China-EU Cooperation in the Field of Science and Technology (S&T)

Ying Li

Introduction

Globalization has made regions and countries increasingly closely linked together. At the beginning of the book *Power and Interdependence*: *World Politics in Transition*, Robert Keohane and Joseph S. Nye mentioned that: 'We live in an era of interdependence' (Keohane& Nye 1977).After the Cold War, the world developedrapidly towards increasing interdependence in a post-hegemonic context. Power is diffused, and new international institutions are sought after by different actors in order to find new rules for global governance. China and the EU pay close attention to science and technology (S&T) innovation andresearch and development (R&D) with the purpose of stimulating economic growth in the context of complex interdependence. In the current era, in order to achieve economic development, to maintain security and to advance global governance, countries and international organizations need to participate in international cooperation. The development of the EU-China partnership proves how strong this need is.

The EU is now China's biggest trading partner, while China is the EU's second largest trading partner.It is crucial for bothsides to work together to meet global challenges. After the creation of the China-EU Comprehensive Strategic Partnership in 2003, the cooperation in a wide range of areas continued to deepen and expand. In November 2013, the two parties signed the China-EU 2020 Strategic Agenda for Cooperation strengthening their cooperation in promoting peace, prosperity, sustainable development, cultural exchanges and other fields. S&T is one of the most influential and promising fields of cooperation for the EU and China Europe gradually became China's main technical cooperation partner and China's largest technology supplier. The EU and China started their S&T cooperation in the early 1980s. In 1998, they signed the formal framework agreement for scientific and technological cooperation(Horvath, Manfred&NannanLund 2008).With joint efforts on both sides, EU-China S&T cooperation is improved and enriched, and achieves remarkable results.

However, the difficulties in China-EU collaborations should not be ignored. In this paper, we analyse the current China-EU partnership from the perspective of S&T cooperation. The progress achieved and difficulties confronted in S&T cooperation reveal the need for further efforts in this complex process.

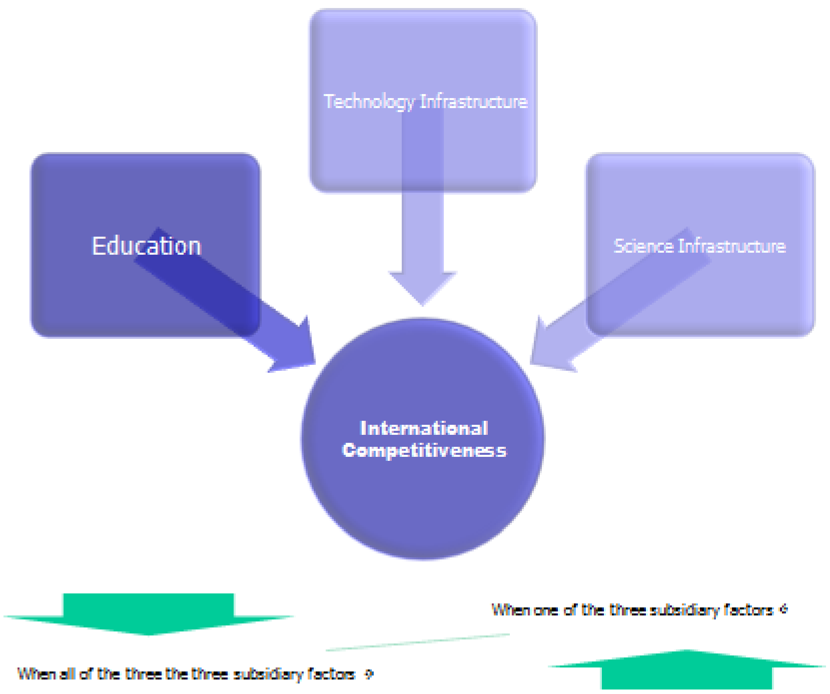
The Relevance of Science and Technology in theChina and the EU Relationship

In this paper, 'science mainly refers to fundamental research, the aim of which is to generate knowledge about the world. 'Technology' can be understood as the application of science to resolve the concrete problems in theprocess of knowing the world. They areclosely interrelated. Technology develops new tools to investigate nature. And new science findings lead to new applications and solutions.

The revolution of modern science and technology is the confluence of the scientific revolution and technological revolution. From the perspective of scientific theory, the revolutionis based onrelativity, quantum mechanics, system theory, information theory and cybernetics; from the perspective of technique and technology, it is the revolution of microelectronics technology, biological engineering, marine engineering, space technology, etc. The modern science and technology revolution led to the emergence of new industry groups that tremendously influenced the various fields of modern production and life. The modern science and technology revolution is changing the world, and it is one of the symbols of the progress of society. Advantages in science and technology largely decide a country's international competitiveness.

Figure 1 shows the relationship between science, technology, education and international competitiveness, the three factors influencing Science and Technology Competiveness. According to the International Science and Technology Competitivenessreport from Chinese Academy of Science, when one of the three sub factors enhances, a country's global ranking and general international competitiveness would accordingly increase. At the same time, only when all three sub factors' index fall, will a country's general international competitiveness fall. When only one of them goes down, it may not greatly influence the General International Competitiveness. For general international competitiveness to decrease, all three sub factors must be involved.

