

Annex A

Economic relationships between China and Southeast Asian countries: Science, technology and innovation issues – A Chinese perspective

This paper is prepared by a Southeast Asia (SEA) specialist at the Institute for Asia and Pacific Studies, Chinese Academy of Social Sciences, in the context of the OECD Review of Innovation in Southeast Asia. It examines the current state and main trends in China's economic relationships with Southeast Asian countries, particularly those concerning science, technology and innovation (STI).^{} Relations between China and SEA countries, especially economic, have developed rapidly since the 1997 East Asian financial crisis. The paper assesses the development of these bilateral economic relationships, primarily in the area of STI, over the last ten years.*

Section A.1 reviews current economic, trade and investment relations between China and each of the SEA countries, with a brief overview of their evolution and examination of predictions regarding the development of relations in the coming decade. Section A.2 discusses China's strategy and policy vis-à-vis the SEA region and the region's main economies. China considers SEA countries as crucial regional partners and hopes to deepen bilateral economic, trade and investment relationships with them in the coming decades. Section A.3 discusses existing relationships in the areas of STI, such as bilateral agreements and academic exchanges over the period 1999-2009. Section A.4 analyses the favourable factors, including political and economic aspects, and the constraints that influence the current state of science and technology (S&T) exchanges and co-operation between China and SEA countries. It appears that there have been significant achievements in the area of bilateral economic relationships, but relatively little progress in bilateral technological relationships. Section A.5 discusses future trends and directions in China's relationship with the SEA countries in STI. It is likely that the coming decade will see relatively strong progress in technological relationships. Section A.6 discusses the role of technology assistance (S&T diplomacy) in future S&T relationships with the SEA countries. Due to certain restrictions, China's technology assistance to SEA countries will be less than that of Japan or other more advanced economies in the East Asian region in the near future. However, it will play an increasing role in constructing bilateral economic relationships. Section A.7 sums up the main findings.

* The countries covered in this study are the ASEAN Member countries Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Singapore, Thailand, the Philippines and Viet Nam.

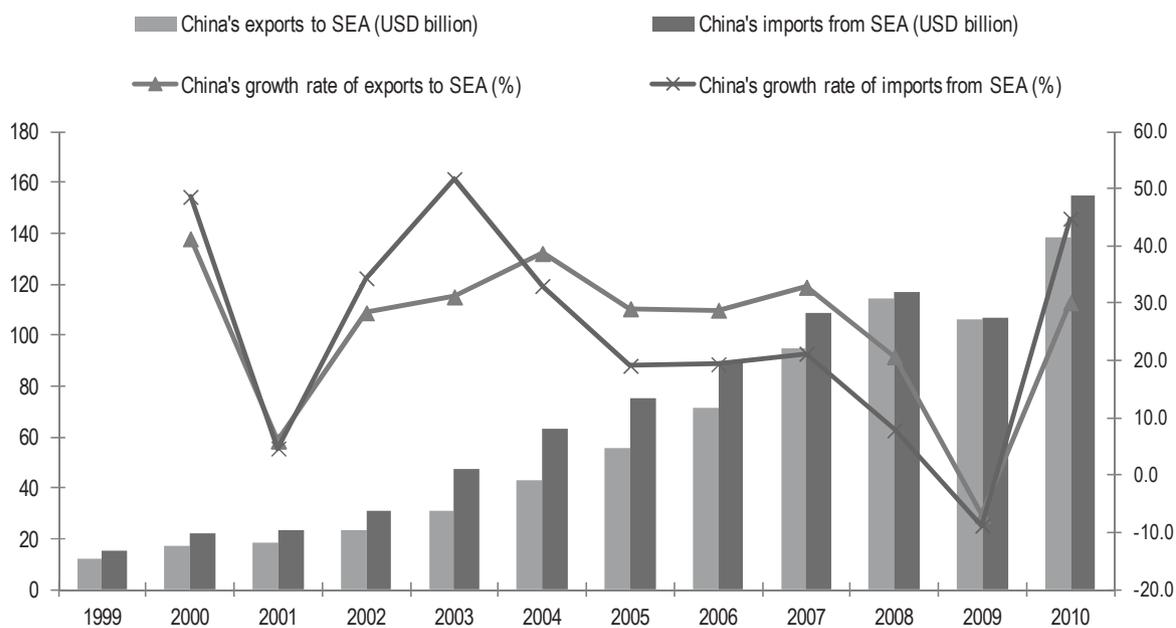
A.1. Bilateral economic relationships between China and SEA countries

A.1.1. The evolution and current situation of bilateral economic relationship between China and SEA countries (1991-2010)

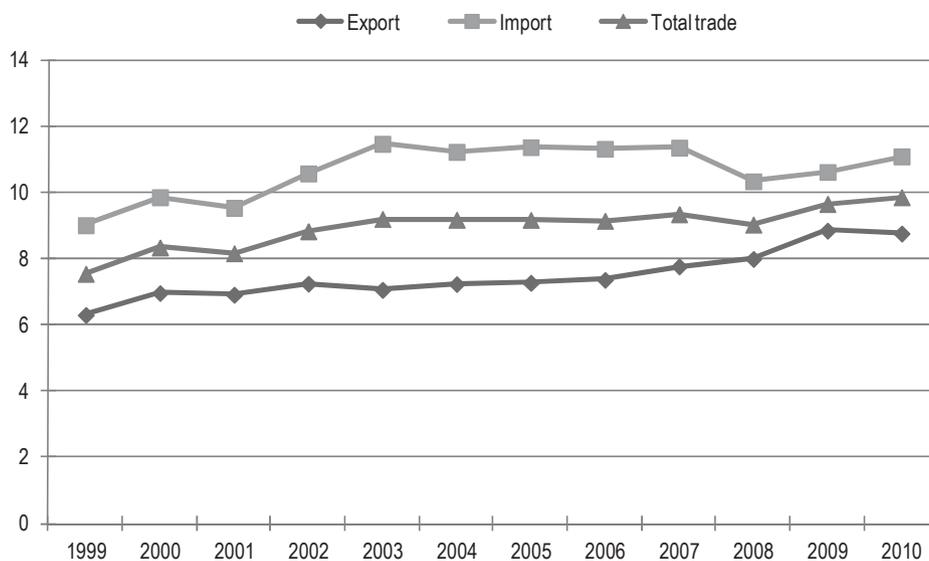
Economic relations between China and SEA countries were established following an improvement in political relations following the end of the cold war. Since the China-ASEAN Dialogue Relations of 1991, both parties have shown keen interest in co-operation. China was accorded full dialogue partner status at the 29th ASEAN Ministerial Meeting (AMM) in July 1996. Subsequently, China was the first ASEAN dialogue partner to accede to the Treaty of Amity and Cooperation (TAC) in Southeast Asia at the 7th ASEAN-China Summit in October 2003. China's accession to the TAC has contributed to making the TAC the basis of a code of conduct for inter-state relations in the region. At the summit, relations between China and SEA countries were raised to a higher plane with the signing of the Joint Declaration of the Heads of State/Government of the Association of Southeast Asian Nations and the People's Republic of China on a Strategic Partnership for Peace and Prosperity.

At the 8th China-ASEAN Summit in November 2004, a five-year plan of action (2005-10) to implement the Joint Declaration was adopted. This plan of action has served as the master plan to strengthen the strategic partnership between the two sides for regional peace, development and prosperity. In 2006 at the Commemorative Summit Marking the 15th Anniversary of ASEAN-China Dialogue Relations, the leaders issued a joint statement aimed at further strengthening ASEAN-China relations towards an enhanced strategic partnership.

With the improvement in bilateral political relations and the opening up of the Chinese economy increasingly closer trade and economic ties between China and SEA have been forged. This is especially the case after the signing, at the 6th Leaders Summit held in November 2002, of the Framework Agreement on Comprehensive Economic Cooperation involving the ASEAN-China Free Trade Area (ACFTA). 1 January 2010 was targeted for the implementation of ACFTA in Brunei Darussalam, Indonesia, Malaysia, the Philippines, Singapore, Thailand and China, and 2015 for Cambodia, Laos, Myanmar and Viet Nam. In November 2004 the Agreements on Trade in Goods and Dispute Settlement Mechanisms were signed and were implemented in July 2005. The Agreement on Trade in Services was signed during the 10th China-ASEAN Summit in January 2007 and entered into force on 1 July 2007. The China-ASEAN Trade Negotiating Committee (CA-TNC) concluded negotiations on the China-ASEAN Investment Agreement in November 2008 and the agreement was signed during the 41st ASEAN Economic Ministers Meeting in August 2009. This put an end to the China-ASEAN negotiation process on a free trade area (FTA) set in the Framework Agreement on Comprehensive Economic Cooperation between China and SEA countries. The implementation of ACTFA in 2010 created the third largest FTA in the world with a combined population of 1.9 billion (Asian Development Bank, 2009) and a gross domestic product (GDP) close to USD 6 trillion.

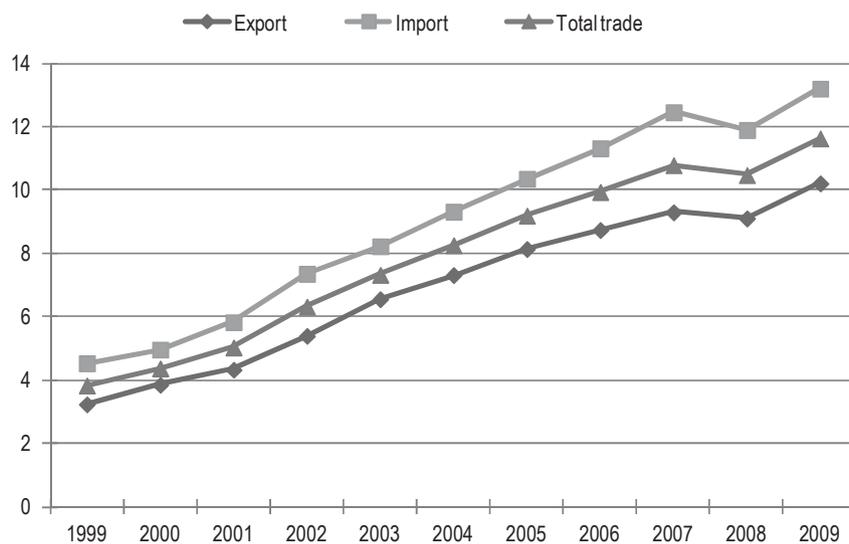
Figure A.1. The volume and growth of China's trade with SEA countries (1999-2010)

Source: UN Comtrade and MOFCOM, P.R.China.

