even misunderstanding of the put out "Transparency of Consumer Energy Prices"[20] might arouse troubles and worries among country entities; (2) pushing a regional order to moderate or regulate the capital market and its natural, spontaneous functional mechanism, would receive conflicting requests from the government, the people and the capital as the hugest negative feedback, and (3) if such a detailed, decent or singular text with legal force under an identity of "Benthamism" to boom EU energy transactions (for profit) and distribution (for welfare) did well enough, there would be no organizations like "the High-Level Group on Energy, Environment and Competitiveness", where, as some comments shew, law had not reached its object of "helping people achieve greatest or ultimate happiness", or a single of such achievement.

That dilemma is not individual in normal European trade but is instead an acquirement of rights. Chinese scholars paid more attention to the latter part of the subject in the past a few years (less than 40 years after the Reform and Open-door Policy was carried on), and it substantially was based on instruction from Bentham's critiques, as the general goal of the central government of PRC (the state) and central commission of CPC (the party) had chosen "public interest", and it undoubtedly consisted a progression of Benthamist Jurisprudence at all. So what is Benthamist law aiming at? One representative's consideration of the "real Benthamist law" shall be what was presented above: public values and principles for public values.

However, there are still other considerations. Among these considerations a typical one is the law of the nature, which comes from Roman imperial scholars that thought of continuously developing customs could be derived from the beginning of human society, and the law for happiness and progression of human beings is not by the side of "ought to be", but by that of "is" (from David Hume)[21]. And another thought is that only through legislation could Benthamist laws be accepted(or he claimed that "education as well as legislation could lead people to happiness"), but in judicial rounds or administrative realms, things may not move so smoothly as Benthamists imagine. Perhaps, energy law has its own characteristics belonging to features from commercial activities. Therefore, seeing through legislative science will probably not result in applicable observations to behavior under the law.

And that means the analysis shall go through other comments on energy law.

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[20] See Yang Zewei, Energy Law and Policy of the European Union and its enlightenment to China, LAW SCIENCE, Feb. 2007, at 138.

[21] *See* Shi Yuankang, From Chinese Culture To Modernity: Paradigm Shift? 330 (Shanghai: Sanlian Bookstore, 2000).

B. Energy Law Under Constructive And Realist Perspectives

1. Constructivists' Energy Law

When talking about energy law for something beside "people's interest""happiness" or "collective profits", and see it through the structure of power distribution theories, to integrate it into part of legislative workloads. There are perspectives contrary to each other, which in general build up two faces of one established theory of understanding energy law texts: They are previously designed to be "constructive" or "realist" ones. This division mode is mainly from double sources of mind flows: (1) three main characters of contemporary history of legal thought: natural law, social law and law doctrine jurisprudence which has been mentioned in the beginning of this part, and (2) the most widely recognized theory of international relationship, which contains neorealism, neoliberalism (containing "neoliberalism") and the later developing constructivism[22]. When it comes to the first claim, that three main characters of jurisprudence and legal philosophy consist sole sources of such a perspective of constructivism or realism, There exist two major relationships in which perspective and its source compose a pair of reflections of each other, one, where constructivism is for the natural law as there an "ought-to-be" common value is constructed, or supposed to be the prior precondition of deductions, and two, realism is for social law as only what exists in reality could be useful for such deductions in pursuit of an answer for the question: How will the energy law suit people's need (if something like "happiness" is too wide to be defined)? However, the second claim bases itself more on effective measurement of the factors: system, unit and interaction, and researches are applying these factors to judge what type shall a theory belongs to.

"Constructivists divide their theories into two parties: one for conventional and another is called critical"[23]. In this part, only the former will be discussed cautiously, for (1) it exactly meets people's customary identification of "construction"-"build up" or the course or efforts of it, and (2) critical thoughts are not welcome by scholars, as in these thoughts even the worst scholars shall see the fatal lack of necessary academic basis of theoretical critiques: theories are easy to be destroyed or fall collapsed, but to build or rebuild it in a rather rapidly changing world is far more demanding- That's what critical authors care little about. Returning to the concept "constructivism" itself, scholars have concluded two major factors of its utility: actors and their identities. The former is the subject, and the latter shall "regulate" or "instruct" their behaviors, especially choices-often it is based on "intersubjective social context", and values like "state interest" or "public interest"[24] are out of exchange of minds from actors. This part engages a plenty of classic theories. From Grotius, Western Europeans have been tending to look for a higher collective convention over state regulations (just like what the UN Chapter is aimed at) - an ideal form of it is "law from the nature"[25], another is human law-under the circumstance that energy supply is trapped by each trade party's distribution regulation, like complex and continually changing tariff imposition or

[22] See Chen Yugang & Chen Zhimin, Constructivism: After Neorealism and Neolibral Institutionalism, WORLD ECONOMY AND POLITICS, 1998, at 28.
[23] See Wang Yizhou, Western International Politics: History And Theories 182-227 (Shanghai: Shanghai People's Press, 1998).
[24] See Clifford A. Bob, Energy Law, ANN. SURV. AM. L., 1983, at 629.
[25] See Zhou Ziya & Jiang Enci, Grotius's contribution to International Law_Written for 400th anniversary of Grotius's birth, LAW SCIENCE, June 1983, at 43.

import permission procedures, the poor and even bourgeoisie or "middle class" are facing sudden shortage of coal or gas in despair. Just unfair or irrational (maybe it's designed by the authorities to be "rational") legal regulation on energy market could be fatal, and this finally leads to humanitarian crises. Later than that of Grotius, Immanuel Kant has raised "eternal peace"[26] for people as the central point of his constructivist theories for the article. Before World War I, constructivists were busy at precautions for the war, but not for "benefits". Finally, after economic crisis in the 1970s, when world market (crtainly including energy market) was being formed, critiques turned to economic from political perspectives and came up with theories as "international civil shall make efforts to reduce or mediate sufferings"[27] and "there should be principles regulating behaviors at a minimum standard"[28] for the human society to guard every individual well.

2. Realists' Energy Law

However, the abstract and obscure ideas from constructivist will not be accepted by realist. Realism may be the most powerful theory on international relationship and state practice; it greatly shapes the energy market since 1980s, or maybe earlier than that time. People love to watch the world and its developing tendency through a recognition of power (should be "state power") and force (perhaps armed), and it meets a minimal identity of human evolution: Darwinism. This is not the beginning; Darwinism is just an end of "the beginning" to an extent; "the beginning" is when Nicole Machiavelli raised the idea of "reason of state"[29]. Each entity gathered as a state would apply its reason for struggle of profits, and other factors or variables will then be secondary-the international system must contain nations which are respectively "powerful" or "powerless", and in reality, the former absolutely "exploit" the latter, and spontaneously forming the shape of an "Empire". It's so welcome in trade, because there always exist someone winning and others losing. Currency and cash flow under supervision of WB or IMF went from this country to another, or maybe investors from their home state, and those who last stand win the most Researchers, especially those on branch of history , are in fervor of this theory, for it authentically interprets the period of expansion of imperialism and exploration with exploitation of the wide range of regions from European Continent to Asia, Africa and America (under Monroe's instructions). The world is not separated, but it's power imbalance that terminate the separation. And what about balance? Balance could be broken, as what the imperialists had done in 1914 gave us the best case proof; it's extremely hard to be rebuilt, and this really means something. The market we are discussing should by all means be an international, multilateral one, not a domestic existence or a part of it in a certain region. So who shape the market, with what ways, could be found under a perspective of realist legal philosophy and economic politics. Thus, nowadays, the most expressive feature of realism is "mimetic" legislation, which most probably appear in developing countries when making certain laws on regulation of energy market as a whole or part of it, for

[26] See Wang Guiqin, Review on Kant's Philosophy of International Law, LEGAL FORUM, Mar. 2007, at 134.
[27] Richard Shapcott, The Critical Theory, in THE OXFORD HANDBOOK OF INTERNATIONAL RELATIONSHIPS 371 (Christian Reus-Schmitt Nanjing: Yilin Press.1d ed., 2019).
[28] Molly Cochran, Ethics of the English School, in THE OXFORD HANDBOOK OF INTERNATIONAL RELATIONSHIPS 315 (Christian Reus-Schmitt Nanjing: Yilin Press, 1d ed. 2019).
[29] See Zhou Baowei, "Reason of State", or "Ration of State"?_Perspective in Triple Context, DU SHU, Apr. 2010, at 36.

example, “Safe Production Law”. In China, this law is publicized (born) in 2002, but in 1930s there was “Gas Laws” in the US. Yet here “secondary” (in the procedure of energy commercial activities) and primary (under category of department) laws should be distinguished, early in 1974 “through the new deal era”[30], there came the “Transportation Security Laws” with relevance to liabilities in security guarantee in part of production of oil, coal and gasoline, and in such a situation has Chinese law makers imitated rules set up in US law for identical regulations. Thus, the institutional structure, presented as (1) orders and logic of the articles made up, and (2) division of regulation under content of laws, for example, index, chapters, sections e.t.c. are “transplanted” into another actor state. It’s a fast step towards regulation, but will a single, individual state owns the fit or appropriate social environment to accept this transplantation? Will that be well “utilitarian” in folks, not in academic debates?

And there’s the comment for that two theories.