Figure 1: The Relationship between Science, Technology, Education and International Competitiveness



Both China and the EU realize that S&T is of critical importance in promoting or maintaining their respective international competitiveness. Nowadays, China has its Chinese National Medium and Long-Term S&T Development Plan 2006–2020, which aims to enhance the domestic innovation capability and S&T level to promote economic and social development andto maintain national security, in an effort to provide strong support to builda well-to-do society, tohave a strong impact on S&T achievements worldwide and to join the ranks of innovative countries, thus paving the way to become a world S&T power by mid twenty-firstcentury. The EU Horizon 2020 programme, a framework programme for research and innovation, aims to establish the EU as a leading knowledge-based economy, producing world-class science and innovation to ensure Europe's global competitiveness.

To achieve their national goals, China and the EU cooperated in many high-tech areas. The main areas of China-EU S&T cooperation are information technology, energy and sustainable development of the environment, nanotechnology, food and aerospace. In relation to China-EU cooperative S&T projects, the proportion of cooperation related to science and technology is about 78%(Wen 2000). For example, the Galileosatellite system project is the largest joint EU-China S&Tproject. When the cooperation on this project commenced in 2003, the EU planned to invest 3.2 billion euros and China to invest 230 million euro (Long& Sun 2004).This project has great political, economic and military importance and high potential value in promoting China's Science and Technology status. The Dragon Programme is China's largest international cooperation project in relation to earth observation. This program wasfunded by theEU's research and innovation program for 2007–2013(FP7), which has been replaced by the Horizon 2020 programme,and which aimed to encourage Chinese participation in Horizon 2020.After high-level meetings in 2014between Chinese and European Space Agency(ESA) officials, it was decided to reinforce thecooperation of Dragon Program[1].

The Purpose of China's and the EU's Participation in International S&T Cooperation

The development of science and high technology programmes usually needs significant financial support and a rich brain pool thatgoes beyond one single country's capability. This creates the need for cooperation among countries in order to maximize the input-profit ratio. One example is the International Thermonuclear Experimental Reactor, one of the most ambitious international energy projects in which China, the US, the EU, Korea, Japan, Russia, India and other countries are collaborating to build the world's largest manmade magnetic fusion device to provide sustainable, large-scale and carbon-free energy.From 2006 to 2016, its budget is over 20 billion euro (Clery2016).

Each country has its own goals when it cooperates in international S&T programmes. Through international cooperation in S&T, the developed countries can obtain an advantage from other countries' resources and thereby save research time and money, while developing countries can shorten the technology gap with advanced countries and attain the benefit of internationalization of talents, training and maximize its knowledge spill over.

Although countries cooperating in international S&T have diversified goals, both developed countries and developing countries can generally obtain mutual benefit and positive results fromcooperation. Countries aims can be summarized as: 1)the US,

Britain, Japan and other advanced scientific research powers: strive for global leadership; 2) France and Russia:enhance scientific research strength, catch up with the world top-level countries; 3) Finland and Singapore:promote domestic economic and social development that has been aided by international S&T cooperation; 4) the US, Japan, Germany:solve common global problems such as global warming; 5) the US:use S&T and diplomacy together to realize diplomatic and political purposes.
We can identify four levels of purpose in international S&T cooperation. The lowest level is that ofcountries with anabsolute technical disadvantage.When they participate in international S&T cooperation, their first aim is to obtain technical assistance and absorb advanced technology from other countries.They always cooperate with scientifically advanced countries.Before joining in the WTO, China was in this situation, which sought to enhance its science and technology research level at all prices.

The next level is that of countries that need certain scientific research resources (finance, favourable policies and equipment)andinternational cooperation in S&T to develop domestic economies, improve scientific research quality, and look forward to obtaining more advanced technology, and seeking to gain more discourse rights in international affairs. China in the current time is considered to be in this level. It has already made quite developments and progress in S&T, and from these progresses it seeks to play a more active role in the international affairs. This is especially illustrated by China's importance in the ongoing Korean Peninsula crisis.

The third level is that of some developed countries, for example France and Russia,who strive to catch up with countries advanced in S&T and need to show their current scientific research strengthfor political purposes, and do sobyS&T cooperation with other countries.

The fourth level,the top level, is countries with the perfect combination of science, technology and diplomacy that could form a positive cycle, for example, the UScan achieve its political purposes through international S&T cooperation and accelerate its international S&T supremacythrough political impulsion(an example is the US had developed "Star Wars" strategy during the Cold War).

Achievements of China-EU S&T Cooperation: Important Historical Junctures, Institutions

From theEU Perspective

After the Second World War, the US became the hegemonic power by the third and fourth S&T revolutions, while Europe, the birthplace of the first and second S&T revolutions, was comparatively lagging behind (Krige 2008). In the late 1970s and early 1980s, with the further development of new technology, international competition in the S&T field was increasingly difficult, and the S&T centre shifted from Europe to the US and the S&T gap between the Europe and the US and Japan wasgradually expanding. This gap was not only reflected in many areas in which Europe was formerly the leading power, such as automobiles and chemistry, but also reflected in most of the new areas, like microelectronics and information technology.
Many global problems, such as natural resources and the energy crisis, the population

explosion, the food crisis and environmental pollution also push countries to work together. In this context, the European Commission/European Unionsought to strengthen S&T cooperation (both within the EU, between Member States, and outside) to effectively use the international S&T resources.