Figure A.2. China's trade with SEA as a share in China's total trade (%) (1999-2010)

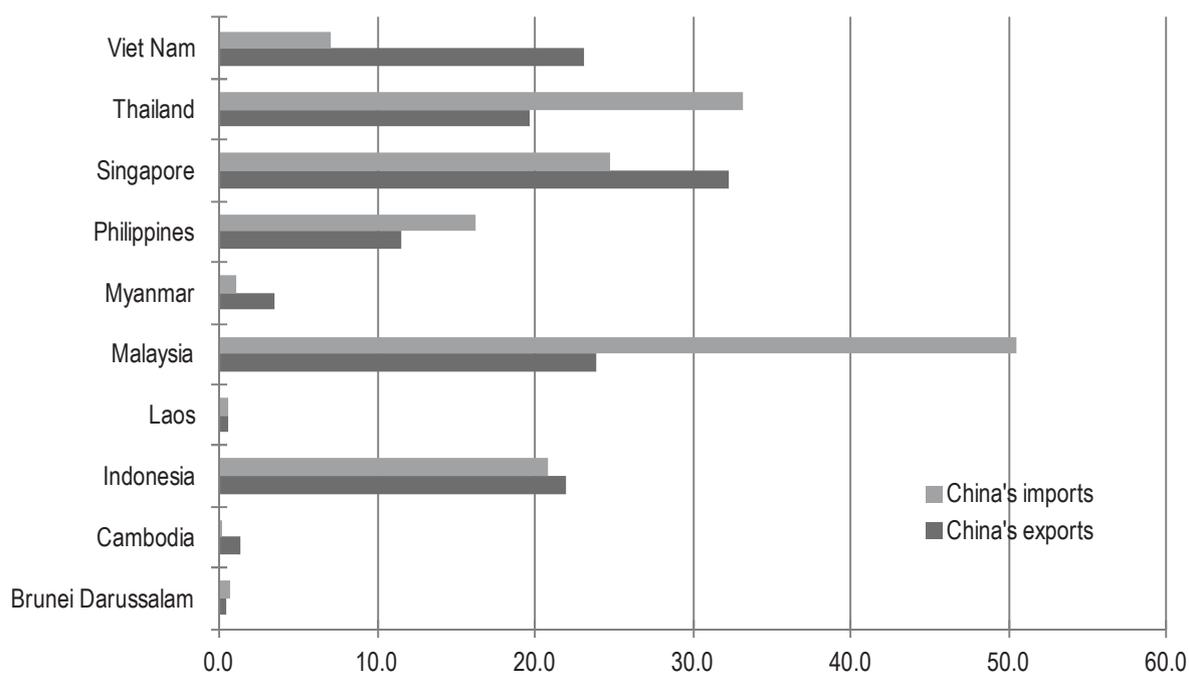
Source: UN Comtrade.

Figure A.3. Share of SEA’s trade with China in SEA’s total trade (%) (1999-2009)



Source: UN Comtrade.

Figure A.4. China’s trade with SEA by country, 2010 (USD billion)



Source: MOFCOM, P.R. China.

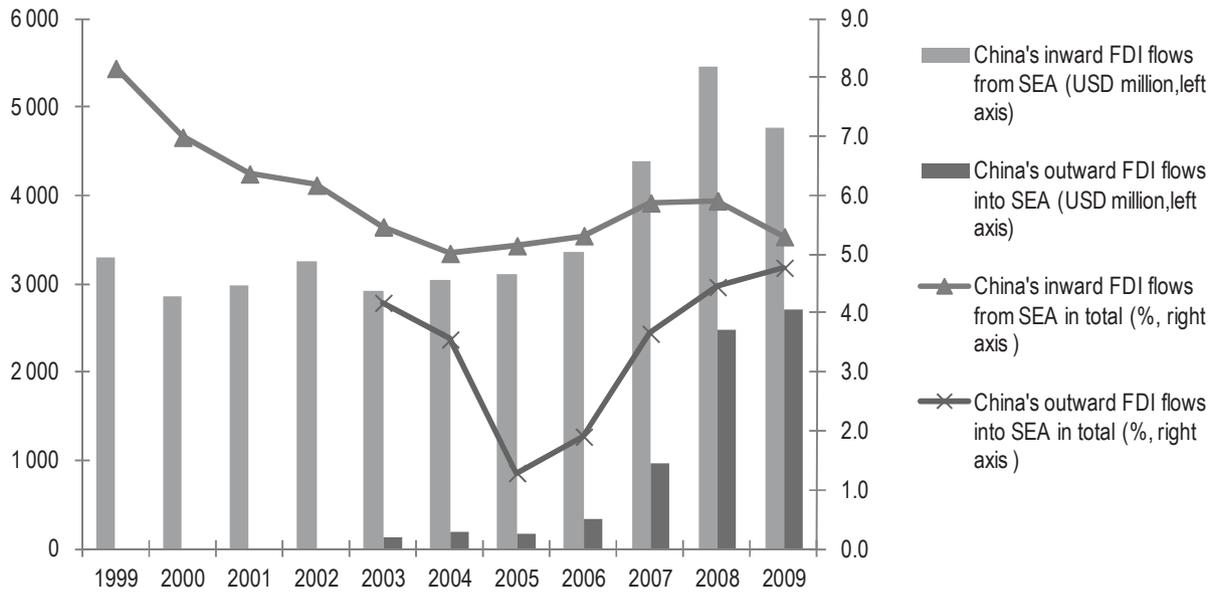
The establishment and development of close bilateral economic relations have promoted the rapid expansion of bilateral trade and foreign direct investment (FDI). Total trade between China and SEA countries increased from USD 27.2 billion in 1999 to USD 213 billion in 2009 for an annual increase of 22.9%, according to China's Ministry of Commerce (MOFCOM). In 2010, total trade between China and SEA countries amounted to USD 292.8 billion (MOFCOM). China's imports from SEA countries reached USD 154.6 billion, a growth rate of 44.8%, while China's exports to ASEAN reached USD 138.2 billion, a growth rate of 30%. ASEAN is China's fourth largest trading partner, accounting for 9.8% of China's total trade, while China is ASEAN's leading trading partner with 11.3% of trade in 2010, marginally larger than that of the European Union (ASEAN).

As seen in Figure A.4 the benefits of ACFTA are unevenly distributed among ASEAN countries. Trade with China tended to feature either a strong surplus as in the case of Thailand, Malaysia and the Philippines, or a trade deficit as in the case of Viet Nam and Singapore. Some observers (*e.g.* Goto 2011) have also noted the impact of Chinese imports on domestic producers and entrepreneurs in Laos, particularly in labour intensive manufacturing.

FDI flows between China and SEA have increased rapidly. China's FDI flows into SEA countries increased from USD 119.3 million in 2003 to USD 2.7 billion in 2009 for an average annual increase of 68.2%. By the end of 2009, China's FDI stocks into SEA countries reached USD 9.6 billion. China has approximately 2 000 firms in SEA countries with 60 000 local employees. As of the end of June 2010, the cumulative total of mutual investments between the two reached approximately USD 69.4 billion; SEA's investment in China totalled about USD 59.8 billion while China's total non-financial investment in SEA was about USD 9.6 billion. China's outward investment is accelerating to catch up with the level of SEA's FDI in China. Due to Singapore's role as a regional hub for capital flows, the volume of Singapore's FDI exaggerates the country's bilateral investment relationships with China or other ASEAN members, as many western companies have headquarters in Singapore and use them to channel investments elsewhere in Asia.

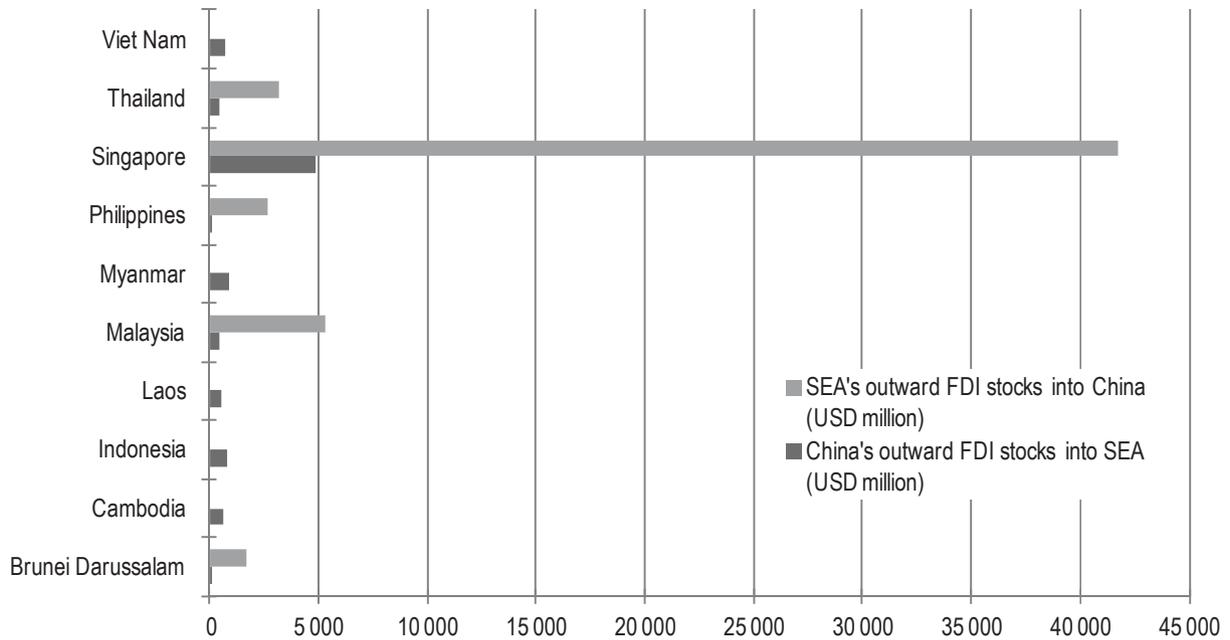
In the field of economic co-operation, China and SEA countries have identified 11 priority areas for bilateral co-operation: energy, transport, culture, public health, tourism, agriculture, information technology, two-way investment, human resource development, Mekong River Basin Development and environment. China and ASEAN have signed many memoranda of understanding (MOUs) and co-operation frameworks in these areas. The turnover of China's economic co-operation, whose measurement is composed of contracted projects, labour co-operation and design consultation, with SEA countries increased from less than USD 2 billion in 1999 to more than USD 11 billion in 2009, for an average annual growth rate of 20.4%.

Figure A.5. China's inward FDI flows from SEA countries and China's outward FDI flows to SEA countries

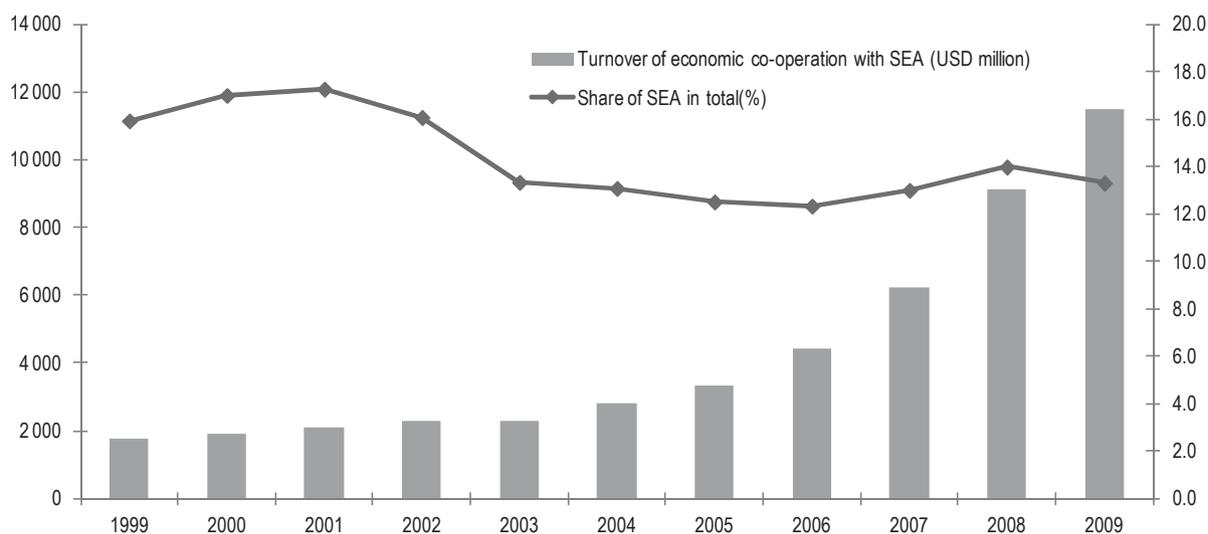


Source: China's Statistical Yearbook (2000-2009) and 2009 Statistical Bulletin of China's Outward Foreign Direct Investment, MOFCOM, P.R. China,

Figure A.6. China's inward FDI stocks from SEA countries and China's outward FDI stocks to SEA countries as of 2009



Source: China's Statistical Yearbook (2000-2009) and 2009 Statistical Bulletin of China's Outward Foreign Direct Investment, MOFCOM, P.R. China.