Energy laws share the facet of constructivism, especially in China, as people view publicized texts of “Renewable Energy Law” “Electricity Law” or even the earliest “Coal Laws”; they shall spontaneously be aware that: these contents are attempting to set up altogether awareness of energy law framework and specific departments of the state- this is what we call “identity”. Also, such an “identity” could be stretched to other entities overseas: transnational corporations dealing with coal transactions have to focus on newly-established rules from new-born departments of such a text system, and departments themselves help construct “pool of rules” to avoid capitulation of supervision or other moral risks- as some scholars shows, sometimes ways to deal with such risks will even escape law texts and, by the way, through adjustment clauses in specific contracts[31]. In this way, that “social practices” are rather usually achieved, to gather a warrant for legislation and also, a guarantee for ideal supposition carried out through gathered “identities”. Or, could this thought be deployed that: only after the text or texts serving energy market appeared (for example, EPCA (1975, c.r. U.S.) and EISA (2007, c.r. U.S.)), consideration or reconsideration of legal relationship energy trade and transferring would be rooted to the state, the people and the business participants. In brief, constructing laws is for making up people’s identities, and people’s identities are for the potency of the institutional upper-structure. Nevertheless, realists may “strike back” just from that point of logic links: upper-structure and its effect on reality. When regulation is considered “restraint” or “second adjustment” (the first is by the market itself), this theory applies better. Before all should energy commerce be valuable or worthwhile after the first industrial revolution could they be regarded as “properties”, and when there are “properties” there is trade, and problems in trade make people advocate legislation, for example, “institutions that ascertain rights of energy serve the cornerstone of energy property transactions”[32](and that also applies to Market access).

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[30] See Joseph P. Tomain & Richard D. Cudahy, Energy Law in a Nutshell 631 (2d ed. 2011).

[31] See S.Scott Gaille, Reducing Conflict and Risk: Why Parties Benefit From Using Enumerated Adjustment Clauses In Energy Construction and Services Agreements, 42 ENERGY LAW JOURNAL 123, 123(2021).

[32] Zheng Jianing, Legal System of Energy Property Transaction in China, COMMERCIAL TIMES, 20 May 2014, at 122.

For another perception or methodology to have a clearer command of this thought, may it please the readers that this article conclude the counterpart character of that two minds: the constructivist law would love to establish or create a new rule and deduce from it to send the upcoming criteria down, where people should only act as receivers of an order; the realist law begins with existing problems, and from the problems relevant laws are induced and provoked, if necessary. The former is abstract, while the latter is concrete; the former is from law to life, and the latter is from life to law; the former is from "ought to be" to "be", yet the latter is from "be" to "ought to be"- they are substantially dialectical. Utility of such a dialectic helps understanding recent energy law systems: for what people want isn't equal to what system tends. On the contrary, they may to some extent "interact", for example, be or has to be affected by "others'".

C. Energy Law Under Internationalist Perspective

And the last party for series of theories is Internationalist. When this concept is discussed, Marxist view is indispensable. Nobody's unchallengeable rights should be deprived, such as right of living, habitation and dwelling on peace, and that's not only for bourgeoisie, but also for proletarians. Not only proletarians' domestic or civil rights should be well preserved, but also they shall be cared about with international cooperation. Therefore could it be concluded that internationalists' energy law is based on five types of interpretation:

(1) attaching importance to the reality that, the world has formed a complete, trans-regional, and multi-cultural energy market over geographical traditions and customs-all members participating in this market shall recognize the basis of interactions all over the world-they are "fragments" which form a global horizon;

(2) construction of rules (multilateral conventions, like VCLT and the United Nations Conventions on the Law of the Sea, UNCLOS) , principles (treaties berween sides and parties) and collective instructions (Proposal of "Human Community with a Shared Future"[33]) has done basic work of system modification- nowadays a political feature under "Global-constitutionism" is built up, and these outcomes boost constructivists' confidence for further stretch of "sum total of concept form nations"[34] to outspread ideal "identities" throughout the world: could the fragments get together to shape a new energy market (for example, standards could be remade or modified to achieve the common ground), thus unite human society;

(3) in form of law content as series of climate conventions show, (whether it is named as the Paris Agreement or the Kyoto Protocol), humans ,when facing a terrifying future of "must limiting the increase of global temperature below 2 degree centigrade in the 21st century"[35], Bentham's idea returns to the proud parliaments and congresses-

[33] See Zheng Guangyong, From Westphalia System to the Necessity of Building a Community of Shared Future for Mankind, 18 JOURNAL OF BEIJING UNION UNIVERSITY(HUMANITIES AND SOCIAL SCIENCES) 29,29 (2020).
[34] Li Shaojun, Grand Theory of International Relations and Comprehensive Explanatory Model, WORLD ECONOMY AND POLITICS, Feb. 2005, at 22.
[35] Climate Change 2021: The Physical Science Basis, Intergovernmental Panel On Climate Change [IPCC] (2021).

now we need a rapid and effective transition[36] of energy components, at any cost, yet it's just an ideal situation, or suggestion only.Under some certain subjects, idealism leads the majority of human beings to a better future; at least, energy law cannot ignore its object to bring "industrial blood" to regions and areas indeed wherever in need;

(4) returning to beginning proposal of this article, researches on institutions are credit to neo-liberal institutionists' arguments, and this hypothesis will of certainty introduce interest measurement- it will be about each step of circulation of energy commerce, for example, transportation (regulation in detail) and overspread trade rules settlement (WTO rules and relevant TRIPS standards). Now that textbooks or teaching scholars would like to redivide regulation on energy transportation in direction of "Incoterms"- from the factory will the actual, legal relationship between buyers and sellers fall into force (calculated or captured by EXW standard ("Ex works")), considering whether a carriage begins with boarding on a ship or vessel (captured by FOB standard ("Free On Board")) or being given to carriers (captured by FCA standard ("Free Carrier")), and it will terminate through substantial, complete delivery to a certain destination (captured by DDP standard("Delivered Duty Paid") mostly)- That means, every single action of an actor is accompanied (and in the meantime, supervised) by a certain institution made up, and people shall have confidence on domestic and then transnational institutional structure for they have been effectively elaborated after being carried out, for negotiations and compromises are unavoidable. It's construction upon constructions, with excellency over stability,

(5) and that provokes Marxists' enthusiasm, for liberal institutions may not function as well as what people have long been imagined. In Marxists' minds and thoughts, undoubtedly institutions as upper-structure should be "rooted in" material living experiences. This identity is so sensitive and attractive for energy circulation is really what must be observed through "material" perceptions- If there exists a committee for energy international trade work, it will just be designed to deal with such collective affairs, and its power of management will not overwhelm that power of state machines and capitalist's financial forces behind them. Energy is in charge and under control of Capitals; laws will fall to serfdom to transnational capital forms and entities, and from one step to another it will of no doubt pass through barrier of taxes, tariffs, fees or fares from government organizations. However, energy is born with its character of welfare. "Coal still plays a dominant role in meeting energy supply for Poland, India, Turkey and China"[37], and distribution of such "welfare" remains far from reasonable. In the past 100 years, capitalists, whether they are from the bank or from the industry, came together for partition of global welfare as well as alienation of proletarians. Credit to this course, barriers from unchallengeable difference of environments and traditions of each state are finally overcome by reunite of the exploited global proletarians, and the market is forced to unite itself, with the pushing force of capital activities and actor interactions.

Therefore, energy law in perspective of internationalism is for the united world economy and people's interest, but by separate actions from greedy market controllers.

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[36] Id. 2 at 34 (Huawei Ltd., 2021) .

[37] Edited by David·L.Schwartz, The Energy Regulation And Market Review 8 (Law Business Research Ltd., 2016).

III. DEVELOPING LEGAL REGULATION: PATHS AND PROBLEMS

A. Demand of Globalization: Multilateralism and Regionalism

Could we continue from a brief introduction of perspectives for observation of energy law system and detailed instittions to the end of meaningful inspiration from internationalists: transnational energy capitals, international system of legal regulation throughout trade (as a dynamic factor) and market (as a static factor), and trend of multilateral interactions- sounds like a "Frankenstein" of all mentioned theories and perspectives at all. But this is what this article really would love to present. Existing energy law system would not easily cope with questions on its theoretical sources, or its future tendency, either. Therefore, a problem is to be answered then: what about the future tendency of this system established and then "edited" (modified) for several times (by several entities)?

Immanuel Wallerstein claimed the concept of "World System"[38], this concept and its subsidiary theory is on the contrary to those thoughts from international relationships, and he points out the influence of productivity and division of work round the global links of economy- in this way, "western capitalism expands and penetrates towards world outside Europe"[39], and thus establish a complete system of Western Capitalism. That implies actually the two theories this article applied to analyze "past and future" of legal regulation on energy market, share way to argue in contrast. Similarly, that theory from Bentham, Wendt and Nye deduce from a relationship framework of energy trade in ideas, but Wallerstein with other scholars end such a deduction at a framework coming soon. Thereby, starting from law contents to an ought-to-be structure and to a tendency of alteration, the logical linkages are soon to be completed.