Europe's internal S&T cooperation started in the 1950s. The treaty establishing the European Coal and Steel Community (1951)mentions S&T research and cooperation in Article 55, albeit limited to the coal and steel sectors. The treaty establishing the European Atomic Energy Community (Euratom Treaty),signed in 1957, included a chapter about research development, and the setting up a Joint Research Centre (JRC), although limited to nuclear research.In the 1980s, after decades of integration, the EECbegan to formulate aunified S&T policy.

The Single European Act(effective since 1 July 1987), building a unified market with a free flow of goods, services, capital and people, was parallel to the implementation of the First Framework Programme (FP1) started in 1984, which was a symbol of the European S&T cooperation coming to maturity. Following the Second Framework Programme (FP2), the EEC set up several institutions of cooperation with other countries, and implemented Science and Technology for Development, the policy for International Scientific Cooperation (ISC), the International Cooperation programme (INCO) and a series of international technology cooperation plans, providing a number of platforms for the EU's international S&T cooperation（Arvanitis & J Gaillard 2014）.

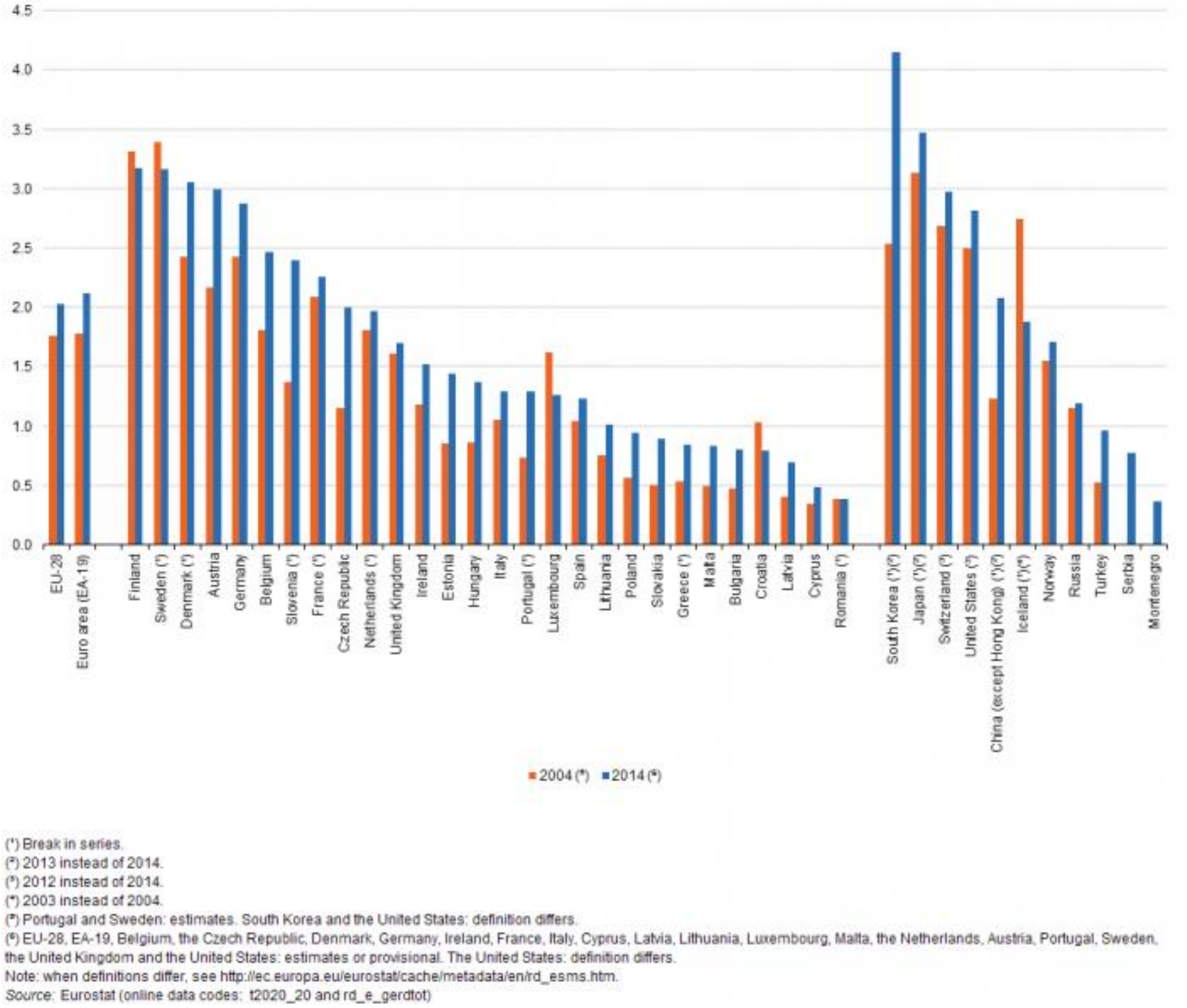
In 1992, the Maastricht Treaty was signed and the European Economic Community (EEC) became the EU. Member States' S&T policies created favourable conditions for the acceleration of international cooperation in S&T（Grieco1996）. After FP3, which is based on the Single European Act, the FP4, based on the Maastricht Treaty, mainly focused on the development of information, communications, remote sensing, energy and industrial technology. The aim of FP5 was to provide contributions to solve economic and social problems in the EU, as well as to provideEuropean responses to global challenges. The FP5 adopted different ways of cooperation for EU candidate States, Central and Eastern European countries and developing countriesby formulatingcorresponding special international technology cooperation plans. Since the start of FP5, the EU has increased its budget forinternational cooperation with non-EU States, year on year.