Figure A.7. Turnover of China's economic co-operation with SEA and share in total (1999-2009)

Source: China's *Statistical Yearbook* (various years 2000-2009).

A.1.2. Outlook for economic relationships (2010-20)

Economic relations between ASEAN and China have laid a foundation for the development of prosperous relations over the next decade. The international economic environment is expected to help further strengthen bilateral economic and trade co-operation. As economic globalisation accelerates, both sides will face challenges. Both China and SEA countries experienced the financial crises of 1997 and 2008, each of which caused a serious shock to their economic growth, and both sides are well aware of the role played by bilateral co-operation in dealing with the crises. Following the East Asian financial crisis of 1997, China began to accelerate the ACFTA negotiation process. During the 2008 global financial crisis, China and SEA countries further strengthened co-operation in financial and other areas with real benefits. In 2009, SEA's exports to China fell significantly less than its exports to the world. Exports of ASEAN-6, Thailand, Singapore, Philippines, Indonesia, Malaysia, and Viet Nam to the United States and the world dropped by 21.3% and 17.7%, respectively, from 2008, while its exports to China fell by only 8.2%.

Secondly, common interests of industrialisation and growth of per capita income may encourage both sides to strengthen co-operation. China's national development target for the next 10 to 15 years is to develop a well-off society, while SEA countries are engaged in building the ASEAN community. However, the huge potential of this bilateral co-operation has yet to be exploited, leaving much room for development in the coming years. Although growing rapidly, trade and FDI are still small as a share of each side's total. There are great prospects for co-operation in other fields such as finance, human resource development, education and technology, with the market potential of some 1.9 billion people yet to be developed.

Third, the conditions for bilateral co-operation have improved and will facilitate further integration. The two sides have gradually set up a series of mechanisms and frameworks to facilitate communication and co-operation, since establishing dialogue in 1991 as illustrated in Figure A.8. In addition to an annual summit of heads of state/government, meetings and consultations are held at the Ministerial and at the senior official levels. These mechanisms form the overall structure of ASEAN-China co-operation. Funds for bilateral co-operation have also increased over time.

Figure A.8. China-ASEAN regional economic co-operation mechanisms

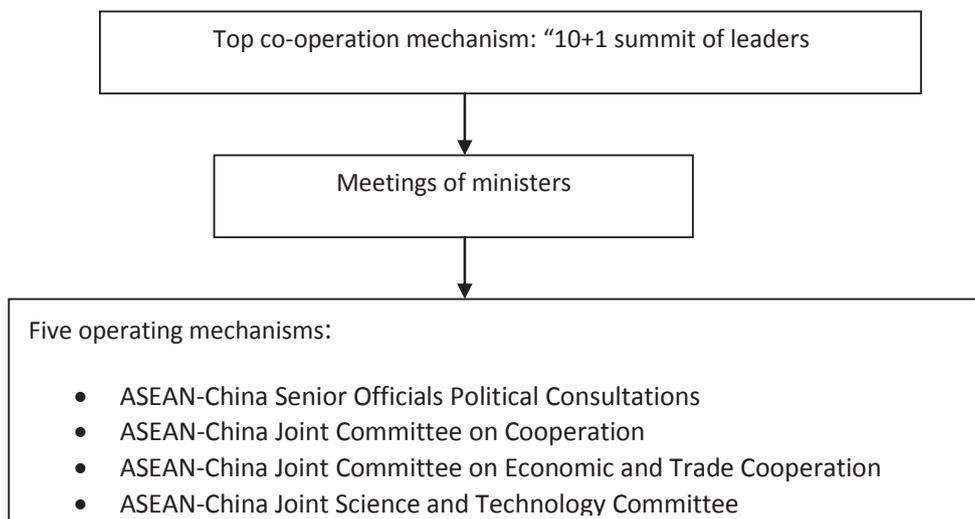
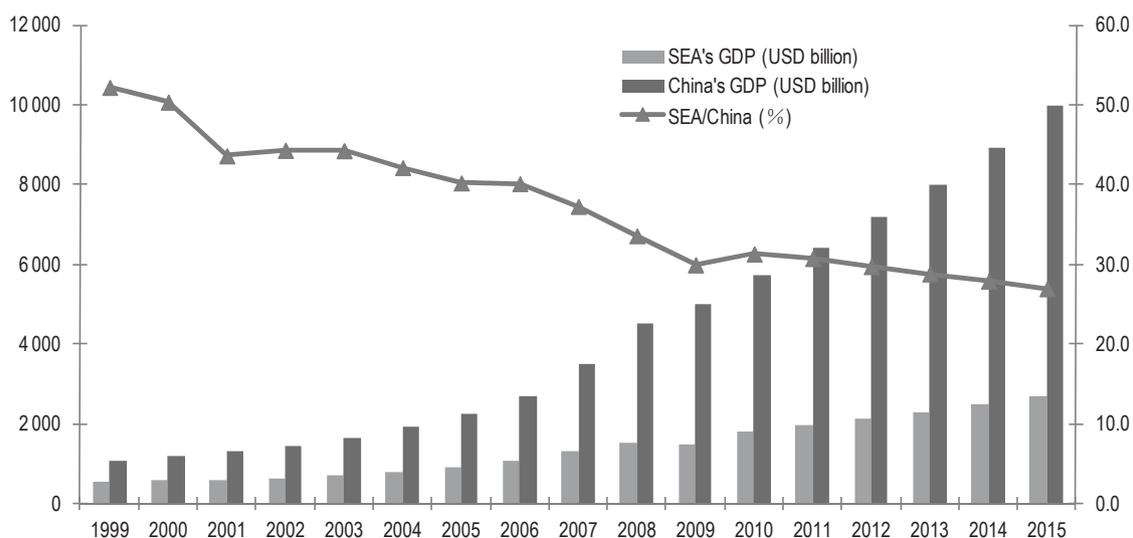


Figure A.9. Comparison of SEA’s GDP to China’s GDP



Source: IMF Database.

Over the next ten years, it is expected that the economic growth of the two sides will continue due to increasing exports from SEA countries to China and China's FDI flows into SEA countries. It is expected however that the distance between their respective GDPs will widen if China continues its unprecedented rates of growth (IMF, 2010). The economic relationship between SEA and China may however experience some challenges in the coming years, primarily due to trade frictions over market access or political issues. A primary area of contention is the South China Sea which has already harmed intra-ASEAN economic cooperation. If these problems continue, the economic integration of ASEAN may be delayed, possibly harming further integration between SEA and China.

As seen, economic relations between China and SEA countries should continue to move towards common prosperity, especially with the enforcement of ACFTA, as long as political relations within the region remain stable.

A.2. China's strategy and policy *vis-à-vis* the SEA region

A.2.1. China's strategy and policies relating to SEA countries, 1999-2009

China and ASEAN share geographical proximity, cultural similarities and economic complementarities. For a long time, China has focused on building its relations with SEA countries and has gradually developed and refined a series of policies. Since the establishment of dialogue relations in 1991, China refers to ASEAN countries as good neighbours, good friends and good partners under the guidelines of China's new security concept. Schüller (2010) argues however that China's interests in fostering closer economic and political ties with SEA go beyond the stated purposes. The ultimate objectives are for trust building, appeasing the concern of ASEAN member countries that China's economic rise would threaten the prospect of their development, and restricting the influence of other powers in the region and their access to the ASEAN market.

"Amicable neighbourhood" policies

In July 1991, Chinese Foreign Minister Qian Qichen was invited to attend the opening ceremony of the 24th ASEAN Foreign Ministers' Meeting and held the first informal talks with foreign ministers of the six ASEAN members at the time. This marked the start of the China-ASEAN dialogue. In July 1994, China was invited to attend the first meeting of the ASEAN Regional Forum (ARF) as ASEAN's consultation partner, and became one of the founders of the forum, which initiated discussions on co-operation in the area of regional security. In April 1995, the China-ASEAN Vice Ministerial Consultation Meeting was held to create a new mechanism to deepen the dialogue between the two sides. In July 1996, at the 29th ASEAN Foreign Ministers' Meeting in Jakarta, Indonesia, China formally became a full dialogue partner of ASEAN. In 2008 the Chinese government decided to accredit China's ambassador to ASEAN. Thus since 1991 China has elevated its relations with SEA countries from general relations to full dialogue partnership. China's relationship with individual ASEAN countries however has been slightly more staggered and slow as seen in Table A.1.

Table A.1. Process of “relations” between China and SEA countries

	Cambodia	Indonesia	Laos	Malaysia	Philippines	Thailand	Viet Nam
Establishment of co-operative good-neighbourly and mutual trust relations for the 21st century					1996		
Establishment of long-term stable relations					2000		
Establishment of a comprehensive co-operative partnership	2006	1999	2000				2003
Establishment of a comprehensive strategic co-operative partnership		2005		2004	2005		2008
Establishment of strategic co-operation and common action plan		2010		2009	2009	2007	

Source: Ministry of Foreign Affairs, P.R. China.

“Secure” neighbourhood policies

In the security field, the two sides actively promoted the idea of strengthening mutual trust through dialogue, resolving disputes through negotiations and realising regional peace through co-operation. The first issue was the South China Sea, a stumbling block to the development of good political relations between China and SEA countries. The signing of the Declaration on the Conduct of Parties in the South China Sea (DOC) in 2002 was the first political document on the issue and was regarded as an important step for settling territorial and jurisdictional disputes peacefully. In an effort to implement the DOC, the first and second ASEAN-China Senior Officials’ Meetings (SOM) were convened in December 2004 and May 2006, respectively. The declaration maintained peace between the parties concerned, however tensions regarding the South China Sea (SCS) have remained. These came to a head in July 2012 when ASEAN was unable to agree on matters related to the SCS- an issue that could potentially derail political and economic relationships within the region in the future.

To build a strong foundation for a long-term partnership, China signed the TAC. China contributed to making it the basis of the code of conduct for inter-state relations in the region and hastened the accession of India, Japan and the Russian Federation to the treaty. This was supported by the Joint Declaration signed by the two parties in 2003. In the same year ASEAN drew up a blueprint for the creation of the ASEAN Community. China expressed its willingness to co-operate actively with ASEAN and provide financial assistance to ASEAN for this process. In regional affairs, China supports ASEAN’s role as the driving force in the regional processes initiated by ASEAN, such as the ASEAN plus Three (APT) process, the ASEAN Regional Forum (ARF) and the East Asia Summit (EAS). China would thus appear to be supportive of the role of ASEAN in the region and in pursuing close relations with the organisation.

Table A.2. Major development in the political and security areas

1975	China officially recognised ASEAN
1991	Foreign Minister Qian Qichen was invited to attend the 24th ASEAN Meeting of Foreign Ministers
1992	China became a Consulting Partner of ASEAN
1994	At the second ASEAN Conference of Foreign Ministers, two agreements were signed: the ASEAN-China Joint Committee of Economic and Trade Cooperation and the ASEAN-China Joint Committee of Cooperation in Science and Technology
1995	The first consultation meeting between high level officials (vice foreign minister) of China and ASEAN was held in Hangzhou
1996	At the 6th meeting of the 29th ASEAN Ministerial Meeting, China's status was raised from consulting partner country to comprehensive dialogue partner country
1997	China signed the Joint Statement on ASEAN-China Cooperation Towards the 21st Century with ASEAN
2002	China signed the Joint Declaration of ASEAN and China on Cooperation in the Field of Non-traditional Security Issues and the Declaration on the Conduct of Parties in the South China Sea
2003	China acceded to the Treaty of Amity and Cooperation (TAC) in Southeast Asia at the 7th ASEAN-China Summit in October 2003, and also signed Joint Declaration on Strategic Partnership for Peace and Prosperity
2004	A MOU on Cooperation in the Field of Non-traditional Security Issues was signed by China in January 2004 in Bangkok
2006	The Commemorative Summit Marking the 15th Anniversary of ASEAN-China Dialogue Relations issued a joint statement to further strengthen ASEAN-China relations towards an enhanced strategic partnership

Source: Ministry of Foreign Affairs, P.R. China.