Recently, in years before 2016, this tendency is pushed by neo-liberalists as a trend of "globalization" side of its partner concept, "globalism". Reforms on energy law have been proceeding for almost 40 years since SPR in the US- after year 1975 US regulation on energy market tend from law of establishment to law for policies, and policies are loyal servants to reform tendency whether it is pushed by administrative or legislative force, or just an advocate made by transnational organizations-existence of legal compliance decides quality of legislation. When systems are faced with globalization, as mentioned in parts above, integration or modification regulation criteria would be an access-over 6 shifting periods of US legislation have told tales of romantic "globalism", and it's fortunate for American people to see US standards, for instance, "Fuel Economy Standard" (set by EISA) , travel throughout the world just for realists have ensured American force of legislation "internationalization", then making US a suitable example of "Hegemony Governance"[40] ; another way is to compete in the "global market" and wait for the consequences; then regulation would be based on reports- for example, China recently carried out a progress report for sustainable energy

[38] See Liu Wanwen, Zheng Dandan, On Some Problems of the International System, 19 PACIFIC JOURNAL 26, 27 (2011).
[39] Wang Junsheng &Yang Yongbin, Analysis on the Basic Connotation and Evolution Mechanism of Modern International System-Also Talk about the Enlightenment to China, DIPLOMATIC REVIEW, Jan. 2010, at 128.
[40] See Jian Junbo, Analysis of the Current International System, ACADEMIC EXPLORATION, May 2008, at 37.

transition, and it directly mentioned part of "participating in 'global energy governance'"[41], or evaluation of such a consequence. State must "be subject to" global standpoint.

However, in 2016 the "Brexit" and Donald Trump's inauguration in a sudden brought about "anti-globalization" (or "de-globalization")- a path through globalization was harshly challenged. Meanwhile, it probably offered a chance. For this article, it's highly like a "return" to"Neo-regionalism", where the model indicates that larger states using rules and principles for expansion of its power projection over a realm of region restricted to a continent[42], or a smaller area for transnational activities. Maybe this path is more suitable for current energy trade: by Feb 1st 2016, valid regional trade agreements had reached a sum number of 419. In Part III of this article EU energy institutions have been talked, and another active centre of regionalism (whether it's positive or negative-which means "protective" in Chinese authoritative expressions), is regional legal narratives occurring in East Asia. Would it be possible for energy market to be fixed or independently nourish such a structure in this region had been heated discussed: Professors began to claim that transition of energy institutions were inevitable, and its essence was transformation of energy capitals- only improvement of institutions could boost capital development[43], so the way to energy "revolution" or "evolution" in law was welcome. Thus, a surprising outcome is pushed out that regionalism may carry with better energy laws and more satisfactory market functions. That path is welcome by legal realists, for actual performance of legal activities decide the world's presence.

Energy booming mechanism could not be parted from domestic appeals and "market infrastructure", and if this concept could be expansively interpreted by researchers it would inevitably involve systems, like "market entry certification system" [44] with subsidiary provisions, such as licenses, preconditions, changing circumstance consideration and pre-entry environmentally protective supervisions. For this course could not avoided and may somehow sound "spontaneous", it naturally harbour the character to affect business activities with legislative transitions. A more aggressive way to achieve the same goal is to follow "Legal Formalism". It stood with the Roman Empire, was debated in the 20th century and was transited to "Neo-Legal Formalism"[45]- laws on energy should be comprehensible, and made something sure about the fluctuate market.

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[41] China's Progress Report On Implementation Of The 2030 Agenda For Sustainable Development 71 (2021).

[42] See Li Xiangyang, New Regionalism and Great Power Strategy, INTERNATIONAL ECONOMY REVIEW, Apr. 2003, at 5.

[43] See Xiao Guoxing, Legal Choice of Energy Capital Transformation, 476 LAW SCIENCE 70, 70(2021).

[44] See Zheng Jianing, On Legal Regulations of Energy Market Entry Certification System, 30 HEBEI LAW SCIENCE 121, 134(2012).

[45] See Lv Jiang, Modernization of Energy Governance: A 'New' Legal Formalism Perspective, 20 JOURNAL OF CHINA UNIVERSITY OF GEOSCIENCES (SOCIAL SCIENCES EDITION) 48, 49(2020).

B. Current Problems As Declination of Human Rights Goes on

No research is rewarding unless it is concerned with current, proceeding problems in reality on the globe. In energy realm, as what this article has pointed out in the beginning part, people' re somehow trapped with these problems at all:

(1) Energy security concerns for Powers (that shape the energy institutions from reasons of states). To avoid conflicts, or just for demand of cutting down costs and boosting the benefits of trade makers, institutions should be more intimately applied from the perspective of nations. Such a voice has covered "interactions" and, a prevailing division of ways to help states may refer to 3 classic types: aggressive, balanced aggression and defence, and diplomatic type of system interactions[46]. As types could not compromise with each other, and states based on various reasons for choice making shall push the tendency of "energy diplomatic" or "energy political" interactions to the unknown. That is somehow defined as security concerns for powers, where nations feel hard to have substantial command of interactions caring about energy.

(2) Demand of Environmentally Protective Policies (and appealed internal transition of energy market). This article could give rise to the problem of energy industrial transition for man kinds can no longer stand by watching the environment turning much worse. China has promised to reach peak of carbon dioxide emissions by 2030, and by 2060 achieve carbon neutrality. However problems appear to involve: A. gap between central government's decisions and province actions, sounding similar to US central authority as the federation and each states behavior, and B. each province's behavior may bridge cooperation and even unification of the state energy policies. What's more, factories and business partners, as the counterpart of legislators, should be granted time to react with effective measures, just for escaping from penalties. Actors are "kidnapped" by standards as "net zero CO2 emissions" and "climate neutrality"[47]- the market will at least fall into unnecessary price fluctuation.

(3) Lack of political stability (and imbalanced path inclination). Researchers found that bilateral relationship between two countries would directly affect stability of energy investment[48]. An example for that is, US and China politicians tried hard to maintain Obama's "Legacies" to proceed normal cooperation of energy exploitation, institution settlement and acceptable, respective legislation. However, state law is decided, if discussed under the thoughts given in subject (2) above, by national political choices, and mind flow which composes infrastructure of that nation when considering energy items, would be given the priority easily for it is concerned by subject (1), security and other fatal affairs. And where there is low stability of interactions there is high-standard protective institutions.

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[46] See Zhao Xiaohui & Xiao Bin, Energy Security Expectations, Status Quo Preferences ans the Energy Diplomacy Decision-Making of Great Powers, JOURNAL OF CONTEMPORARY ASIA-PACIFIC STUDIES, June 2011, at 110.

[47] See Lin Weibin & Wu Jiayi, Disussion on the Framework Roadmap of China's Energy Transformation Under the Goal of Carbon Neutrality, PRICE THEORY AND PRACTICE, Sep. 2021, at 9.

[48] See Li Kuangran & Li Zhengtu, Preliminary Study on the Legal Mechanism of China's Foreign Energy Investment Protection_An Analysis Based on the SCO Framework, JIANGHUAI TRIBUNE, May 2021, at 142.

(4) Potential but urgent pursuit of "Energy Justice" (which leads idea retrospection to Benthamism). Economists began the discussion from "Strict Egalitarianism"[49] for distribution of commodities. In the development of methodology of interpretation, it is given "opinio juris" in its concept transitions. The deductive method calls earnestly for social participation to form a force correcting defects of energy market in service, and this article advocates Marxist thoughts for justice achievement in human rights (if subject (1)(2)(3) have provided a penetration for declination of regulations, which means for "defects"). Now that shortage is continuously made out of the institutional structure, that barriers, supervisions, lack of treaties, internal conflicts on policies, loss of control from the central authority to regional powers, and people's need not yet met, constitute leak of institutions, and they are all reflective features from the market as the place where monetary factors are substituted with materials, to meet the basic economic rules and orders. Labors act as engines for productivity, and the way commodities are alienated shall be similarly injected to money, and even labors as human. States are just pretenders of capitals (in this period of time), and rules must be both regulatory media and civil guards- in perception of state ruled by law. Lives are deprived from the world, and all energy laws, whatever their structures are, shall be for lives themselves.

May it please governments of the nations all over the world that, energy shortage would but must not in this way constitutes a murder to inhabitants.

CONCLUSIVE DISCUSSION

An analysis on legal form of energy institutions with its structure may be faced with problems especially in reality and on law doctrine study. Usually, the former decides the latter in several ways: Benthamist or Utilitarians would see such a course in direction of pursuit of human happiness, and law is for meeting civilians' demand; Realists could research on comparative power and effects from state capability and influence on energy affairs, whether they are domestic or international; Constructivists in another direction penetrate international relationships and national governance, consider through institutional "make-up" could a structure be deduced from mind flows but actual demands, and values internally injected are honored in the first place; Internationalists, whether they are Neo-liberal institutional, or Marxist-Leninist, appeal to stand up to a level over the global political and economic tendency for searching for a resolution of transition of energy regulatory institutions. However, from the case study in China and comparative case analysis through EU, US and other representative region for legal outcomes under a perception of institutionalism or legal formalism could the article conclude that problems, like security concerns, environmental protection goals, stability leaks and the following humanitarian crises, would not be easily covered by the paths round globalization and regionalization (sub-globalization): for a better functioning energy institution model of structural legislation, shift to joint cooperation or critical mixture of thoughts of constituency for the subject, is required at once.

[49] See Wang Mingyuan & Sun Xueyan, "Energy Justice"and its Sinicization_An Analysis Based on Electric Power Legal System, ACADEMIC JOURNAL OF ZHONGZHOU, Jan. 2020, at 61.