In March 2000, the EUMember States developed the Lisbon Strategy, and action and development plan, for the economy of the EU between 2000 and 2010. The aim was to build the EU to be the most competitive and dynamic knowledge economy in the world by 2010, and consistent with EU values, to achieve sustainable economic growth and to create more job opportunities（Borrás&Radelli2011）. The European Commissioner for Research, Philippe Busquin, suggested that the EU should build a European research area, centralize European scientific research resources, strengthen scientific human resources and increase cooperation with the rest of the world（Busquin 2000）.FP6 and FP7 sought to formulate of a new S&Tpolicy.In theperiod of FP6 and FP7, the EU S&T policytransformed from being asingle-issueS&T policy to a comprehensive policy, combining technology, industry and economic policy. The EU adopted a broader strategy of S&T cooperation, gathering Member States' research institutions to develop networking and research coordination, and paid more attention to international research cooperation with the world's main S&T powers.

In the era of world multipolarization after 1989–1991, the S&Tinnovation ability of the US and Japan remained ahead of that of the EU.The emerging powers (Brazil, Russia, India, China, South Africa (BRICS)) were running after the EU Member States, and the EU faced new challenges Therefore, Máire Geoghegan-Quinn, the European Commissioner for Research, Innovation and Science from 2010 to 2014, pointed out that the EU must work with international partners to strengthenR&D and innovation cooperation in order to cope with global challenges. In September 2012, the EU formulated guidelines and basic ideas for a new stage of international S&T cooperation under the new R&D framework Horizon 2020. The EU would strengthen international technology cooperation in two ways: on the one hand, by encouraging international bottom-up cooperation, strengthening the openness of Horizon 2020, and encouraging non-EU countries to take part in theEU's development plans; on the other hand, by strengthening the strategic orientation of international cooperation andsetting up"Science Diplomacy"for international cooperation withkey countries and regions in order to achieve specific goals. 'Science diplomacy' will use international cooperation in research and innovation as an instrument of soft power and a mechanism for improving relations with key countries and regions. Good international relations may, in turn, facilitate effective cooperation in research and innovation. This Communication proposes to enhance and focus the Union's international cooperation activities in research and innovation by using the dual approach of openness complemented by targeted international cooperation activities, developed on the basis of common interest and mutual benefit, optimal scale and scope, partnership, and synergy. In this way, the EU began to construct its S&T policy from the perspective of the overall macro-functional organization network, combiningthe innovative elements and efficient allocation of innovation resources in the construction of policies and systemsin order to improve the efficiency of the whole EU innovation system.

As can clearly be seen in Figure 2, in the past 10 years the gross domestic expenditure on R&D in most EU countries has significantly increased.

Figure 2Gross Domestic Expenditure on R&D, from 2004 to 2014 (% of GDP)



Source:http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Gross_domestic_expenditure_on_R_%26_D,_2004_and_2014_(%25_of_GDP)_YB16.png

From the ChinesePerspective

According to the definition of the United Nations Educational, Scientific and Cultural Organization, S&T policy is a series of important institutions and actions, which are implemented by the governments to promote effective development of S&T, and to realize the goal of the overall societal construction. The development of China's S&T policy over the past 67 years is closely linked with this core aim. In different periods, Chinese S&T policy was based on different system models, and the policy showed different characteristics. The development of Chinese S&T policy can be divided into three periods.

a) *Under the socialist planned economy system (1949–1978)*. During this period, Chinese S&T policy was based on the socialist planned economy system. The government controlled all S&T resources, used its administrative power to promote the establishment of a S&T system and the development of S&T. It arranged S&T

activities and allocated technology resources. During this period, the economic and S&T power in China was relatively weak, so this systemhelped China to concentrate resources and accomplish large projects, but with limited funding. However, to a certain extent, the link between science, economy, and society was cut, reflecting not only the disconnection between sciences and economy, but also the disconnection between S&T and science and education.

b)*Under the reform and transition system (1978–1992)*. In 1978, the first Chinese national S&T conference was held.At the conference, it was clearly mentioned that S&T is the most important productivity factor and that modern S&T is the key driver to the Deng ‘four modernizations’. Since 1978, Reform and Opening-Up has been launched by the Chinese government. Within this context, S&Tpolicy changed in light ofthe reform and economic transition. During this period, two Chinese National Medium and Long-Term Science and Technology Development Plans were formulated: the 1978–1985 National Science and Technology Development Plan and the 1986–2000 Science and Technology Development Plan. The two plans has decided favourable policies for S&T, and China has systematically developedits strategies.