“Prosperous” neighbourhood policies

Since 1997 China and ASEAN have held 13 10+1 meetings to encourage prosperous relations. In order to promote the smooth implementation of the agreement on trade in goods, both ASEAN and China commenced the Early Harvest Plan for agricultural products in 2003 to allow consumers on both sides to enjoy the benefits of the FTA as soon as possible. Until 2006, some 600 agricultural products enjoyed zero tariff rates. This was further expanded as of the commencement of ACFTA in 2010 to include more goods.

China also contributed funds to ASEAN cooperation by creating a special fund for Asian regional co-operation in 2004 and investing USD 32 million over time. To promote China-ASEAN infrastructure and inter-connectivity, China announced in 2009 its decision to set up a USD 10 billion China-ASEAN Investment Cooperation Fund to finance major ASEAN-China investment co-operation projects in infrastructure, energy and resources, information and communication technology and other fields.

Table A.3. Major bilateral economic agreements between China and SEA countries

	Brunei Darussalam	Cambodia	Indonesia	Laos	Malaysia	Myanmar	Singapore	Philippines	Thailand	Viet Nam
Agreement for Avoidance of Double Taxation and the Prevention of Fiscal Evasion with Respect to Taxes on Income	2004		2001	1999	1985		1999	1999	1986	1995
Agreement on Promoting and Protecting Investment	2000	1996	1994	1993	1988	2001	1999	1992		1992
Agreement on Trade		1996		1988	1988			1975		1991
ASEAN-China Joint Committee on Trade, Investment and Economic Cooperation		2000			1988				1985/ 2003*	1994
ASEAN-China Joint Committee on Bilateral Cooperation			2000				1999			
Memorandum of Understanding on Promoting Trade, Investment and Economic Cooperation	2004					2004	1999	2005		1992
Memorandum of Understanding on Border Trade				1988		1994				1998
Agreements on Bilateral Currency Swaps / Agreement on Bilateral Bank Cooperation			2009	2002	2009				2001	
Memorandum of Understanding on SMEs							2007			
China-Singapore FTA							2008			
Joint Declaration on Bilateral Cooperation		2000	2000	2000	1999	2000	2000	2000	1999	
Agreement on Enlarging and Deepening Bilateral Economic and Trade Cooperation								2007	2009	2006

Notes: *In 1985 China and Thailand established a Joint Committee on Trade and Economic Cooperation at the ministerial level; it was upgraded to deputy prime minister level in 2003.

Source: The Ministry of Foreign Affairs, the People's Republic of China.

Table A.4. China's main proposals made during the "10+1" summits, 1997-2009

China's proposals	
The 1st China-ASEAN Leaders Summit held in Malaysia in 1997	To strengthen co-operation in the fields of resources, technology, market, finance, information and human resource development
The 2nd China-ASEAN Leaders Summit held in Viet Nam in 1998	To contribute USD 200 000 to the ASEAN Fund
The 3rd China-ASEAN Leaders Summit held in Philippines in 1999	To increase the role of ASEAN-China Joint Science and Technology Committee; and strengthen agricultural development
The 4th China-ASEAN Leaders Summit held in Singapore in 2000	To add USD 5 million to the China-ASEAN Cooperation Fund to promote bilateral co-operation in economy, trade, technology and information and expand co-operation in the field of human resource development; to support the e-ASEAN Framework Agreement; to propose the establishment of the China-ASEAN Expert Group on Economic Cooperation.
The 5th China-ASEAN Leaders Summit held in Brunei in 2001	To make agriculture, information and communications, human resource development, mutual investment and Mekong River development as priority areas for co-operation in the near future. To train 100 senior information and communication personnel for ASEAN countries.
The 6th China-ASEAN Leaders Summit held in Cambodia in 2002	To start the process of CAFTA; to implement the "early harvest" plan; to establish regular meetings of Ministries of Information Industry; to sign the long-term memorandum of co-operation on the information industry of China and ASEAN; to train 500 information technology staff for ASEAN in the next five years.
The 7th China-ASEAN Leaders Summit held in Indonesia in 2003	To co-operate with ASEAN in the fields of electronic information, biotechnology, the use of remote sensing, seismology, marine sciences and research of biological resources in tropical areas.
The 8th China-ASEAN Leaders Summit held in Laos in 2004	To propose ten new initiatives for co-operation, such as the establishment of meetings of China-ASEAN energy ministers; to sign an MOU on the Information Highway in the Greater Mekong Subregion with the Mekong River Basin 5 countries; to add USD 5 million to China-ASEAN Cooperation Fund and to set up a total of USD 15 million in special funds for Asian regional co-operation, particularly for strengthening co-operation on human resource development projects of the Vientiane Plan of Action.
The 9th China-ASEAN Leaders Summit held in Malaysia, in 2005	To add transport, energy, culture, tourism and public health as five new priority areas of co-operation.
The Commemorative Summit Marking the 15th Anniversary of ASEAN-China Dialogue Relations in China in 2006	To donate USD 1 million to the ASEAN Development Fund; to offer USD 1 million to support the ASEAN integration initiative; to train 8 000 ASEAN talents and invite 1 000 young people from ASEAN to China in the next five years.
The 10th China-ASEAN Leaders Summit held in Singapore in 2007	To speed up the negotiation on the Investment Agreement; to make a co-operation strategy plan on China-ASEAN transport over the next 10-15 years; to develop a plan to train 8 000 personnel in various areas for ASEAN in the next 5 years.
The 11th China-ASEAN Leaders Summit held in Singapore in 2007	To advocate the establishment of China-ASEAN network and information security co-operation framework for emergency response; to sign a China-ASEAN Memorandum of Understanding on technical regulations, standards and conformity assessment; to establish a China-ASEAN Centre; to reach a consensus agreement on intellectual property rights; to develop a China-ASEAN environmental protection co-operation strategy; To establish the China-ASEAN Cooperation Centre on environmental protection. To implement the initiative to train 8 000 professionals in various fields for ASEAN in the next five years and to train about 2 000 people in 2008 through various training programmes. .../...

Table A.4. China’s main proposals made during the “10+1” summits, 1997-2009 (cont’d)

The Bao’ao Asia Forum April 2009	To establish the China-ASEAN Investment Fund in the amount of USD 10 billion for infrastructure, energy resources, information and communication projects; to offer the SEA countries USD 15 billion in credit, including preferential loans of USD 1.7 billion in the next 3-5 years; to provide RMB 270 million in special assistance to less developed ASEAN countries.
The 12th China-ASEAN Leaders Summit held in Thailand in 2009	To increase from the USD 1.7 billion announced in April 2009 to USD 6.7 billion of the USD 15 billion in preferential loans; to actively promote the China-ASEAN action plan of comprehensive grain production capacity building; to implement the China-ASEAN rural development plan; and to pass the China-ASEAN co-operation strategy on environmental protection; to enhance co-operation in the fields of biodiversity conservation, ecological protection, cleaner production, environmental protection industry, new energy and renewable energy; to train 100 ASEAN environmental officials in the next three years; to reach 100 000 exchange students in 2020 in each side; to develop a joint action plan on the implementation of the Joint Declaration on Strategic Partnership of the China-ASEAN for peace and prosperity from 2011 to 2015; to establish the China-ASEAN Centre.

Source: Ministry of Foreign Affairs, the People’s Republic of China.

A.2.2. China’s major strategy and policies relating to SEA countries (2010-20)

Developing good-neighbour relations and strengthening its strategic partnership with SEA countries are part of China’s long-standing foreign strategy. It is believed that sustained good political relations can promote fruitful economic and technological co-operation between the parties over the long term. China has implemented all measures currently required under the ACFTA framework and as a result has contributed to strengthened co-operation with individual SEA countries. At present China has signed an FTA with Singapore and may consider signing similar FTAs with developing countries within ASEAN in the future.

In addition, China will co-ordinate its regional policies with SEA countries to promote the regional integration process through the “East Asian community” based on the current framework of “10+1” and “10+3”. At the same time, China wishes to resist trade protectionism in the world.

A.3. Science, technology and innovation relationships between China and SEA countries

China and SEA had engaged in co-operation on S&T before becoming strategic partners. Bilateral S&T co-operation was established at both the governmental and non-governmental levels. The former includes the official S&T co-operation between the governments of China and SEA countries, with official meetings, the signing of agreements on S&T and the establishment of working groups to engage in S&T activities. The latter is mainly carried out by universities, research institutes and enterprises and involves activities such as exchanges of researchers and students, development of joint research projects, joint publication of scientific papers, academic meetings and the China-ASEAN Expo.

A.3.1. Introduction of governmental co-operation on S&T between China and SEA countries (1995-2009)

An institutional framework for S&T co-operation

Progress on bilateral S&T co-operation has mainly taken place under the “10+1” framework since 1997. In addition to the annual leaders’ summit, the ASEAN-China Joint Science and Technology Committee (JSTC) was established in 1995 and meets every two years alternately in China and ASEAN countries to plan, approve, co-ordinate, monitor and evaluate joint co-operative programmes and activities. Many joint programmes and activities have been set up under this Committee.

Table A.5. Work of the China-ASEAN Joint Committee on Science and Technology Cooperation

	Time	Place	Contents
1st meeting	Mar. 1995	Bandar Seri Begawan, Brunei	Both sides signed the Terms of Reference of the ASEAN-China Joint Science and Technology Committee (JSTC) and the Procedural Guidelines of the ASEAN-China Joint Science and Technology Committee (JSTC)
2nd meeting	Oct. 2001	Bo’ao, Hainan	The two sides put forward a number of proposals on co-operation programmes, including to hold seminars on technological co-operation on functional foods, marine science and technology, the application of remote sensing to precision agriculture, and information resources services and management among ASEAN countries; to hold a training class on earthquake prediction techniques; and to conduct co-operation in the field of rice.
3rd meeting	Sept. 2003	Ho Chi Minh City, Viet Nam	Both sides reviewed progress in S&T co-operation in the priority fields of the past years; proposed new co-operation projects; exchanged ideas about funds and its channels; listed materials technology as an additional priority; and signed minutes of the third meeting of the China-ASEAN Joint Science and Technology Committee.
4th meeting	Information not available		
5th meeting	Information not available		
6th meeting	Sept. 2010	Suzhou, China	Exchange of ideas about modifying China-ASEAN S&T Cooperation Agreement and improving the joint co-operation mechanisms; agreement to further expand support channels for relevant projects with the help of good mechanisms.

Source: China International Science and Technology Cooperation and Ministry of Foreign Affairs, China.

Meetings of ministers under the Joint Committee are held in the fields of agriculture and forestry, information and communication technology, the environment, energy, and education. The working groups in these fields are responsible for S&T activities between China and SEA countries as a whole or individually. In addition, China and SEA countries have founded research centres, for example, China founded the China-ASEAN Cooperation Centre on Environmental Protection in 2010. Its main responsibilities are environmental co-operation in the framework of ASEAN; developing and implementing proposals on China-ASEAN co-operation on environmental projects; co-ordinating affairs related to the implementation of the China-ASEAN Cooperation Strategy of Environmental Protection; advancing China-ASEAN co-operation in the environmental protection industry; and carrying out relevant exchanges and co-operation.