COMPREHENSIVE SURVEYS ON VALIDATING WEARABLE ECG DEVICES AND RELATED FDA'S SAMD REGULATING DEVELOPMENT

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Abstract: Wearable technology is becoming more and more popular because of its convenience and accessibility, especially in connected health. Machine Learning algorithms are proven to be a practical approach in improving the accuracy of wearable technology. Recently, the FDA has established several goals of regulating AI/ML-based Software as a Medical Device (SaMD) to validate products before applying in a clinical setting thoroughly. This review comprehensively analyzes studies validating different wearable devices and algorithms conforming to the FDA standards and discusses the potential consequences of wearable devices' usage. We find an acceptable accuracy for the devices and the need for further investigation into this technology.

Keywords: SaMD; Medical AI; Administrative Law; Wearable Technology; ECG

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Table of Contents

INTRODUCTION

Connected Health is defined as the model for healthcare management that offer a remote and more personalized service with the utilization of technology.[1] The goal of connected health is to provide opportunities for patients to participate more in their healthcare, and the emergence of low-cost costumer technologies enables this aim.[2] One of such technologies is wearable consumer electronic devices: with technological advancements in battery and computing, these devices have been able to keep track of medical data in a non-clinical setting.[3] In April 2015, Apple Inc. releases the Apple Watch Series which could measure a person's health data including fitness tracking, heart rate (HR) detection, and energy expenditure. In particular, Apple Watch Series 4, released in September 2018, has hit the market with its built-in software and hardware to perform a single-lead electrocardiogram (ECG) and detect atrial fibrillation (AF).

AF is a common type of cardiac arrhythmia from which more than five million people in the US suffer.[4] It is proven to increase the risk of stroke, heart failure, and mortality.[5] Currently, the most common technique for carrying out heart analysis is a standard 12-leads ECG, which records heart activity through putting electrodes on the body surface.[6] However, such technique requires patients and physicians to be present in the same place along with the 12-leads ECG device, which is ineffective and bothersome for the detection of AF in consideration of AF's asymptomatic nature.[7] While simpler ECG devices seem to be a solution, negative results could occur if the detection device is unable to perform long-term recording of ECG.[8] It is suggested that around 700,000 people in the US may have potential AF that is left undiagnosed, bringing up the need for the development of devices with portability, accuracy, and auto-triggered testing functionality at the same time.[9]

Several low-cost arrhythmia detection devices, including the previously mentioned Apple Watch Series, have been developed with ECG functionality.[10] Many of the devices are capable of instantaneous diagnosis and transmittion of physiological

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[1] Paul Walsh, Support Vector Machine Learning for ECG Classification 10.
[2] Id.
[3] Nabeel Saghir et al., A comparison of manual electrocardiographic interval and waveform analysis in lead 1 of 12-lead ECG and Apple Watch ECG: A validation study, 1 CARDIOVASCULAR DIGITAL HEALTH JOURNAL 30–36 (2020).
[4] Dhruv R. Seshadri et al., Accuracy of the Apple Watch 4 to Measure Heart Rate in Patients With Atrial Fibrillation, 8 IEEE J. TRANSL. ENG. HEALTH MED. 1–4 (2020).
[5] Zachi I Attia et al., An artificial intelligence-enabled ECG algorithm for the identification of patients with atrial fibrillation during sinus rhythm: a retrospective analysis of outcome prediction, 394 THE LANCET 861–867 (2019).
[6] Vincenzo Randazzo, Jacopo Ferretti & Eros Pasero, ECG WATCH: a real time wireless wearable ECG, in 2019 IEEE INTERNATIONAL SYMPOSIUM ON MEDICAL MEASUREMENTS AND APPLICATIONS (MEMEA) 1–6 (2019), https://ieeexplore.ieee.org/document/8802210/ (last visited Feb 19, 2022).
[7] Id.
[8] Kenichi Hashimoto, Naomi Harada & Yuji Kasamaki, Can a Patch Electrocardiographic Device Be a Leading Actor for Detecting Atrial Fibrillation? ― Diversifying Electrocardiographic Monitoring Devices ―, 86 CIRC J 189–191 (2022).
[9] Seshadri et al., supra note 4.
[10] Randazzo, Ferretti, and Pasero, supra note 6.

data for any further clinical review.[11] The driving force of consumer interest in these devices culminated in the US Food and Drug Administration (FDA) clearing several portable healthcare technologies.[12] They could potentially help carry out population-level screening of AF combining with subsequent reviews from cardiologists to prevent severe cardiovascular diseases.[13] Nonetheless, the accuracy of diagnosis brought by these arrhythmia detection devices must be validated rigorously before their usage in a population-level setting.[14]

Most of the devices depend on the algorithms behind them to make diagnosis; therefore, the mechanism for these algorithms largely influence the performance of detection. Machine Learning (ML) has been more and more dominant in the design of algorithm: it is becoming as an effective approach to integrate multiple factors together to promote diagnostic accuracy.[15] For example, on Apple Watch Series 4 and later, Apple uses convolutional neural networks (CNNs) as the ML algorithm to classify data obtained from the watch's sensors.[16] There are other ML techniques that have different designs and, thus, are expected to show different levels of accuracy in the analysis of symptoms and detection of cardiovascular diseases. Some individual studies have evaluated the accuracy of arrhythmia diagnosis for a certain wearable monitoring device with/without assessments of its algorithm, and carried out experiments to compare it to a standard 12-lead ECG device currently used for clinical observation, yet few of them perform comparative analysis among the devices/algorithms to analyze the characteristics for each of them, which could provide consumers and clinicians direction for choosing the most effective and appropriate one.

FDA has been paying close attention to the regulation of the medical devices using AI/ML-based software, and published an action plan in 2021 discussing actions needed for an effective validation of SaMD.[17] These actions include: 1. A new framework for the AI/ML-based SaMD 2. Standards for Good Machine Learning Practice (GMLP) 3. Transparency of SaMD to the public 4. Effective validation and improvement for SaMD 5. Putting the application of SaMD in the real-world scenario.[18]

Given the rapidly grown wearable technology and environment of connected health, many devices are left without evaluation conforming to the FDA standards before their actual use, and consequences of this revolutionary healthcare system are not discussed thoroughly. This study aims to analyze the performance of currently available arrhythmia detection devices and algorithms, with a discussion of the consequences of using these devices, for a better understanding of the capability and potential usage of wearable technology in aiding clinical decisions.

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[11] Kevin Rajakariar et al., Accuracy of a smartwatch based single-lead electrocardiogram device in detection of atrial fibrillation, 106 HEART 665–670 (2020).
[12] Id.
[13] Id.
[14] Id.
[15] Martin P. Than et al., Machine learning to predict the likelihood of acute myocardial infarction., 140 CIRCULATION 899–909 (2019).
[16] Walsh, supra note 1.
[17] FDA, Artificial Intelligence/Machine Learning (AI/ML)-Based Software as a Medical Device (SaMD) Action Plan (2021).
[18] Id.

I. METHODS

All data we use are studies that are relevant to either wearable ECG devices or algorithms that are tested in terms of their performance on diagnosis of cardiovascular diseases. This study compares the results drawn from the sources, and then provides a comprehensive analysis on these devices and algorithms, including their ability in detection as presented in the relevant studies, factors that influence the process of presenting the results, such as participants, criteria, and focuses of these studies, and the limitations brought up in this comparison process that might lead to future developments of the subject.

The following inclusion and exclusion criteria are applied to a found study to ensure its level of relevancy.

Inclusion criteria:

1. The study must either evaluate a certain electronic arrhythmia detection device or an algorithm that could be applied to arrhythmia detection.

2. Overall analysis on the current situation of the usage of electronic devices in healthcare will also be included.

3. The study must have some quantitative evaluation of information regarding the detection of a cardiovascular disease. For example, it might assess an ECG device's sensitivity and specificity of AF detection.

4. The study is presented in English.

Exclusion criteria:

1. The study only discusses devices that can perform ECG or arrythmia detection but are not easily appliable under the current environment of connected health, such as a 12-lead ECG device.

2. The study only presents an algorithm but does not evaluate its effectiveness on arrythmia detection.

This study is going to start by discussing the main topics of the sources and classifying them into different types of studies. This process helps articulate the nature of all gathered information and provides an open-up for the subsequent analysis. Then, a brief summarization of the targeted diseases and the devices and/or algorithms in the studies will be presented.

There are several indicators that could be used in the comparison of the studies. Many studies present some or all of the following descriptive medical indexes: sensitivity, specificity, positive predictive value, and negative predictive value. Therefore, even with different participants and cohorts, these studies are comparable due to the shared mathematics, which provide a direct insight into the effectiveness of the presented devices. In particular, F1 score is used in some of the studies to obtain a more balanced statistical measurement of a device's performance. This is calculated by the harmonic mean of the precision (positive predictive value) and recall (sensitivity).

Another commonly used indicator is the area under the curve (AUC) of the receiver operating characteristic (ROC) curve, which illustrates the diagnostic ability of a binary classification system, in this case the presence of the target cardiovascular disease.

Because of the relatability of the studies with common metrics such as sensitivity, specificity, and predictive value, quantitative data analysis will focus mostly on these measurements to reasonably compare results as much as possible. However, due to the different experimental conditions, influential factors in the studies will be considered to elucidate unexplainable differences. If certain metrics cannot be analyzed without its context, this study will refer to them without emphasizing them as decisive variables for the evaluation of the devices or algorithms.