c) *Under the socialist market economic system (since 1992)*. In 1992, the 14th National Congress of Communist Party of China approved the programme for the establishment of a Chinese socialist market economy. The transformation from planned economy in to a market economy is a long-term and arduous task. In 1995, the State Council put forward the strategy of invigorating the country through science, technology and education. The preliminary goal was toestablish a S&Tsystem adapted to the socialist market economic system in 2000, and then in 2010 to improve the system, realizing the organic combination of technology and economy at that time (Xu 2008). In 2001, China joined World Trade Organization (WTO) and started to formulate the first medium- and long-term S&T development plan under thesocialist market economy, with the aimof constructinga well-off society. In 2006, the State Council issued the Chinese National Medium- and Long-Term S&T Development Plan 2006–2020. Thisplan’saim is to enhance the independent innovation ability and build an innovative country.It made a comprehensive planfor the development of Chinese S&T over the following 15 years. It is the programmatic document for the future development of S&T in China.

Table 1 shows the percentage of China’s R&D investment in terms of gross domestic expenditure from 1995 to 2015. The percentage increased four times since 1995. When reading the Table 14.3, we can see that China’s investment percentage exceeds many EU member States. This proves on one side China’s determination in reinforcing its science and technology research, and on the other side China’s financial strengths.

Table 1 Gross Domestic Expenditure on R&D in China, from 1995 to 2014 (% of GDP.DataRevision)

Year	Gross domestic expenditure on R&D (%)		Year	Gross domestic expenditure on R&D (%)	
	After revision	Before revision		After revision	Before revision

1995	0.57	0.57	2005	1.31	1.32
1996	0.56	0.57	2006	1.37	1.38
1997	0.64	0.64	2007	1.37	1.38
1998	0.65	0.65	2008	1.44	1.46
1999	0.75	0.75	2009	1.66	1.68
2000	0.89	0.90	2010	1.71	1.73
2001	0.94	0.95	2011	1.78	1.79
2002	1.06	1.06	2012	1.91	1.93
2003	1.12	1.13	2013	1.99	2.01
2004	1.21	1.22	2014	2.02	2.05

Source: National Science and Technology Funds Statistical Bulletin, 2015, available athttp://www.stats.gov.cn/tjsj/zxfb/201611/t20161111_1427139.html.

Institutionalized Bilateral Cooperation Between the EU and China and Its Problems

EU-China S&T cooperation started in the early 1980s. In December 1998, the two sides signed the EU-ChinaScience and Technology Agreement, their first cooperative framework arrangement. Who are the main actors in the S&T policy decision-making in both China and the EU? In the EU, there are the European Council, the European Commission (DG forEnergy, the JRC, DG for Research and Innovation, DG for Trade), the Council of the European Union, the European Parliament, the European External Action Service, companies, universities and think tanks. In China, the Ministry of Science and Technology, the Ministry of Foreign Affairs, the Ministry of Commerce, the National Development and Reform Commission, companies, universities andpublic institutionsare the main actors (see Figure 3).

Figure 3Actors Influencing S&Tdecision-makingin China and the EU

EU-China S&T cooperation has three main channels: the European Commission's Framework Programme, the intergovernmental S&T cooperation between China and EU Member States and the Sino-EU technology trade. This chapter mainly deals with China-EU S&T cooperation at the centralized EU level. The EU is an important strategic partner of China in S&T.The Chinese government attaches great importance to the international scientific and technological cooperation with Europe. The Chinese government and the EU central institutions have signed many scientific and technological cooperation agreements(Qi 2015), which are listed in Table 2.

Table 2 S&T CooperationAgreements between China and EU Governments

Year	Important event for EU-China S&T cooperation	Significance	Concrete measures
1998	First "EU-China Agreement for Scientific and Technological Cooperation" signed	Symbolized the comprehensive S&T cooperation between China and the EU and promoted the substantial cooperation of EU and China in basic science and high technology	Cooperation projects in biotechnology, information society, environment, energy and food security
2004	Dragon Programmelaunched	Large S&T cooperative programme between China and the EU in the field of earth observation	Various forms of cooperation, including scientific research, data sharing, technical training, academic communication
2005	Joint declaration on S&T cooperation between China and Europe	A guiding document for future China-EU S&T cooperation	Set out the guiding principles, common goals and specific measures for China-EU S&T cooperation
2006	"China-EU S&T Year" Campaign	New period of China-EU S&T cooperation	1) various activities, such as the exhibition, academic seminars 2) series of follow-up seminars, such as follow-up energy seminars, China-EU conference on Chinese medicine, robot seminar
2008	"EU-China Agreement for Scientific and Technological Cooperation" Renewed	Same Terms remained	Same Terms Remained
2009	China-EU technology partnership plan	New equal cooperation mechanism	Joint collection, review and determination of the cooperation projects in the common decided strategic priority areas, and joint investment of no less than 30 million euro per year
2012	EU-China Joint Declaration on Innovation Cooperation Dialogue	High level EU-China Innovation Cooperation Dialogue initiated, official platform for exchanges and cooperation on innovation between both sides to be	Annual basis dialogue will be held and annual report will be organized to be reported to the EU-China Summit; Representatives from enterprises, universities and research institutes