Table A.6. Working groups on S&T between China and individual countries

	Brunei Darussalam	Indonesia	Laos	Malaysia	Myanmar	Philippines	Singapore	Thailand	Viet Nam
Establishment of S&T Joint Committee		1997		1992		#	1993	1978	#
Establishment of Agricultural Joint Committee						#			
Establishment of Economic, Trade and Technology Joint Working Committee		1990	1997		1997				

Note: # year not available.

Source: Ministry of Foreign Affairs, P.R. China.

Many agreements and MOUs have also been signed between ASEAN and China on S&T co-operation in fields considered as being important or crucial. They cover both traditional industries such as agriculture or fisheries and modern industries such as ICT and environmental protection. Bilateral agreements and MOUs mainly cover: training programmes for officials in the fields of agriculture, ICT, mining and others; joint research and development (R&D); sources of funds for co-operation; infrastructure programmes; information exchange and dialogue between governments; and seminars.

Table A.7. Agreements related to S&T signed by China and ASEAN

2002	Memorandum of Understanding on Agricultural Cooperation
2003	Memorandum of Understanding on Cooperation in Information and Communication Technology
2004	Memorandum of Understanding on Joint Cooperation in Pushing Forward the Construction on the Information Superhighway in the Greater Mekong Sub-region
2005	The Beijing Declaration on ASEAN-China ICT Cooperative Partnership for Common Development
2005	The Plan for the GMS Biodiversity Conservation Corridors Initiative
2007	A 2007-2012 Plan of Action to Implement the Beijing Declaration on ASEAN-China ICT Cooperative Partnership for Common Development
2007	An extended ASEAN-China MOU on Agricultural Cooperation for 2007-2011
2009	Memorandum of Understanding between ASEAN and China on Strengthening Cooperation in the Field of Standards, Technical Regulations and Conformity Assessment
2009	Memorandum of Understanding between ASEAN and China on Cooperation in the Field of Intellectual Property
2009	Cooperation framework of the China-ASEAN Telecom Regulatory Council on network security and the China-ASEAN 2009-2010 Cooperation Plan for Communications.

Source: Ministry of Foreign Affairs, P.R. China.

Table A.8. Agreements on S&T co-operation between China and individual SEA countries, 1978-2009

	Brunei Darussalam	Cambodia	Indonesia	Laos	Malaysia	Myanmar	Philippines	Singapore	Thailand	Viet Nam
Agreement or MOU on S&T Cooperation		2008	1994/ 2009		1992	2000/ 2009	1978	1992	1978/ 1997	2002
Agreement or MOU on Agricultural Cooperation	2009	2000	2001	2000	2003	2000	1999		1997	2004
Agreement or MOU on Forestry Cooperation			2001							
Agreement or MOU on Fishery Cooperation	2000		2001			2001	2004/ 2007			2000
MOU on Mining Cooperation			2001			2000				
MOU on Energy Cooperation	2010									
MOU on ICT	2000				1992	2004	2001			
MOU on Environmental Cooperation								2007	2005	
Agreement on Co-Operation Framework for Space Science and Technology				2008	2003					

Source: Ministry of Foreign Affairs, P.R. China.

Most bilateral agreements and MOUs were signed before those between China and ASEAN. However, the latter have replaced the former to some degree. For example, most bilateral agreements and MOUs involving agriculture were signed in 2000 or earlier, with few being signed since. Moreover, the agreements or MOUs between China and ASEAN have broader coverage than those between China and individual SEA countries. They play, as is expected, a more important role in promoting bilateral co-operation than those between China and individual SEA countries.

In addition to the agreements outlined above, at the Fifth China-ASEAN Leaders Summit held in 2001, five priority areas for co-operation in the 21st century were identified. These were; ICT, environment, agriculture, human resource development and education. The documents adopted since this time are listed above in Table A.8.

ICT co-operation

Since its recognition as a priority area some important documents and co-operation mechanisms have been adopted. These include the China-ASEAN Telecommunications Ministers Meeting, other high-level exchange mechanisms and the China-ASEAN ICT Week. The priority areas for co-operation include ICT infrastructure, universal service, network and information security, and human resource development. Key projects include the construction of the Information Superhighway in the Greater Mekong Sub-region (GMS), the establishment of the China-ASEAN Information Highway, the China-ASEAN Telecom Forum for Universal Service, the China-ASEAN Coordination

Framework for Network and Information Security Emergency Responses. ASEAN believes that these projects will encourage development in regional areas and increase business growth throughout ASEAN by allowing businesses to harness technologies and access new markets (ASEAN Study Centre).

Environmental co-operation

Environmental co-operation is also a priority area with mechanisms such as: the China-ASEAN Environment Ministers Meeting, the environmental ministerial meeting on the GMS, and the China-ASEAN Centre for Environmental Protection. The priority areas for co-operation include the implementation of the Plan for the GMS Biodiversity Conservation Corridors Initiative.

Agricultural co-operation

Both China and SEA countries are agriculture-based economies and attach importance to agricultural development. Their agriculture is complementary and offers potential for co-operation. The agricultural co-operation mechanisms are the China-ASEAN Agricultural Ministers Meeting and other high-level exchange mechanisms, with priority areas being cultivation of hybrid rice and aquaculture. This co-operation is not limited to trade of agricultural products but extends to farming, animal husbandry, aquaculture, processing of agricultural products, animal disease control, rural energy and ecology, and many other areas. Modes of co-operation include human resource development, agricultural science and technology exchanges, small-scale demonstration projects abroad, and promotion of agricultural trade. Highlights of agricultural co-operation, especially since the ACFTA was implemented, include the promotion of super rice, technology dissemination and personnel training. Future agricultural co-operation between China and ASEAN will focus on the seed industry, exchanges of agricultural personnel and high-level industrial co-operation with increased scientific and technological input (Xinhuanet, 2010).

In addition, both sides pay great attention to co-operation on forestry and have signed agreements and joint participation in international co-operation projects such as the model forest and the China-ASEAN precious tree seedling-breeding base created in 2010. China encourages forestry enterprises in Myanmar, Laos, Cambodia and other ASEAN countries to plant trees and undertake drug replacement planting.

Education co-operation

Co-operation in education is also an important area. China and SEA countries need to improve the level of education and fuel economic growth with a well-qualified population. Since CAFTA, relations between China and SEA countries in terms of educational exchanges and co-operation have become closer. China and SEA countries have signed a series of agreements on educational co-operation (Table A.9) and have established a comprehensive co-operation partnership in education. In 2009, nearly 100 high-level education delegations visited each other.

The China-ASEAN Education Cooperation Week, which has now been held three times, and the roundtable conference of education ministers, the first of which was held in August 2010, are platforms for co-operation on education. The China Educational Resource Show is held at the same time as the Education Cooperation Week in Guiyang, China. A working group for education co-operation has been established between China and Malaysia, Singapore and Thailand. The China-ASEAN Education Information Network provides students and faculties with information on study and research exchanges.

It is expected that co-operation on education between China and SEA countries will increase. The roundtable conference of education ministers decided on the following initiatives: *i)* continuation of a high-level dialogue to strengthen education co-operation and joint research; *ii)* the number of exchange students from each side will reach 100 000 by 2020; *iii)* to this end, China will offer 10 000 government scholarships a year for the next ten years to students from SEA countries studying in China; *iv)* both sides will set up a high-end talent exchange scholarship in the fields of education, environment, medicine, climate, science and technology for joint training of high-level personnel; *v)* both sides will make an effort to promote the mutual recognition of academic degrees.

Table A.9. Bilateral agreements on education between China and SEA countries

	Brunei Darussalam	Cambodia	Indonesia	Laos	Malaysia	Philippines	Singapore	Thailand	Viet Nam
Agreement or MOU on Education Co-operation	2001	2004	2010	2002/ 2005	1997/ 2005	2007	2001	2009	2000/ 2005
MOU on Higher Education Co-operation	2004				2009		2009	1999	
Agreement on Mutual Recognition of Qualifications and Academic Degrees in Higher Education						2009		2007	
Number of schools by mutual certification					38		9	75	

Human resource development

Both China and SEA countries have large populations and attach importance to human resource development (HRD). The co-operation mechanisms include the China-ASEAN HRD Ministers Meeting and other high-level exchange mechanisms, with the priority areas focusing on training. China has financed more than ten projects involving training and exchange of personnel since 2000 under the China-ASEAN Cooperation Fund. As of November 2007, the Fund had financed training for more than 6 000 professionals from SEA in the fields of economics, trade, telecommunications, finance, earthquake prediction, agricultural biotechnology, marine technology and AIDS.

In addition, China and most SEA countries have carried out various forms of training in different fields. As of November 2009, the Ministry of Agriculture of China had trained more than 1 000 agricultural management and technical personnel from SEA countries, and carried out more than 40 agricultural technology pilot projects with SEA countries. Furthermore, training is also organised for a small number of government officials. From 1993 to the first half year of 2007, a total of 364 Cambodian government officials and economic and technical personnel received training in the fields of health, sports, diplomacy, finance, business, industry, agriculture, transport, etc. During the first half of 2010, 66 Cambodian officials participated in 27 training programmes in China in the fields of industry, agriculture, transport, health, communications, infrastructure construction, environmental protection, tourism, climate, water and development of small and medium-sized enterprises (SMEs).

China has also benefited by receiving training programmes provided by some SEA countries. In 1996, a HRD plan was signed between Singapore and China to train Chinese mayors in urban planning and management, economic planning and social development. In 2004, both sides decided to set up a China-Singapore Fund to support the exchange and training of young officials from both sides. In 2007, a MOU was signed to carry out personnel training of national park staff in China's central and western zones on the basis of Singapore's experience in park management.

A.3.2. Academic exchanges between China and SEA countries

Exchange of researchers and students

As seen above, co-operation between ASEAN and China with regards to education has grown considerably. The number of Chinese students choosing SEA countries to pursue advanced studies has increased. By 2009, 229 000 Chinese students were studying abroad. As of August 2009, 68 510 were studying in SEA countries, of whom 36 000 were in Singapore, more than 10 000 in Thailand, 9 200 in Malaysia and 13 in Brunei. In 2009, Singapore was the seventh destination country of Chinese students studying abroad.¹ Among numbers of foreign students in Malaysia Chinese students ranked third.

Since the reform and opening to the outside world, the number of foreign students in China has expanded rapidly. In 2009, foreign students studying in China exceeded 230 000, 34 735 of which were from ASEAN as of August 2009. According to projections by the Ministry of Education of China, it is expected that 100 000 students from each side will study in the alternate country by 2020.

Table A.10. Students and researchers from SEA countries studying in China

	Total of foreign students in China	Viet Nam	Thailand	Indonesia	Malaysia	Philippines	Singapore	Laos	Myanmar
2000	52 150	647	667(10)	1 947(4)			854(7)		
2001	61 869	1 170(6)	860(10)	1 697(4)	632				
2002	85 829	2 300(5)	1 737(6)	2 900(4)	840	638	583		
2003	77 715	3 487(3)	1 554(5)	2 563(4)	841	602	551	403	232
2004	110 844	4 382(4)	2 371(6)	3 750(5)	1 241	1 375	929	509	
2005	141 087	5 842(4)	3 594(6)	4 616(5)	1 589	2 176	1 322	569	
2006	162 695	7 310(4)	5 522(6)	5 652(5)	1 743	1 512	1 392		
2007	195 503	9 702(4)	7 306(5)	6 590(8)					
2008	223 499	10 396(4)						320	
2009	238 184	12 247(4)	11 379(5)	7 926(8)			2 200	320	

Note: The number in parentheses indicates the rank among in total foreign students in China.

Source: The Minister of Education of China.