In addition to the quantitative analysis, qualitative assessment, including comparison of the conclusion sections for the sources, will also be performed, and relationships such as agreement or contradiction will be noted. Any differences will be accounted for with potential causes such as different demographic features of participants or standards in measurement. Due to the outstanding numbers of studies regarding the accuracy of Apple Watch Series, they will be analyzed and discussed among themselves in detail. These studies will make Apple Watch Series a current model for the arrhythmia detection device, and any results drown from its analysis could potentially lead to advancements in such technology. Finally, as analyzed in some studies, the use of these devices might be influential to people's decision and mental health, such as their engagement with healthcare systems, or the existence of health anxiety, so the consequences of healthcare devices will be discussed at the end.

II. RESULTS

With the inclusion and exclusion criteria, a total number of 20 studies are eventually included in this review. For convenience, these studies will be labeled [1] to [20], each of them having the same number as that in the reference list. Several factors lead to this relatively small number of literatures. First, in the rapidly expanding market of healthcare technology, there are more than 100,000 mobile health-related apps and >= 400 wearable activity monitors.[19] However, research or clinical validation is not performed on many of them before their practices directly to the consumers, leading to the limited number of available research.[20] On the other hand, there is an unbalanced number of research toward the currently most popular Apple Watch devices, while other devices receive much less attention. Lastly, most of the studies provide insights into further developments of the healthcare technology, but they also point out the need for more rigorous investigations and evaluations, so the archive is yet to be complete.

Table 1 and 2 show the classification of the studies in terms of their objectives and target disease, respectively. Among all devices, Apple Watch receives most evaluation, with 9 studies validating its accuracy and another 3 studies mentioning its usage. Other kinds of wearable or portable devices include the AliveCor, the ECG-WATCH and other patch-type devices. 4 studies assess 4 different algorithms that could

[19] Giuseppe Boriani et al., Consumer-led screening for atrial fibrillation using consumer-facing wearables, devices and apps: A survey of healthcare professionals by AF-SCREEN international collaboration, 82 EUROPEAN JOURNAL OF INTERNAL MEDICINE 97–104 (2020).
[20] Id.

help improve the detection functionality for healthcare devices. 17 studies discuss the diagnostic capability of the device. 11 studies choose the detection of atrial fibrillation for the performance assessment, with 2 focusing on myocardial infarction, 1 on heart rate variability, and 3 on ECG generation and classification.

Table 1 *Classification of Studies' Objective*

TYPE	NUMBER OF STUDIES (%)
DEVICE (55%)	
APPLE WATCH	9 (45%)
ECG-WATCH	1 (5%)
ALIVECOR	1 (5%)
ALGORITHM (20%)	
MYOCARDIAL ISCHEMIC INJURY INDEX (MI^3)	1 (5%)
VECTOR MACHINE LEARNING	1 (5%)
GLASGOW ALGORITHM	1 (5%)
CONVOLUTIONAL NEURAL NETWORK	1 (5%)
OTHERS (25%)	
DEVICE COMPARISON	1 (5%)
TECHNOLOGY DISCUSSION	3 (15%)
GENERAL ASSESSMENT FOR ARRHYTHMIA DEVICE	1 (5%)

Table 2 *Classification of Studies' Subject of Evaluation*

Evaluation Subject	Number of Studies (%)
Atrial Fibrillation	11 (55%)
Myocardial Infarction	2 (10%)
ECG Generation & Classification	3 (15%)
Heart Rate Variability	1 (5%)

Others	3 (15%)

A. Participants and Cohorts

Each of the studies feature their own study design, and thus incorporate different demographics as participants. As summarized in Figure 1, among all 20 studies, 5 do not include participants, either because the study is an overview of devices/algorithms or the current situation (Study [2], [8], [10], and [20]), or because the study uses ECG from existing databases (Study [7]). Other 15 studies have different recruit standards regarding the purpose of the study, yet normally only participants older than 18 could be recruited. In most cases, the summarization of participants for the studies will incorporate a section indicating the age and sex distribution, with some studies listing participants' history of diseases.

The number of participants largely varies among the 15 studies. Figure 1 maps each range of participant-number to the corresponding studies. 80% of the studies have less than 1000 participants, while Study [11] and Study [14] have 180922 and 419297 participants, respectively.[21] Most of the studies that have age statistics report a mean age of around 60, whereas Study [5] and Study [13] have participants with a mean age of 31 and 26.4, respectively.[22] There are no significant patterns for sex distribution. Note that due to the discrepancy in studies' objectives, the cohorts of different studies consist of people with different backgrounds, either healthy subjects or patients of cardiovascular diseases. In particular, Study [16] explores the impact of AF screening using devices through a questionnaire, the respondents of which are healthcare professionals.[23]

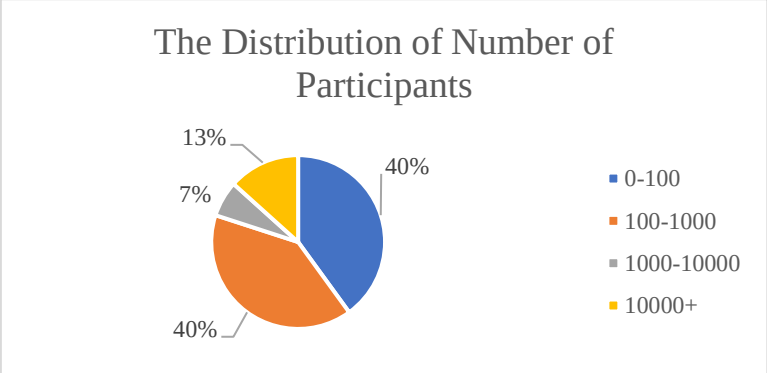

Figure 1 *The Distribution of Number of Participants*

[21] Attia et al., supra note 5; Marco V. Perez et al., Large-Scale Assessment of a Smartwatch to Identify Atrial Fibrillation, 381 N ENGL J MED 1909–1917 (2019).
[22] Saghir et al., supra note 3; Ahmad Turki et al., Estimation of Heart Rate Variability Measures Using Apple Watch and Evaluating Their Accuracy: Estimation of Heart Rate Variability Measures Using Apple Watch, in THE 14TH PERVASIVE TECHNOLOGIES RELATED TO ASSISTIVE ENVIRONMENTS CONFERENCE 565–574 (2021), https://dl.acm.org/doi/10.1145/3453892.3462647 (last visited Feb 19, 2022).
[23] Boriani et al., supra note 19.

B. Comparison among Accuracy Test Results

In terms of the medical indexes used to evaluate accuracy for a test – sensitivity, specificity, positive predictive value, and negative predictive value – 7 studies have directly mentioned them as indicators for the measurement (Figure 2). Among these studies, three are for the validation of Apple Watch and its related health applications, one is for AliveCor KardiaBand (KB), and the three left are assessments for algorithm's performance.

The three Apple Watch validation studies focus on two functionalities for Apple Watch: the Irregular Rhythm Notification Feature and the single-lead ECG generation (Apple Watch Series 4 or later). For the irregular rhythm notification functionality, Study [9] and Study [14] validate its accuracy and obtain a positive predictive value of 78.9% and 84%, respectively.[24] Note that because of the new generations of Apple Watch Series 4 and later, the older versions that rely on photoplethysmography (PPG) senser for notification have received less attention. Study [9] and Study [15] present the performance of the single-lead ECG generated by Apple Watch Series 4 or later. In particular, Study [9] evaluates the effectiveness of both ECG app 1.0 and ECG app 2.0, the latter providing additional classifications such as AFib with high heart rate and differentiating between poor recordings and inconclusive recordings.[25] For ECG 1.0, the sensitivity for AFib detection reaches 98.3% (236/240), while the specificity for sinus rhythm (SR) confirmation is 99.6% (238/239), if only the two results of AFib and SR are considered.[26] With the inclusion of all inconclusive recordings – either unreadable or unclassifiable – the Apple ECG app 1.0 correctly classifies 85.2% (236/277) as AFib and 90.5% (238/263) as SR.[27] As for ECG 2.0, the first set of sensitivity and specificity is similar to that for ECG 1.0, reaching a number of 98.5% (474/481) and 99.3% (436/439), respectively.[28] The second set, in consideration of inconclusive recordings, increases with a sensitivity of 96.0% (474/494) and a specificity of 97.1% (436/449).[29] Study [15], which reports on AW 4's accuracy for AF detection, obtains a much smaller sensitivity of 41% and a 100% specificity.[30] Note that it reports a 96% sensitivity and a 100% specificity when a rhythm assessment of the AW4 generated ECG is carried out, instead of the notification provided by AW algorithm.[31]

Among the other four studies with a direct measurement of the medical indexes, Study [3] evaluates the performance of AliveCor KB, yielding an overall sensitivity of 94.4%, which is improved to 95.4% when viewing those that are appropriately diagnosed as unclassified due to sinus tachycardia as correct diagnosis.[32] Its specificity

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[24] Apple, Using Apple Watch for Arrhythmia Detection (2020), https://www.apple.com/healthcare/docs/site/Apple_Watch_Arrhythmia_Detection.pdf; Perez et al., supra note 21.

25 Apple, supra note 24.

26 Id.

27 Id.

[28] Id.

[29] Id.

[30] Dhruv R. Seshadri et al., Accuracy of Apple Watch for Detection of Atrial Fibrillation, 141 CIRCULATION 702–703 (2020).

[31] Id.