		created	may participle the Dialogue

In 1998, at the second Asia-Europe Meeting in London, the Chinese Prime Minister Zhu Rongji put forward a proposalaimed at enhancing Asia-Europe S&Tcooperation. In the same year, the China-EU Scientific and Technological Cooperation Agreement was signed in Brussels, andin 1999, was approved bythe Chinese government and the Council of the EU. After that, the EU's most influential Framework programme for research and China's most important national science and technology programmes ('973' and '865' programmes, etc.) were open to each other. This agreement symbolized a comprehensive openness and breakthrough in EU-China S&Tcooperation, which promoted substantial cooperation between the countries in basic science and high technology. Since 1999, EU-China S&Tcooperation has expanded continuously. On 11 December 2001, China formally joined the WTO, becoming its 143th member. Although the EU does not fully recognize China's Market Economy Status (see Chapter 7 byPonjaert and Ghislain), the extent and depth of China-EU S&Tcooperation haveincreased. In 2003, China and the EU began their Comprehensive Strategic Partnership; accordingly, their cooperation in a wide range of areas continues to deepen and expand.

Problems in China-EU S&T Cooperation

Though the S&T cooperation developed greatly after 1998, there have been problems, obstacles and even failures. Threetypes of problems have been identified in China-EU S&T cooperation.

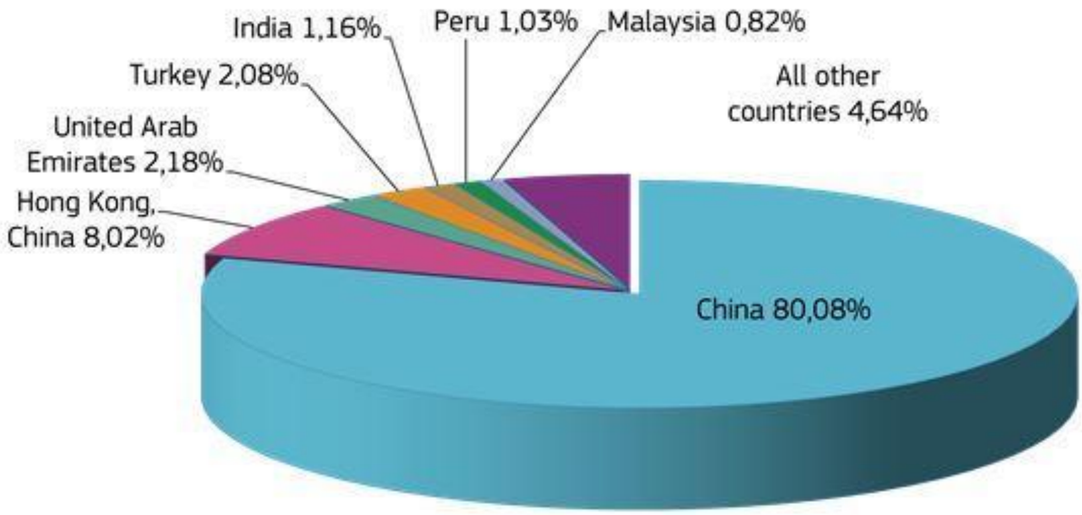
Different Understandings of Costs and Benefits

The different opinions concerning costs and benefits, more specifically, the different understanding as to what can be gainedfrom a joint S&T project, can lead to unpleasant results. The most distinct example of this divergence is Galileo project. It started with the idea of breaking the US's technology and market monopoly in S&Tby developing an alternative satellite navigation system. In 2003, China and the EU agreed to collaboratein this project, despite the US's strong opposition. The president of the European Commission, Romano Prodi, said that the Galileo project was closely linked to the future of Europe, and it was 'a struggle between monopoly and anti-monopoly' (Scott 2007). From 2003 to 2006, China invested 230 million euros (Long&Sun 2004)) (while the budget of the EU was 3.2 billion euros) and Chinese technical personnel undertook a series of technical projects. However, due to the worries of damages to technology security and concerns about intellectual property, from 2006, China was excluded from the most important decisions about the Galileo project. China began to focus on its own BeiDou Navigation Satellite System. The Chinese opinion is that, in relation to the Galileo project, China invested considerable money and human resources but did not receive its due return (Liao 2008). The EU side, however, was very concerned about China's satellite development, which it feared might put the EU in a more disadvantageous situation in the S&T cooperation. The report by Bernard Deflesselles makes clear the EU's opinion aboutthecollaboration of Galileo project: the Chinese took advantage of European technology, and the regulated utility, which was an important part of the Galileo programme, could be jammed by the Chinese satellite system (Cazennave 2010).