Joint research projects

At present, China has a limited number of joint research projects with SEA countries with the exception of Singapore, signalling an uneven impact of China across ASEAN in this respect. Some of the developing SEA countries seek to strengthen their R&D co-operation with China. Indonesia has identified seven areas for technological development, including food and agriculture, energy, health and medicine, for 2010-14. At the meeting of the China-Indonesia Science and Technology Joint Committee in 2010, ten projects for co-operation were decided upon. China and Viet Nam have also undertaken a number of joint research studies and seminars on the prevention and control of the trafficking of women and children and promotion of safety for immigrants in recent years.

Joint research projects are undertaken mainly on the bilateral level between China and Singapore. This is because Singapore has the most highly developed technology among ASEAN countries, especially in the fields of biomedical, environmental and water technologies, and interactive and digital media. Inter-governmental co-operation between China and Singapore has two main aspects: joint R&D and commercialisation of scientific research achievements in the fields of materials, manufacturing, biotechnology, microelectronics and information technology (IT). The China-Singapore Technology Company was established in 1995 and the two parties began a joint research programme in 1998. In October 2003, the Representative Office of the Torch Centre of China's Ministry of Science and Technology was formally established in Singapore. In 2007, the two parties explored S&T co-operation on the eco-city and promotion of interaction in the field of digital media technology, followed by the implementation of joint research projects in microelectronics, materials and other fields and the carrying out of joint research projects under an MOU on R&D co-operation on interactive digital media technology signed in March 2008.

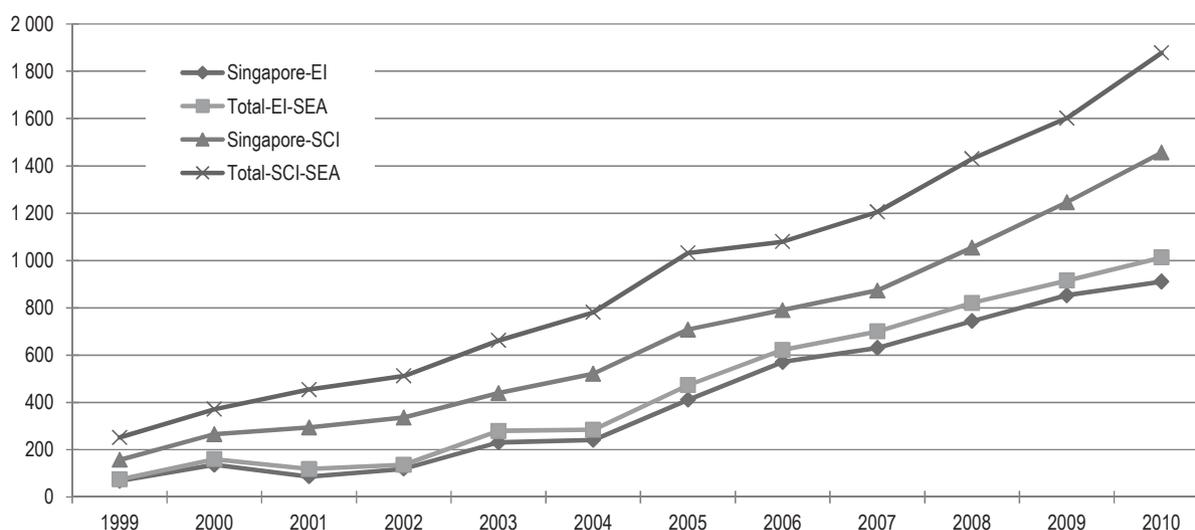
In addition, China has developed R&D co-operation with Thailand and the Philippines. Among the international academic institutions with which China's National Natural Science Foundation signed a co-operation agreement (or MOU), only the National Research Council of Thailand (NRCT, signed in 1992) and the International Rice Research Institute (IRRI, signed in 2000) in the Philippines represented ASEAN as of March 2008. China also encourages Chinese research institutions and high-technology enterprises to participate in Malaysia's Bio Valley programme. However, the relationship between SEA and China with regards to joint research projects is quite weak and shows much room for improvement.

Joint publication of scientific papers

Based on the Engineering Index (EI) and the Science Citation Index (SCI), co-authored publications involving authors from China and SEA countries (but not limited to these) are rising steadily (Figure A.10). Between 1999 and 2010, they amounted to 5 596 in EI and 11 260 in SCI. Among these, the papers with authors from China and Singapore (but not limited to these) rank first, an indication of the scientific and technological strength of Singapore (Tables A.11 and A.12). China is also strengthening co-operation with other SEA countries with publications listed in EI increasing from 5 in 1999 to 102 in 2010 and those in SCI increasing from 95 in 1999 to 422 in 2010. While these numbers have been growing, they account for an insignificant share of the 472 000 Chinese scientific papers published internationally. Moreover, papers by authors from China and SEA countries often have co-authors from other countries or regions (see Statistical Appendix, Table A.A2).

Generally speaking, papers involving countries that are strong in scientific and technological areas cover a wider span of subjects. Those with authors from China and Singapore range over 173 subjects, while those from China and some less advanced SEA countries deal with fewer than 20. In addition, the areas covered differ. Because of Singapore's strength in the engineering, electrical & electronic area, the largest number of papers by authors from China and Singapore is in this category (see Statistical Appendix, Table A.A3).

Figure A.10. Papers published jointly at the bilateral or multilateral level



Source: Ei Compendex Web. Science Citation Index Expanded (SCI-EXPANDED)

Table A.11. Joint publications of scientific papers by China and SEA countries

Based on EI statistics (1999-2010), as of December 2010

	Journal papers	Conference papers	Total
Singapore	5 004	1 649	6 653
Malaysia	205	39	244
Thailand	160	37	197
Philippines	113	2	115
Viet Nam	64	5	69
Indonesia	43	4	47
Brunei	4	2	6
Myanmar	2	0	2
Cambodia	1	0	1
Laos	0	0	0
Total	5 596	1 738	7 334

Note: The papers are jointly published by authors not only from China and SEA countries, but also from other countries such as the United States, Japan, Korea, and EU member states.

Source: EI Compendex Web.

Table A.12. Joint publications of scientific papers, China and SEA countries

Based on SCI statistics (1999-2010), as of December 2010

	Journal papers	Authors from countries or regions	Subjects
Singapore	8 141	99	173
Malaysia	1 435	84	123
Thailand	972	106	139
Philippines	414	101	89
Indonesia	206	81	79
Cambodia	40	26	23
Brunei	19	5	14
Myanmar	18	30	15
Laos	12	20	15
Viet Nam	3	3	1
Total	11 260		

Note: The papers are jointly published by authors not only from China and SEA countries, but also from other countries such as the United States, Japan, Korea, and EU member states.

Source: Science Citation Index Expanded (SCI-EXPANDED).

Academic conferences

There are few joint academic conferences in the region, and those that are held are generally under a multilateral framework which includes both SEA and China (see Table A.A4). The few bilateral academic conferences that occur are usually held by China and Singapore.

Table A.13. Joint conferences at the regional level

2005 and 2008	China-ASEAN Symposium on Intellectual Property Rights
2006	China-ASEAN Agricultural Energy Forum
2007	China-ASEAN Forestry Cooperation Forum
2007	China-ASEAN Human Resource Development Cooperation Forum
2009	China-ASEAN Subtropical Agricultural Industrialization Development Forum
2009	New and Renewable Energy Development and Application Forum
2010	China-ASEAN Joint Conference on Intellectual Property Rights
2010	China-ASEAN Seminar on the development of aquaculture industry

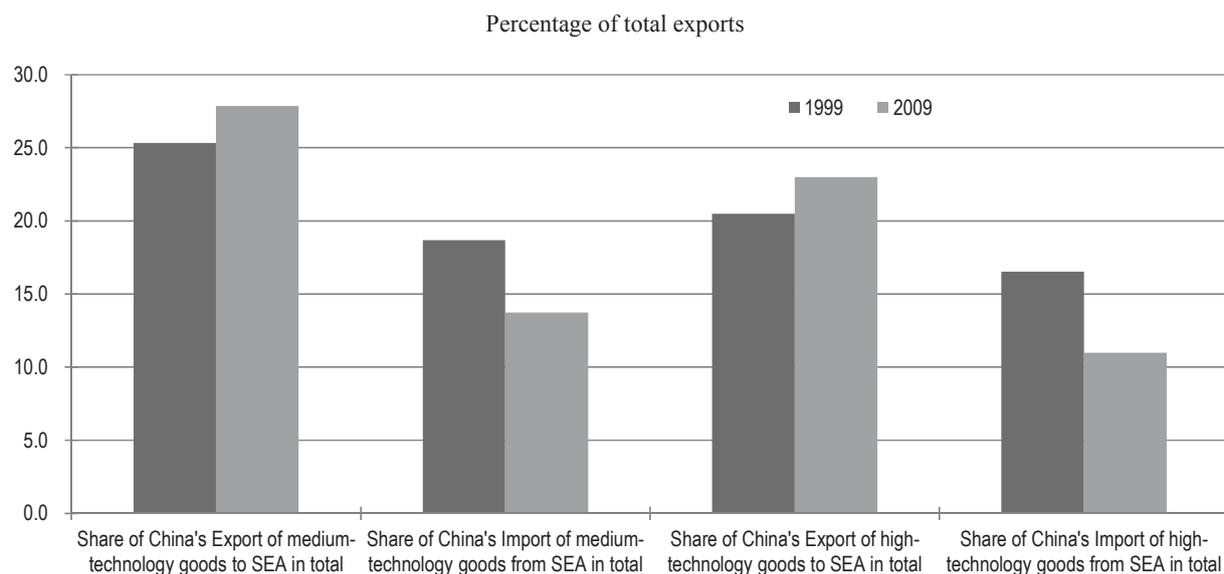
Source: Ministry of Science and Technology, China-ASEAN Expo, State Intellectual Property Office of China.

A.3.3. Technology flows through trade and investment between China and SEA countries*Bilateral trade in medium- or high-technology products*

China's medium- and high-technology exports to SEA countries have increased as a share of total exports while China's imports from SEA countries have decreased (Figure A.11). This indicates that China's technological gap with SEA countries is increasing. Moreover, while China has an overall trade deficit with SEA countries, it runs a trade surplus in medium- and high-technology products at USD 27.7 billion in 2009 up from USD 367 million in 1999.

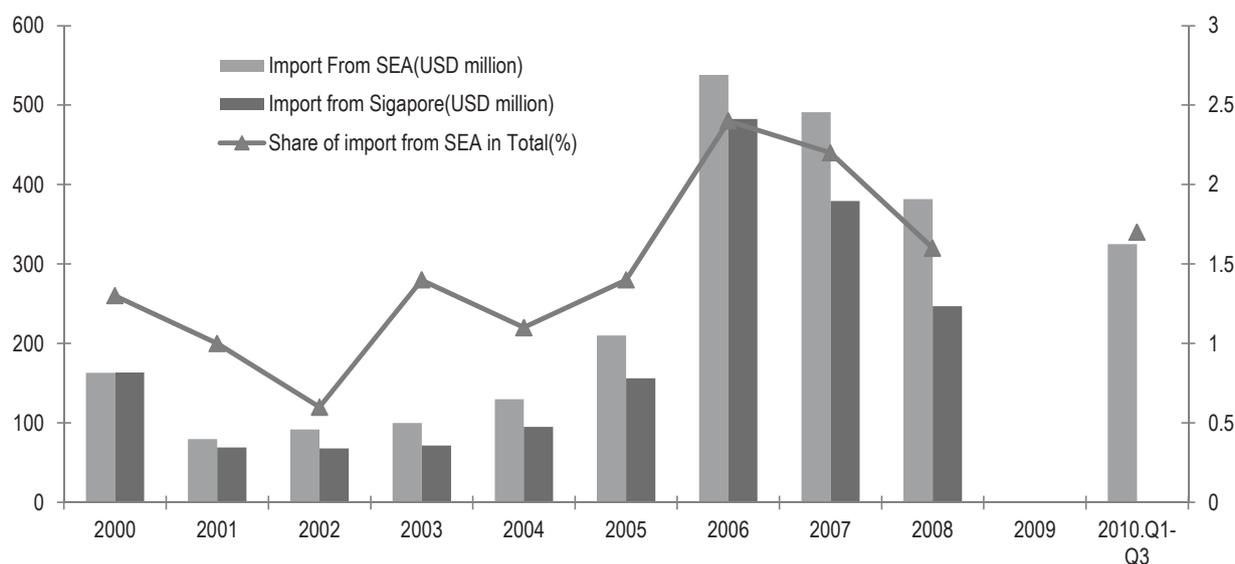
Technology trade

China's technology imports² from SEA countries are in an inverted U shape. Prior to 2006, they were USD 200 million before increasing to more than USD 500 million and then decreasing to less than USD 400 million. China's imports of technology services from SEA countries accounted only for around 1.5% of its total technology imports, reaching a peak of 2.5% in 2006. Singapore is the major source of China's technology imports from SEA countries, accounting for 70-80% of the total. Owing to the present level of China's technology, China has exported few technological services and little technology to SEA countries. Exports of royalties and licence fees totalled USD 400 million in 2009.