[32] Rajakariar et al., supra note 11.

is 81.9% with unclassified readings seen as false and is increased to 90.7% when all unclassified readings are excluded.[33] The positive and negative predictive values for the KB are 54.8% and 98.4%, respectively, with the former increasing to 72.3% once unclassified diagnoses are excluded again.[34]

The other three studies present an assessment for the proposed algorithm. Study [1] measures statistics regarding the performance of a machine learning algorithm called myocardial ischemic injury index, MI^3, in the detection of type 1 myocardial infarction.[35] The algorithm provides an index with threshold values of low-risk, intermediate-risk, and high-risk for the patients to make clinical decisions. Within the low-risk range, the algorithm has a negative predictive value of 99.7% and a sensitivity of 97.8%; above the high-risk range, it reaches a positive predictive value of 71.8% and a specificity of 96.7%.[36] The MI^3 algorithm reaches an overall AUC of 0.963, indicating a well discrimination between those with and without type 1 myocardial infarction.[37] Note that this study also compares the target algorithm with other diagnostic strategies to gain an understanding for MI^3's comparative accuracy.[38] With the given threshold, MI^3 is better at identifying low- and high-risk patients, the primary reason being its flexibility of the testing condition and simplicity of stratification of risks using a single index.[39] Study [7] evaluates the use of Support Vector Machine in ECG readings and classification.[40] This study classifies heartbeat types into five labels, and the algorithm's F1 score is the major indicator for its performance.[41] The algorithm reaches a weighted F1 score of 0.97, calculated by the average of metrics for each label, in consideration of the number of samples as weights; when the data is unweighted, F1 score is 0.82 due to the unbalance of dataset towards many normal heartbeats.[42] Study [11] focuses on convolutional neural network, the algorithm currently applied by Apple Watch. Two analyses of its performance are determined: the first analysis tests the model on the first sinus rhythm ECG for each patient, while the second includes multiple ECG data for the same patients, thus indicating whether additional information could yield better results.[43] The first analysis obtains results as follows: AUC 0.87, sensitivity 79.0%, specificity 79.5%, F1 score 39.2%, and an overall accuracy of 79.4%; in the second analysis, all the statistics improve: AUC 0.90, sensitivity 82.3%, specificity 83.4%, F1 score 45.4%, and an overall accuracy of 83.3%.[44]

Table 3 outlines the results for the seven studies in this section. Since different values could be yielded because of different standards of data processing, the lower value will be considered in the graph.

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[33] Id.
[34] Id.
[35] Than et al., supra note 15.
[36] Id.
[37] Id.
[38] Id.
[39] Id.
[40] Walsh, supra note 1.
[41] Id.
[42] Id.
[43] Attia et al., supra note 5.
[44] Id.

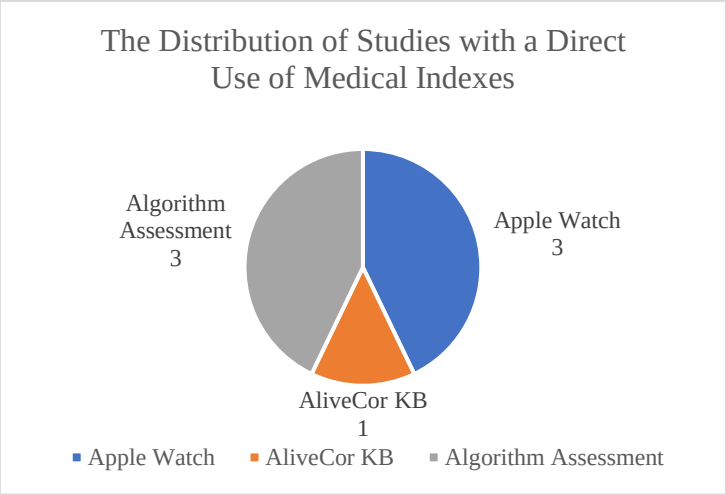


Figure 2 *The Distribution of Studies with a Direct Use of Medical Indexes*

Table 3 *Statistics for Accuracy Test Results*

	Device/ Algorithm	**Sensitivity (%)**	**Specificity (%)**	**PPV (%)**	**NPV (%)**	**F1 Score (%)**	**AUC**
Study [1]	MI[3]	97.8	96.7	71.8	99.7	N/A	N/A
Study [3]	AliveCor	94.4	81.9	54.8	98.4	N/A	N/A
Study [7]	Vector Machine Learning	N/A	N/A	N/A	N/A	82	N/A
Study [9]	Irregular Rhythm Notification	N/A	N/A	78.9	N/A	N/A	N/A
	ECG 1.0	98.3	99.6	N/A	N/A	N/A	N/A
	ECG 2.0	98.5	99.3	N/A	N/A	N/A	N/A
Study [11]	Convolutional Neural Network	79	79.5	N/A	N/A	39.2	0.87
Study [14]	Irregular Rhythm Notification	N/A	N/A	84	N/A	N/A	N/A
Study [15]	ECG	41	100	N/A	N/A	N/A	N/A

C. Apple Watch evaluation

Though without direct use of the common medical indexes, another six studies add to the comprehensive evaluation of Apple Watch apart from the above three studies. Table 4 lists the studies and the corresponding topics of interest. They are intended to assess different aspects of Apple Watch: Study [4] and [13] determine the Apple Watch's accuracy of measuring heart rate, and heart rate variability, respectively. Study [5] compares the ECG generated by Apple Watch to a standard 12-lead ECG, and Study [19] supplements the ECG evaluation by concentrating on the QTc interval measurement. Finally, Study [12] is designed to comprehensively discuss the influence of using Apple Watch on patients' life, while Study [18] focuses on diagnostic testing at clinical settings as the consequence of using Apple Watch's abnormal pulse notification.

As reported by Study [5], a moderate to strong agreement is shown in the Apple Watch generated ECG.[45] Specifically, the agreement between the AW ECG and the 12-lead ECG is analyzed in terms of heart rate detection, RR, PR, QRS, ST, QT, and QTc intervals.[46] A weakness for the AW ECG is the fact that it only carries lead 1 information, which may largely differ from other information carried by a standard 12-lead ECG.[47] Therefore, though AW can accurately measure heart rate and interval lengths on healthy subjects in this study, its effectiveness and potential on directing clinical decisions should be further tested when it comes to a wider population with a variety of medical pathologies.[48] Study [19] adds to the evaluation of AW ECG by validating its QTc measurement, and a similarly strong agreement is observed.[49] The heart rates detection for AW ECG matches that on a 12-lead ECG, and all patients identified as high risk are identified by the smartwatch.[50] The QTc measurements is adequately accurate, and when adjusting the smartwatch position on patients, the AW ECG performs better, indicating a need for identification of the best smartwatch position.[51]

Study [4] presents the heart rate measurement from AW Series 4, suggesting a correlation coefficient (r_c) of 0.7 between AW readings and the telemetry.[52] The r_c for patients who were in AF is larger than that for those who were not ($r_c = 0.86$ for patients in AF, and $r_c = 0.64$ for patients not in AF); this, nevertheless, could be caused by patients' own awareness of AF conditions, with those who are in AF being more careful and thus precise at getting the AW reading.[53] Similarly, Study [13] carries out an evaluation for AW's ability of measuring heart rate variability using a standard ECG as reference and yields a reasonable agreement between the two.[54] However, as observed

45 Saghir et al., supra note 3.
46 Id.
47 Id.
48 Id.
49 Marc Strik et al., Validating QT-Interval Measurement Using the Apple Watch ECG to Enable Remote Monitoring During the COVID-19 Pandemic, 142 Circulation 416–418 (2020).
50 Id.
51 Id.
52 Seshadri et al., supra note 4.
53 Id.
54 Turki et al., supra note 22.

during the experiment, the watch must be worn properly tight, otherwise an inaccurate measurement will occur.[55]

Study [18] analyzes the healthcare utilization following the irregular pulse notification function of Apple Watch.[56] The result shows that a clinical actionable cardiovascular diagnosis after only occurs in 11.4% (30/264) patients.[57] Patients who experienced symptoms are more likely to undergo clinical diagnosis than those who did not, while there is no difference of seeking clinical diagnosis between patients who received a direct alert from the pulse detection and those who did not.[58] The limited amount of clinical actionable diagnosis indicates a high false positive rate among the AW's function of abnormal pulse notification, which could potentially lead to an excessive use of healthcare resources.[59] On the other hand, being a more general assessment of the impact of Apple Watch on patients' quality of life and healthcare utilization, Study [12] leverages a more patient-focused experiment through using the Atrial Fibrillation Effect on QualiTy-of-life (AFEQT) questionnaire score as the primary.[60] Secondary outcomes include a set of patient-reported information regarding the use of personal digital devices, healthcare utilization investigation, and the data of Apple Watch using, such as number of irregular rhythm notification or heart rate records.[61] Although this study is not yet to be done, it shows the need for a patient-centered environment for research regarding personal health devices. There are also limitations of the study. First, there might be a possibly incomplete ascertainment as to patients' use of healthcare systems.[62] Second, people with AF might be more likely to purchase AW, even though those with a history of AF are not recommended for using ECG feature on AW.[63]

Table 4 *Corresponding Topic of Interest for Apple Watch Studies*

Apple Watch Studies	**Topic of Interest**
Study [4]	Heart rate accuracy
Study [5]	ECG generation
Study [12]	Influences on patients
Study [13]	Heart rate variability accuracy

55 Id.
56 Kirk D Wyatt et al., Clinical evaluation and diagnostic yield following evaluation of abnormal pulse detected using Apple Watch, 27 Journal of the American Medical Informatics Association 1359–1363 (2020).
57 Id.
58 Id.
59 Id.
60 Sanket S. Dhruva et al., Apple Watch and Withings Evaluation of Symptoms, Treatment, and Rhythm in those Undergoing Cardioversion (AWE STRUCk): A Pragmatic Randomized Controlled Trial (2021), http://medrxiv.org/lookup/doi/10.1101/2021.07.10.21260230 (last visited Feb 19, 2022).
61 Id.
62 Id.
63 Id.