Intellectual Property Rights

Intellectual property rights (IPR) have been a sensitive issue in the S&T cooperation between China and the EU. Because of the differences in the EUIPR protection system and that ofChina, conflicts in the field of high-tech trade occur frequently. In 2004, the EU listed China in the list of countries with most serious IPR problems. In 2009, China remained the only country in this category (Holslag& Jonathan 2015). According to European Commission's Report on the Protection and Enforcement of intellectual property rights in third countries published in 2015, China remains the priority 1 country concerning the issues of IPR, though EC has acknowledged its "various improvements in Chinese IP legislation". (European Commission 2015). This is certainly related tothe IPR-violating goods, as shown in Figure 4

Figure 4 Countries of Origin of IPR-violatingGoodsEntering the EU



This highly controversial issue is also related to IPR protection in S&T.

For example, in 2015, the UK's Supreme Courtruled that Huawei infringed on patent technology ofthe intellectual property company Unwired Planet. In the judgment of the Supreme Court, Unwired Planet's patent is essential for 2G technology standards and it can improve the switch between mobile communication systems. Huawei was ruled to have infringed Unwired Planet'spatent. In March, the Dusseldorf Local Court came to the same decision. However, Huawei did not accept the decisionand appealed the judgment.Because ofIPR problems, many Chinese manufacturers could not sell their mobile phonesin the European market. In responding to this issue, at the occasion of IFA 2014 (Internationale Funkausstellung Berlin), Huawei's consumer business chairman, Yu Chengdongsaid to the organizer of IFA that entering the European market was very difficult for Chinese companies because of patent issues. Thus, from the Chinese perspective, EU's IPR protection is a technical barrier to exclude competitors.

Political Mistrust

Some problems in EU-China S&T cooperation have deep historical roots, such as the EU's high-tech products restrictions on China. After the Second World War, the Coordinating Committee for Multilateral Export Controls was established by Western bloc powers to place an arms embargo on socialist countries. After the Tiananmen Square protestsin 1989, the EU started an arms embargo and placedexport restrictionson high technologyon China. Now, in 2017, in the situation of the current European economic downturn, easing restrictions on technology exports to Chinawould be conducive to trade growth and job creation in the EU, which would promote European economic recovery. However, these restrictions havenot been lifted.Chinese electronic information technology, new materials, sensing technology and lasers, shipbuilding and maritime equipment and many other technologies are still blacklisted. In April 2009, the European Parliament decided to maintain the sensitive technologies and arms embargo on China.

Another example for the political mistrust between China and the EU is the FP7. China is the most active non-EU actor in the EU's FP7. The statistical results of China's 1,099 projects and 1,747 applying units show that China's average successful rate is 23.53%. Table 3 shows China's success rate in each subject area. However, the success rate of security, fusion energy and frontier explorations is still zero.This proves that EUpolitical considerations still make the application and decision procedure of EU-funded research projects unclear and discriminatory. This greatly harms the cooperation interests,which are necessary for a successful cooperation, and generates mistrust.

Table 3: China's SuccessRate in Applying FP7 Fondation

(Specific Programms)	Priority area	Unit Application			Project application		
		Number of applications	Number selected	Success rate	Number of applications	Number selected	Success rate
CAPACITIES	International cooperation activities	44	10	22.73%	27	5	18.52%
	Research for the benefit of SMEs	6	2	33.33%	6	2	33.33%
	Research infrastructures	52	7	13.46%	21	6	28.57%
	Science in society	15	5	33.33%	15	5	33.33%
	Subtotal	117	24	20.51%	69	18	26.09%
COOPERATION	Energy	77	16	20.78%	48	8	16.67%
	Environment (including climate change)	280	40	14.29%	140	25	17.86%
	Food, agriculture and fisheries, and biotechnology	141	33	23.40%	107	32	29.91%
	Health	153	29	18.95%	83	15	18.07%
	Information and communication technologies	269	52	19.33%	199	37	18.59%
	Joint technology	1	1	100.00	1	1	100.00

	initiative			%			%
	Nanosciences, nanotechnologies, Materials and new Production technologies(NMP)	41	7	17.07%	32	7	21.88%
	Security	12	0	0.00%	9	0	0.00%
	Socio-economic sciences and humanities	197	16	8.12%	112	9	8.04%
	Space	10	2	20.00%	7	2	28.57%
	Transport (including aeronautics)	133	53	39.85%	61	16	26.23%
	Subtotal	1314	249	18.95%	799	152	19.02%
Euratom	Fusion energy	1	0	0.00%	1	0	0.00%
	Nuclear fission and radiation protection	4	1	25.00%	4	1	25.00%
	Subtotal	5	1	20.00%	5	1	20.00%
Frontier exploration	(ERC)European Research Council	11	0	0.00%	11	0	0.00%
	Subtotal	11	0	0.00%	11	0	0.00%
PEOPLE	MarieCurie actions	300	137	45.67%	215	78	36.28%
	Subtotal	300	137	45.67%	215	78	36.28%
	Total	1,747	411	23.53%	1,099	249	22.66%

Source: European Commission: Seventh FP7 Monitoring Report

Unlike the S&T cooperation between China and the US, the main bodies engaged in China-EU S&T cooperation are universities and research institutions. Chinese enterprises are not that active in the China-EU Framework Cooperation. For example, in FP5, there were only seven enterprises, which is less than 5% of the total number. In FP6, the number increased to 51 and accounted for 15% of the total project. In FP7, the rate was still not very high, only 12%.