Figure A.11. China's trade in medium- and high-technology goods¹ with SEA countries

1. Based on UNIDO's classification of medium- and high-technology products.

Source: UN Comtrade.

Figure A.12. China's imports of technology from SEA countries

Source: MOFCOM.

FDI flows and stocks related to technology and education from China to SEA countries

Table A.A1 (see Statistical Appendix) shows that China's flows and stocks of FDI to SEA countries for scientific research, services and geo-survey and for education and IT account for only 1.4%, 0.1% and 0.4%, respectively, of China's total outward FDI stocks to SEA countries. The share of outward FDI stocks in education to SEA countries in total FDI stocks in education is the second highest (33.5%),³ after Power and other utilities, while the share of outward FDI stocks in scientific research, services and geo-survey and IT industries to SEA countries in China's total FDI stocks in these industries is very low, at 4.6% and 2%, respectively. China clearly invests more in education in SEA countries than in scientific research, services and geo-survey and IT industries.

Table A.14. History of the China-ASEAN Expo

Contents		Effects
1st Expo, 2004	SMEs, technology and innovation; special exhibition in the fields of electronic information, optical electromechanical integration, biomedicine, new materials, energy, resources and the environment.	Information not available.
2nd Expo, 2005	Advanced and applicable technology; special exhibition.	China signed 19 projects with SEA countries in the fields of agriculture, biomedicine, new materials, environmental protection, electronic information, mechanical and electrical industries with turnover of RMB 235 million, traded goods valued at RMB 16.7 million.
3rd Expo, 2006	Advanced and applicable technologies for rural areas; 20th Anniversary Exhibition of China's Spark Programs.	China signed 58 co-operation projects with SEA countries with a total investment of USD 3.1 billion, for which China introduced 18 investment projects from SEA countries with a total investment of USD 515 million while China engaged 40 investment projects in ASEAN with a total investment of USD 2.56 billion.
4th Expo, 2007	Applicable technologies in rural areas; Achievement Exhibition of Agricultural Science and Technology Commercialisation.	China signed 59 "going out" projects with a total investment of USD 1.58 billion. China signed 37 co-operation projects with SEA countries for the investment of USD 1.19 billion.
5th Expo, 2008	Information and communication co-operation.	The 10 ASEAN countries signed 58 co-operation projects with a total investment of USD 3.55 billion, while China signed 44 "going out" projects valued at USD 2.76 billion.
6th Expo, 2009	Advanced and practical high technology in rural areas; agricultural machines and technology for SEA countries.	ASEAN signed 59 projects totalling USD 3.18 billion, while China signed 48 "going out" projects for a total investment of USD 1.89 billion.
7th Expo, 2010	Trade in services; special show in the fields of financial services, logistics services and education services.	China signed 58 "going out" projects with SEA countries for a total investment of USD 2.66 billion.

Source: www.caexpo.org.

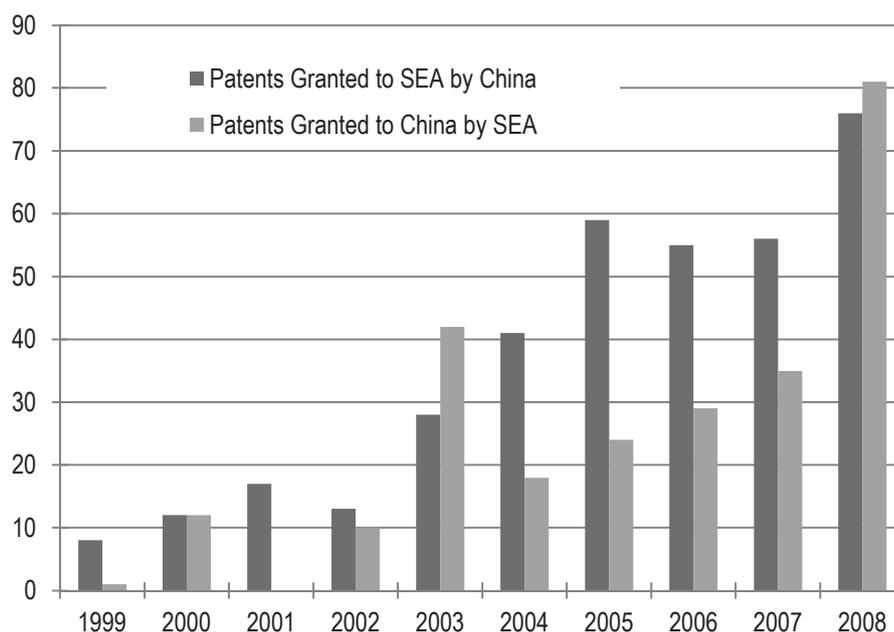
China-ASEAN Expo

The China-ASEAN Expo (CAEXPO) serves as an important channel for promoting trade, investment and technology transfer between China and ASEAN. At the meeting of China-ASEAN leaders held in 2003 it was decided that China would be the permanent venue for the annual Expo, with a view to strengthening the exchange of products and information to help the CAFTA process. Since 2004, the China-ASEAN Expo has become a platform for increasing bilateral economic and trade relations. So far, it has led to trade turnover of USD 9.89 billion and investment projects valued at USD 41.76 billion. The China-ASEAN Business and Investment Summit (CABIS) held back-to-back with the CAEXPO, also serves as an effective way of bringing government and the private sector together to exchange views on matters affecting the economy and business of ASEAN member states and China.

A.3.4. Intellectual property issues

There is very little co-operation on intellectual property (IP) between China and SEA countries. In 2008 China granted 412 000 domestic patents, an increase of 17.1% from the previous year. 94 000 of these were invention patents, an increase of 37.9%. This is in contrast to 47 716 patents granted to foreign countries or regions, of which only 76 went to SEA countries. SEA countries, for their part, granted 10 176 patents to foreign countries or regions, among which only 81 were to China. Most of these patents involved Singapore and China (Singapore granted 51 of the 81 patents to China, and China granted 58 of the 76 patents to Singapore). The number of patents granted to China by SEA countries grew steadily between 2004 and 2008, however much work remains to be done to encourage intellectual property within the region.

Figure A.13. Patents granted between China and SEA countries (1999-2008)



Source: WIPO and State Intellectual Property Office of PRC and China's Statistical Yearbook (2000-2009).

A.4. Factors favourable to S&T co-operation

A.4.1. Factors favourable to S&T co-operation between China and SEA countries

Political context

Economic and technological co-operation between China and SEA countries has accelerated rapidly since the signing of the CAFTA Agreement on Trade in Goods in 2004. The developments outlined throughout this paper cannot be separated from the improvement in political relations between China and SEA countries, which has laid a solid foundation for S&T co-operation and produced expectations of stable S&T co-operation. The actions outlined may also serve as an indication of increasing mutual trust, an important prerequisite for future economic and technological co-operation.

Economic context

Chinese and SEA developing economies are fast evolving. In their pursuit of economic development and higher per capita income, S&T plays an increasingly important role. Both sides are presently making an effort to restructure their industrial base from labour-intensive to technology-intensive industries and paying attention to green technology and the introduction of clean energy. For example, because the owners failed to carry out health impact assessments (HIA), work at 65 new plants at Map Ta Phut, Thailand's biggest industrial estate, was suspended by the courts in December 2009. In addition to traditional industries such as agriculture, which does not necessarily imply low technology, high-technology industries such as the environment and clean energy are becoming a focus of co-operation.

Technological context

Increasing R&D inputs on both sides enlarges the opportunities for S&T exchanges and co-operation. To meet the demand for technology, China and some SEA countries are trying to increase their R&D. As Table A.15 indicates, China and Singapore have high R&D growth rates, and the share of gross expenditure on research and development (GERD) in GDP in Singapore and China keeps rising. Malaysia also would like to increase this ratio. Malaysia's public investment in R&D during the Ninth Malaysia Plan was about 0.7% of GDP and total expenditure on R&D was expected to reach 1% of GDP under the Tenth Malaysia Plan. Thailand's present R&D budget is THB 25 billion, only 0.25% of its THB 10 trillion GDP. The Science Ministry of Thailand expects annual spending on R&D to reach THB 100 billion, equal to 1% of Thailand's GDP, by the end of the 11th National Economic and Social Development Plan in 2016. The real or projected increase in R&D in these countries will raise the level of their technology and specialisation and enhance their ability to supply technology for economic growth.

Table A.15. Gross expenditure on R&D: growth rates and share of GDP in China and SEA countries, 2000-2009
Percentage

	Growth rate of GERD		GERD as a share of GDP			
	Singapore	China	Singapore	Malaysia	Thailand	China
2000	13.3	31.9	1.9	0.5	0.3	0.9
2001	7.4	16.4	2.1		0.3	1.0
2002	5.3	23.5	2.2	0.7	0.2	1.1
2003	0.6	19.6	2.1		0.3	1.1
2004	18.6	27.7	2.2	0.6	0.3	1.2
2005	12.8	24.6	2.3		0.2	1.3
2006	9.3	22.6	2.3	0.6	0.3	1.4
2007	26.5	23.5	2.5		0.2	1.4
2008	12.4	24.4	2.6	0.6		1.5
2009	15.2	25.7	2.3	0.6		1.7

Source: National statistics offices.

A.4.2. Constraints on S&T co-operation between China and SEA countries

The factors that affect the level of S&T co-operation between China and developing SEA countries are related to their ability to supply technology, as this is closely related to their stage of economic development and their policies.

Stage of economic development

At present, China and SEA countries are in a process of technology accumulation. China is moving towards becoming an emerging technology power while some developing SEA countries with small shares of R&D in GDP lag behind in terms of S&T capabilities. They are not yet creative centres like the United States or the European Union. They have insufficient ability to meet their or their partners' demand for technology required for economic growth and therefore need to source technology from countries such as the United States, the EU and Japan. In short, China and SEA countries, with the exception of Singapore, are more demanders than suppliers of technology.

S&T co-operation policies

Other constraints on S&T co-operation are the limited policy support geared towards S&T cooperation between China and SEA and the predominant focus on advanced countries for S&T cooperation on both sides. Although both sides view international S&T co-operation as very important in order to compensate for their deficiencies in S&T, especially S&T research capabilities, infrastructure and funds, each directs their co-operation policies towards countries with advanced technology, leaving little room for co-operation between them. China developed its international S&T co-operation programme in 2001 in order to enhance its technological strength through international co-operation.