Study [18]	Occurrence of follow-up diagnostic testing
Study [19]	QT interval

D. Other devices and evaluation

Three studies discuss devices and algorithms other than Apple Watch using their own criteria of evaluation. Study [6] introduces the ECG-Watch as a low-cost wearable device, being able to provide heart records with a 10-second single ECG and a built-in algorithm capable of detecting AF.[64] This study indicates the portability of wearable devices as the primary advantage over the traditional 12-lead ECG, because in a traditional setting, patients and physicians should be in the same physical location to carry out an ECG recording, rendering sporadic ECG anomalies such as AF undetected in most cases.[65] The experiment section of the study shows a favorable agreement between the ECG-WATCH recording and the 12-lead ECG.[66] The other study, Study [10], provides a brief introduction to the Glasgow Algorithm, an ECG interpretive algorithm, and compares its criteria of myocardial infarction to the AHA/ACCF/HRS recommendations for such criteria.[67] It is shown that the Glasgow Algorithm's capability exceeds the standard criteria of MI detection.[68]

Study [2], on the other hand, is a comprehensive review of the commercially available devices in the detection of paroxysmal AF.[69] Since such AF could be asymptomatic, ECG devices should either be capable of recording for a long period of time or have an auto-trigger function, otherwise false negative results could occur.[70] Figure 3 shows the duration of monitoring for each kind of devices verses their burden on patients, as evaluated by Study [2]. Patch-type devices, such as eMemo and Zio Patch, are the most well-balanced in terms of the duration and burden, with a small number of electrodes and no electrode leads.[71] The currently most reliable devices for long-term detection of AF are insertable cardiac monitors (ICM); however, they are quite invasive compared to the wearables.[72] Ambulatory ECGs (AECG) have the highest AF diagnostic accuracy due to its largest number of electrodes, yet the conventional AECG can only record for 24 hours.[73] While there are commercially available long-term AECGs, it still might be burdensome to patients because the

64 Randazzo, Ferretti, and Pasero, supra note 6.
65 Id.
66 Id.
67 Stryker Emergency Care, What is the Glasgow Algorithm? - stryker emergency care (2010), https://www.physio-control.com/uploadedFiles/learning/clinical-topics/The%20University%20of%20Glasgow%2012-Lead%20ECG%20Analysis%20Algorithm%203304421.B.pdf.
68 Id.
69 Hashimoto, Harada, and Kasamaki, supra note 8.
70 Id.
71 Id.
72 Id.
73 Id.

electrodes cannot be changed throughout the observation.[74] Finally, with the development of algorithms, healthcare products such as the Apple Watch are available in the market, but their accuracy of detection is still under further investigation.[75]

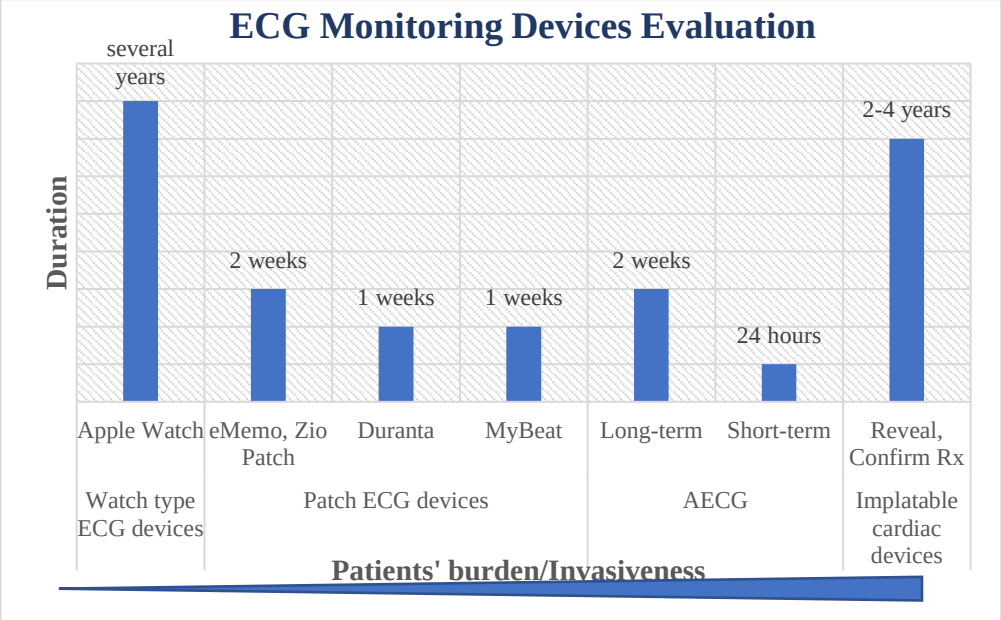


Figure 3 *ECG Monitoring Devices Evaluation*

E. Consequences Brought by Wearable Technology

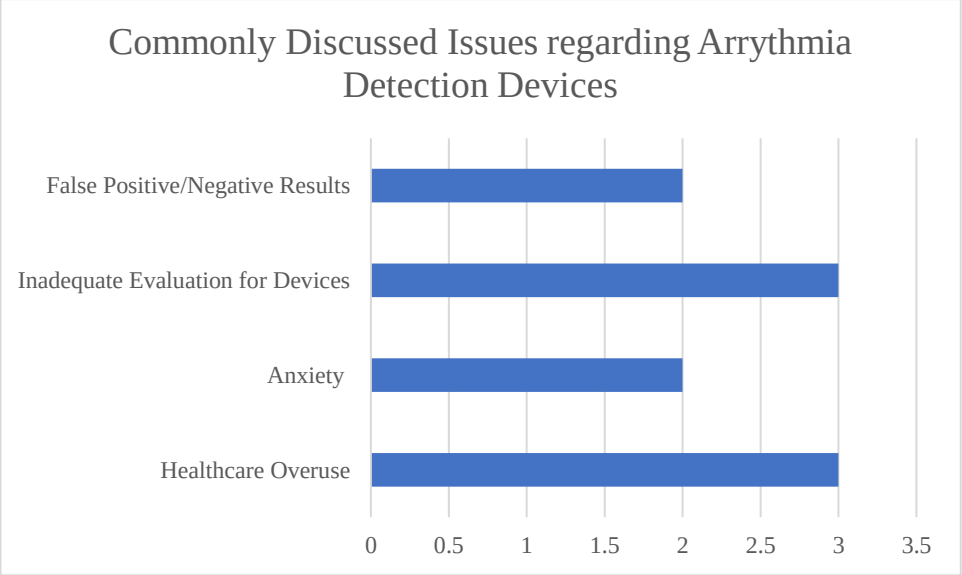
Apart from all the evaluations for the arrythmia detection devices and algorithms, four studies manifest some undesired problems and consequences brought by such technology. Figure 4 summarizes the commonly discussed issues among those studies. Study [8] focuses on the substantially increasing healthcare utilization due to personal ECG devices, which could cause a burden on the cardiology services.[76] In particular, two of the currently most reliable devices, AliveCor and Apple Watch, give the responsibility of any result other than normal sinus rhythm back to users by suggesting them to consult a physician, essentially causing the extra workload for cardiac physiologists.[77] This study points out that further developments in deep learning-based detection algorithms might result in a reduction of any false positive results and a better use of personal ECGs.[78]

Study [16] seeks for the opinions of healthcare professionals (HCPs) in terms of their advice for the available wearable devices/apps for AF.[79] 57% of respondents have suggested using these devices; among the respondents, electrophysiologists and general cardiologists are more likely to advise their uses compared to other specialist

[74] Id.
[75] Id.
[76] Rob Brisk et al., Personal ECG Devices: How Will Healthcare Systems Cope? A Single Centre Case Study (2019), http://www.cinc.org/archives/2019/pdf/CinC2019-335.pdf (last visited Feb 19, 2022).
[77] Id.
[78] Id.
[79] Boriani et al., supra note 19.

physicians.[80] When asked about the disadvantages of using wearable devices/apps, 65% HCPs refer to the anxiety in people who test positive for AF, and 40% point to the false reassurance because of a negative result.[81] Lastly, the study emphasizes the need for clarifications of the validated devices and Apps so that patients are assured to use those that are rigorously tested.[82] Study [17], on the other hand, compares the degree of healthcare use for those who use wearables and those who do not, concluding that while the mean pulse rates was similar between the two cohorts, individuals using wearables had a higher healthcare use score.[83] The need for more data to guide the utilization of wearable devices is again supported.[84]

Study [20] illustrates the health anxiety among people from the use of wearable devices by describing a case of a 70-year-old woman with paroxysmal AF.[85] There was an excessive use of smartwatch for cardiac monitoring one year after her initial AF diagnosis, and the patient was shown to believe that notifications from the smartwatch were a sign of worsening cardiac function, leading to additional clinical visits.[86] As noted by the study, ambiguous data including inconclusive readings could trigger similar behavioral response as compared to irregular rhythm notification.[87] The study concludes that compared to the traditional clinics, wearable devices strengthen the personal access to health data, which could bolster the belief that those already under appropriate therapy should still use such data to seek for medical care, which is in fact not necessary.[88]



[80] Id.
[81] Id.
[82] Id.
[83] Libo Wang et al., Association of Wearable Device Use With Pulse Rate and Healthcare Use in Adults With Atrial Fibrillation, 4 JAMA NETW OPEN e215821 (2021).
[84] Id.
[85] Lindsey Rosman, Anil Gehi & Rachel Lampert, When smartwatches contribute to health anxiety in patients with atrial fibrillation, 1 CARDIOVASCULAR DIGITAL HEALTH JOURNAL 9–10 (2020).
[86] Id.
[87] Id.
[88] Id.