Conclusions

Since the 1980s, China and the EU have worked together to enhance their S&T cooperation, based on their common needs. After China and the EU started to use the S&T framework cooperation agreement, they built a successful institutional cooperation framework. Now, in 2017, their cooperation is in a new stage and China and the EU are trying to adapt to their new equal cooperation mechanism.

However, the problems summarized in this chapterare serious obstacles that hamper the deepening of this cooperation. They are mainly that:

a) transaction costs remain high as both parties still engage in cost-benefit calculations;
b) misunderstandings and dilemmas frequently occur because of divergences in ideologies very often;

c) the establishment of a partially shared normative framework is difficult to achieve; and
d) enlarging the large numberof decision-making actors is difficult in the short term, as well as decentralizingsocietal actors.

Thus, in the era of globalization and the new S&T revolution, the EU and China need to create a better way to build mutual trust and communication. There is still a long way to go,but it is the only way to go.

---

1. For more information concerning Dragon Program, please refer to its website http://www.dragon-star.eu/

Bibliography

Borrás, S. & Radaelli, C.M., 2011. The politics of governance architectures: creation, change and effects of the EU Lisbon Strategy. *Journal of European Public Policy*, 18(4), pp.463–484. Available at: http://www.tandfonline.com/doi/abs/10.1080/13501763.2011.560069 [Accessed May 9, 2017].

Busquin, P., 2015. *Towards a European Research Area*, Brussles. Available at: http://www.aic.lv/bolona/Bologna/contrib/EU/Toward_EResArea.pdf.

Carstairs, A.M., 1980. *A Short History of Electoral Systems in Western Europe (Routledge Library Editions: Political Science Volume 22)*, London: Routledge.

Cazenave, F. & Spragg, T., 2010. Galileo, the UK and China – the wrong trio for the EU? Available at: https://www.thenewfederalist.eu/Galileo-the-UK-and-China-the-wrong-trio-for-the-EU [Accessed May 9, 2017].

Chen, Q., 2015. *Research on International Science and Technology of Developed Countries*, Beijing: Qinghua Press.

Clery, D. & Cho, A., 2016. More delays for ITER, as partners balk at costs. *Science*, 352(6286), pp.636–637.

Defazio, D., Lockett, A. & Wright, M., 2009. Funding incentives, collaborative dynamics and scientific productivity: Evidence from the EU framework program. *Research Policy*, 38(2), pp.293–305. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0048733308002709 [Accessed May 9, 2017].

EUR-Lex, 1957. Treaty establishing the European Atomic Energy Community. Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3Axy0024 [Accessed May 9, 2017].

Gaillard, J. & Arvanitis, R., 2014. *Research collaboration between Europe and Latin America mapping and understanding partnership*, EAC, éditions des archives contemporaines. Available at: http://www.documentation.ird.fr/hor/fdi:010061605 [Accessed May 9, 2017].

Grieco, J.M., 1996. State interests and institutional rule trajectories: A neorealist interpretation of the Maastricht treaty and European economic and monetary union. *Security Studies*, 5(3), pp.261–306. Available at: http://www.tandfonline.com/doi/abs/10.1080/09636419608429281 [Accessed May 9, 2017].

Holslag, J., 2015. Explaining Economic Frictions Between China and the European Union. In V. Aggarwal & S. Newland, eds. *Responding to China's Rise*. Brussels: Springer International Publishing, pp. 131–150. Available at: http://link.springer.com/10.1007/978-3-319-10034-0_7 [Accessed May 9, 2017].

Horvath, M. & Nannan, L., 2008. *Review of the Science and Technology Cooperation between the European Community and the Government of the People's Republic of ChinaReview of the Science and Technology Cooperation between the European Community and the Government of the People's Republic*, Brussels.

Krige, J., 2008. *American Hegemony and the Postwar Reconstruction of Science in Europe*, Cambridge,Massachusetts: The MIT Press.

Liao, Z., 2008. *Contemporary China's Participation in International High Science-Technology Cooperation from the Viewpoint of the China-EU "Galileo*

Project" Cooperation, Beijing: Renmin University Press.
Pan, J., 2010. *Research on International Science and Technology Competitiveness*, Beijing: Science Press.
Qi, Y., 2015. *Output Characteristics and Performance Evaluation of International S&T Cooperation Projects Supported by the Government*, Beijing: Beijing University of Science and Technology.
Scott, D., 2007. China and the EU: A Strategic Axis for the Twenty-First Century? *International Relations*, 21(1), pp.23–45. Available at: http://journals.sagepub.com/doi/10.1177/0047117807073766 [Accessed May 9, 2017].
Wen, X., 2000. *High-Tech Knowledge Chrestomathy*, Beijing: University of Defense Technology Press.
Xu, K., 2008. Engineering education and technology in a fast-developing China. *Technology in Society*, 30(3), pp.265–274.
Zhang, M., 2011. Achievements and Problems in Sino-Europe Science and Technology Collaboration. *Institute of European Studies of Chinese Academy of Social Sciences*. Available at: http://ies.cssn.cn/wz/yjsjy/ktfd/201207/t20120731_2458975.shtml [Accessed May 9, 2017].