Figure 4 *Commonly Discussed Issues regarding Arrythmia Detection Devices*

III. DISCUSSION

Wearable technology has allowed people to participate in their own healthcare management, which is the main goal of connected health. The emergence of more and more wearable detection devices should come by no surprise. This prompts FDA to publish standards that ensure an effective validation process for these devices. Rigorous research must be done in accordance with the FDA standards for SaMD to maximize the utility of wearable devices and minimize unfavorable consequences. This study thus provides insight regarding the current position of wearable technology by reviewing and comparing its published validations and discussions.

As classified in the Result section, the 20 studies included in this review use various metrics, include different cohorts, and focus on different perspectives of the problem. While it is difficult to discuss all the studies in a shared context, this review will analyze the studies consistently by referencing studies making connection throughout the discussion. Specifically, quantitative assessments, including indications behind the data, will be compared under the same context, as to whether the device/algorithm performs well under evaluation and obtains enough validation to be in use. Studies arguing about the problems of wearable technology will be combined for a wholistic review of the barriers of this technology, and a guidance for future research directions.

To start with, Apple Watch receives the most research interests among watch type devices, following by a few other devices such as AliveCor and ECG WATCH. Study [2] summarizes the advantages and disadvantages of different kinds of ECG devices in terms of their duration of monitoring and the burden on patients, indicating a tradeoff between the two.[89] While watch type devices have the longest duration of monitoring because they can be worn all the time, they do not have the approved accuracy compared with other prescriptive ECG devices.[90] Studies evaluating them are therefore valuable for any decision to incorporate them into clinical use.

Published by Apple, Study [9] reports a positive predictive value of 78.9% for Apple Watch's irregular rhythm notification, and 98.5% for its ECG 2.0, in detecting AF.[91] Study [14] obtains a similar positive predictive value of 84% for the irregular rhythm notification function when patients with a first notification received a second notification and a clinical ECG concurrently, but among all participants, AF was only observed in 34% of those receiving a notification on a clinical ECG performed later.[92] The actual predictive value would not be as low as the second figure since AF is usually paroxysmal, yet this finding points out the need of a durable monitoring function for wearable detection devices if they are applied to the real world setting, as pointed out by the 5th FDA action plan.[93] For the detection algorithm along with Apple Watch's ECG, Study [15] reports a much smaller sensitivity of 41% in distinguishing AF and

[89] Hashimoto, Harada, and Kasamaki, supra note 8.
[90] Id.
[91] Apple, supra note 24.
[92] Perez et al., supra note 21.
[93] FDA, supra note 17.

proposes a potential solution of combining a rhythm assessment with the AW generated ECG.[94] This indicates the need for a better algorithm to classify AF and other types of cardiovascular diseases with the generated ECG. Study [5] and Study [19] provide information regarding the evaluation of ECG diagrams generated by AW, both of which show strong agreement between AW ECG and a standard 12-lead ECG.[95] However, there are some drawbacks of using AW, including its sensitivity to motion artifacts and the limitation of using only 1 lead in the generation of ECG.[96] Similarly, the heart rate and heart rate variability measurements are mostly accurate as assessed in Study [4] and Study [13], but are easily affected by wearing positions to maintain such accuracy.[97] These results support the fact that Apple Watch is indeed currently one of the most reliable wearable arrhythmia detection devices, yet not as positive as the Apple's report, studies reveal a decent number of issues through experimentation. To fulfill the FDA's actions of promoting GMLP and an effective evaluation process, improvements in algorithms are needed. AliveCor and ECG WATCH are also brought into consideration in Study [3] and Study [6], respectively. The AliveCor assessment reaches a sensitivity of 94.4%, with a significant number of unclassified readings and false positives.[98] Study [6], on the other hand, is a brief introduction for ECG WATCH, which does not include much data for analysis. However, it comments on the usefulness of other devices: for example, AliveCor, as discussed in Study [6], filters too much signal and thus loses important information regarding heart activity.[99] In general, while Study [6] and Study [19] show confidence in the further use of the wearable devices, other studies such as Study [4] and Study [13] assert needs for further validation before its use in aiding clinical decisions. In addition, as the false positive rates and unclassified readings are still the main issue of wearable technology, more advanced algorithms need to be tested and put in practice.

Most of the currently available algorithms apply Machine Learning in the detection of cardiac diseases as a more inclusive and precise approach. The four studies describing algorithms feature MI^3, Vector Machine Learning, Glasgow Algorithm, and Convolutional Neural Network, respectively. The MI^3 algorithm in Study [1] is trained to output an indicator that takes into consideration of various influential factors, proving that the proposed algorithm is more adaptive to different conditions with better performance than traditional algorithms.[100] In Study [7], the Vector Machine Learning algorithm can classify different types of ECG and thus is potentially applicable in the wearable devices as a powerful ECG reading tool.[101] The Glasgow Algorithm in Study [10] employs multiple factors in detecting myocardial infarction, which is similar to MI^3 in terms of their finer resolution for thresholds.[102] Study [11] presents a Convolutional Neural Network trained to detect the signatures of AF patients' ECG, which is essentially the most relevant to the current issues of false results produced by

[94] Seshadri et al., supra note 30.
[95] Saghir et al., supra note 3; Strik et al., supra note 49.
[96] Saghir et al., supra note 3.
[97] Turki et al., supra note 22.
[98] Rajakariar et al., supra note 11.
[99] Randazzo, Ferretti, and Pasero, supra note 6.
[100] Than et al., supra note 15.
[101] Walsh, supra note 1.
[102] Stryker Emergency Care, supra note 67.

wearable devices.[103] These algorithms are continuously proven to be effective, and further research should focus on the comparison among algorithms to determine the specialty of each of them. If systematically trained and tested, they can be essential in the popularization of wearable technology.

There are many potentially unfavorable problems with this market of wearable technology when they are used in reality. The biggest issue, as mentioned in Study [8], [12], [17], and [18], is the healthcare overuse after a more personal level of engagement realized by wearables.[104] Because of the false positive results, the frequency of people seeking for clinical assurance of their health is bound to grow. Both Study [17] and [18] indicate that such increasing amount of healthcare utilization is not proportional to the actual effect on patients' health[105].

What comes next is the patients' anxiety induced by overusing wearables. Study [16] reports the opinions of healthcare professionals, most of whom point out the problem of anxiety, especially due to false positive results.[106] Additionally, Study [20]'s description of a patient suffering from anxiety reveals the fact that a lot of people are not informed with the correct way of using this technology and interpreting its results.[107] In fact, being an unprecedently penetrative tool, wearable device is almost inevitably overused by patients regardless of its accuracy. This information gap is also present in the validation of devices: as the market spreads rapidly without restriction, too many devices are available, whereas few of them are validated to be in use. The 3rd and 5th FDA action plan both points to the importance of a patient-centered environment for the use of SaMD.[108] To fulfill these goals, actions to effectively promote transparency for consumers and control the wearable technology in reality are necessary.

There are also problems with regard to the nature of wearable technology. Study [4] reflects on whether the awareness of having AF affects people's use of Apple Watch, because readings from the watch have to be manually obtained, those without being aware of a possible AF might not have the incentive to obtain a reading, and therefore cannot find out their real conditions.[109] Furthermore, there is an asymmetry between the buyers and users of wearable technology: most young people consume products like Apple Watch, but those who need to be tracked with their heart activity are normally the elders. If wearable devices are to be implemented to a large scale, these issues must be considered and resolved to realize an effectively controlled and managed environment to the interest of the public.

CONCLUSION

Studies examining wearable devices and potentially applicable algorithms show relatively high accuracy for the detection of AF. Still, almost all of them indicate a need for further research on a larger cohort with a similar structure to the real world, one of

[103] Attia et al., supra note 5.
[104] Brisk et al., supra note 76 at 1; DHRUVA ET AL., supra note 60; Wang et al., supra note 83; Wyatt et al., supra note 56.
[105] Wang et al., supra note 83; Wyatt et al., supra note 56.
[106] Boriani et al., supra note 19.
[107] Rosman, Gehi, and Lampert, supra note 85.
[108] FDA, supra note 17.
[109] Seshadri et al., supra note 4.

the FDA action plans for SaMD. There are also underlying problems of the wearable technology use, most primarily due to the high level of personal engagement in healthcare it provides, such as the overuse of healthcare resources and patients' anxiety given the unlimited access to data, especially when false-positive results may occur. These issues must be formally resolved before the large-scale application of wearable technology in aiding clinical decisions. Given the rapid development of connected health, wearable devices such as the Apple Watch are bound to become the mainstream tool for this more patient-centered environment of healthcare distribution. However, many of them do not conform to the FDA regulation for SaMD. Therefore, any new wearable device should be under a formal validation process so that such technology can be appropriately applied to the public.

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