Singapore is China's only partner amongst SEA countries. SEA countries individually have no official policies for international S&T co-operation (Schüller, 2008), although ASEAN has an institutional framework for international S&T co-operation based on the prerequisite that the partner be a world leader.

In addition, there are too few funds for S&T co-operation. For a long time, China and SEA countries lacked the funds to start S&T co-operation. In recent years, the situation has improved somewhat. With its increasing economic strength, China finances some S&T exchanges and co-operation with SEA countries. However, this is not significant when considering the amount provided by other countries. For example, Japan contributed USD 195 million to ASEAN for youth exchange programmes in East Asia in 2007; by contrast, funds used for China-ASEAN co-operation totalled less than USD 50 million.

In summary the main features of bilateral S&T co-operation are as follows:

The scale of S&T co-operation is currently small. There are much fewer joint publications of scientific papers (based on a case study), joint research projects, bilateral academic conferences and patents granted to each other than to third parties. For example, the joint projects in technology for agriculture are small and scattered and it is hard to see any obvious economic and social benefits to local people.

Second, the S&T co-operation is one-way. Generally speaking, between Singapore and China, Singapore is the exporter of technology and China is the receiver. Between China and SEA developing countries, China is the exporter of technology and the developing SEA countries are the receiver. The result is few possibilities of joint research and joint achievements.

Third, S&T co-operation cannot only be bilateral. Important S&T conferences attended by China and SEA countries and joint research projects are held at the multilateral level and seldom at the bilateral level. This suggests that S&T co-operation between China and SEA countries will probably benefit from a multilateral framework and should look towards its development.

A.5. Future trends and directions in China's relationship with SEA countries in S&T and innovation

As of 2007, China had developed S&T exchanges and co-operation with 152 countries and regions and signed intergovernmental S&T agreements with 99. China's Ministry of Science and Technology (MOST) has accredited 131 S&T officials in 45 countries including Singapore, Thailand and Indonesia, and 62 Chinese institutions abroad. Thus despite weak S&T co-operation in the region some factors are improving.

China, as an emerging technological power, is accumulating a technological advantage over developing SEA countries. The overall level of technology in SEA countries is still low owing to the level of R&D inputs and to shortages of S&T personnel, a problem that is hard to remedy quickly. In contrast, China's strength in S&T has increased steadily, especially in the present century. It has relatively integrated disciplines from basic theory to applied science, ranging from biotechnology to electronic information. China accounts currently for 11.5% of the world total of S&T papers and in 2008 ranked second after the United States in terms of numbers of international S&T papers.

There is great potential for China-ASEAN S&T co-operation, largely based on their complementarities. Demand for China's technology from developing SEA countries will increase. The future S&T co-operation may have the following prospects:

First, the scale and quality of bilateral S&T co-operation is likely to be enhanced. Today's increasing exchanges of researchers and students will probably lead to greater S&T co-operation. The funds provided by China for S&T co-operation have increased, especially in recent years, and will lead to more joint research projects. In addition, the S&T co-operation mechanism is maturing and will provide both sides with better support.

Second, S&T co-operation will expand from traditional to modern industries. China's progress in high technology or new technologies in these years will probably offer new areas for S&T co-operation. Also, joint research between SEA countries and China may fill the gaps or even replace some of joint research projects between SEA countries and third parties.

Third, bilateral S&T co-operation will take place simultaneously with multilateral S&T co-operation. The leading S&T powers will continue to have a positive impact on bilateral S&T co-operation between China and SEA countries, meanwhile, the latter can make full use of multilateral and regional frameworks to strengthen bilateral S&T co-operation and exchange.

A.6. Role of technology assistance (S&T diplomacy) in China's future S&T relationship with SEA countries

A.6.1. Development of technology assistance (1999-2009)

China's technology assistance policies (S&T diplomacy)

S&T diplomacy is seldom used in China's official documents and is difficult to find in statements. However, technology assistance is regarded by China as an important way to strengthen S&T co-operation with developing countries. By the end of 2009, China had offered economic and technical assistance to more than 120 countries and donated to more than 30 international and regional organisations (News China, 2010). By the end of August 2009, China had carried out various forms of technical co-operation in recipient countries and sent 550 000 technical experts in agricultural development, research and consulting, geological prospecting, etc. (China Economic Net, 2010). China's technology assistance to developing countries focuses on agriculture, medicine, energy, environmental protection, information and communication, and manufacturing.

China's S&T assistance policies aim to develop science and technology in developing countries, enhance their scientific and technological base, and promote their economic and social development through personnel training and demonstration projects. This assistance is available to developing SEA countries. China actively supports the development of S&T co-operation in high-technology fields in SEA countries in order to strengthen their high-technology base. For example, China helped to implement a project on rice breeding and marketing in Myanmar, to carry out a co-operation project to eliminate malaria quickly in Cambodia and Indonesia and to promote a project for an agricultural technology demonstration platform in the Philippines. In order to strengthen S&T co-operation with SEA countries, China will set up a series of offices for China-ASEAN co-operation in the fields of business, investment, tourism and youth training programmes, as well as co-operation projects in poverty alleviation, medical and health, port co-operation, inspection and quarantine co-operation (Xinhuanet, 2010).

China's foreign aid to SEA countries

In recent years, China has expanded its foreign aid to developing countries, including SEA countries. China is a key source of foreign aid to Cambodia. According to the 2010 Aid Effectiveness Report (AER) prepared by the Cambodian Rehabilitation and Development Board (CRDB) of the Council for the Development of Cambodia (CDC), over the period 2000-09, development assistance from China to Cambodia totalled USD 465 million or 7% of the overall endorsement from all partners. The amount increased annually from USD 2.6 million in 2000 to USD 114.7 million in 2009, at which time its development assistance ranked second after Japan. Aid from China to Cambodia was concentrated on transport (70.2%), community & social welfare services (15.9%), governance and administration (8.9%), information and communication (2.2%), post and telecommunications (2.1%), and others (0.73%). China also increased its foreign aid loan to the Philippines to about USD 1.1 billion in 2010, more than double the USD 483 billion in 2009 (NEDA, 2010). China's aid to the Philippines has focused on agricultural areas. In 2003, the Sino-Philippines Agricultural Technology Centre built by the Chinese was completed. This has promoted advanced and practical technology for improving food (mainly rice) yield and resulted in China's hybrid rice growing over large areas of the Philippines.

China is the fourth largest source of assistance for Laos. According to statistics from the Laotian Department for International Cooperation, the Ministry of Planning and Investment (2009), Laos received ODA of over USD 78 million from China from 2004 to 2008, of which USD 35.8 million was grants and USD 42.2 million in soft loans, accounting for approximately 7.4% of aid given to Laos. Chinese aid to Laos (2004-08) concentrated on transport (47.2%), rural development (15.7%), health (12.4%), communication (8.4%), education (7.8%), and cement factories (7.8%). Comparing the structure of China's aid to that of other countries, China concentrates more on transport and communications while other countries tend to have a more diversified profile. Aid from other countries goes to public administration (23%), transport and communication (20%), agriculture and rural development (14%), education (13%), health (9%), energy and mining (8%), trade (7%), and others (6%).

China's assistance to Viet Nam largely concentrates on development sectors and areas such as industry, mining, railway construction, energy, textiles, chemicals and physical infrastructure. This aid is largely in the form of preferential loans. China's assistance to Viet Nam is rather modest both in amount and in the percentage share of Viet Nam's total aid. Based on statistics from the official records of the Ministry of Planning and Investment (2008), the total of soft loans and grants from China between 1993 and 2008 was just over USD 359 million (almost 1.1% of total ODA inflows to Viet Nam), of which more than USD 330 million was in preferential loans (accounting for 1.2% of total soft loans provided to Viet Nam) and only around USD 29 million in the form of grants (0.53% of total grants to Viet Nam).

In 2007, China and Indonesia signed a consulting project on the technological transformation of four strategic firms in order to enhance Indonesia's technology and innovation in shipbuilding, steel, aircraft and others. A Chinese firm participated in the technology assistance. As of 2009, China's largest telecommunication equipment company, ZTE, completed the training of more than 5 000 local telecommunication professional personnel in Indonesia.

Information on China's aid to Thailand is not available, presumably because the amount, if any, is negligible. In 2008, total ODA from all sources was USD 39.09 million, of which only 0.31% (or USD 120 400) from Asian countries, including China.

Some international studies (*e. g.* Goto 2011) argue that much of China's foreign aid is tied to preferential treatments for Chinese state owned enterprises and to promoting Chinese exports. As seen above, the aid from China to SEA has had a strong focus on transport. While benefits of the improvements in transport are clear for the recipient countries, they have also facilitated significant increases in Chinese imports to countries bordering with China, which have been said to have the effect of crowding out local production in the case of less developed countries (LDC).

Human resource development

Apart from funding foreign-aid projects, China's technology assistance policies address the development of human resources in developing countries. For a long time China has offered scholarships and training programmes to developing countries. As of the end of 2009, China had offered government scholarships to more than 70 000 foreign students from developing countries studying in China. China has also trained 120 000 professionals in economics, management, agriculture, health, justice, education, environmental protection. At present, more than 10 000 persons from developing countries are trained in China every year.

In recent years, the Chinese government has significantly increased the scholarships granted to students and scholars from SEA countries studying in China. As noted previously, in 2008 China set up the China-ASEAN (AUN) Scholarship Program (a special full scholarship) to encourage students, teachers and scholars from SEA countries to study and participate in exchanges with China. As of 2007, 8 095 students and scholars from SEA countries had Chinese government scholarships. Students and scholars from Laos receive more scholarships from China than from other SEA countries. During the academic year 2009/10, China expected to provide 1 200 government scholarships to SEA countries under the AUN and other scholarship programmes.

6.2. The role of S&T diplomacy in promoting S&T relationships

S&T diplomacy will play an increasingly important role in promoting S&T relationships between China and SEA countries.

First, S&T itself helps to enrich the resources available for S&T diplomacy and improve foreign relations. Since the improvement in relations between China and SEA countries in 1991, S&T diplomacy, including government agreements and MOUs on S&T co-operation, development of S&T co-operation projects and training of personnel, have occurred, however there is need for further expansion in the future.

Second, S&T helps both sides to settle issues not only in the traditional areas but also in non-traditional ones. For example, the SARS (severe acute respiratory syndrome) outbreak in 2003 caused alarm across China and SEA countries. Both sides used their S&T strengths to control its spread. At present, both sides make active use of S&T diplomacy to express views and settle issues of concern.

Third, S&T diplomacy can produce real benefits for both sides. Training projects and government scholarships for students and scholars from other countries bring obvious and direct benefits to local people and help ease or increase relations between the two sides.

In the future, China will continue to make use of S&T assistance to broaden and deepen its relations with SEA countries. The increasing role of S&T in China's economic growth will expand the space for S&T diplomacy, and China may exploit its strengths in S&T to increase its assistance to developing SEA countries. S&T diplomacy is no doubt an effective means of helping China and developing SEA countries meet the challenges in the fields of environment, energy and renewable industries and to promote sustainable economic development, common prosperity and ensure security. For example, good development in the GMS benefits not only local people by improving their living standards but also the local environment and border security for China and GMS members.

There are likely to be changes in China's S&T diplomacy. The participants are expected to become more diverse by broadening partners beyond Singapore and possibly increasing funding for S&T assistance, particularly to the least developed SEA countries such as Cambodia, Laos and Myanmar. In addition to direct intergovernmental co-operation, more Chinese enterprises and multilateral institutions will participate in S&T assistance to developing SEA countries. S&T diplomacy should also expand from traditional to high-technology industries

A.7. Summary of main findings

- The improvement in political relations between China and SEA countries between 1991 and 2003 paved a good foundation for exchange and co-operation in the economic and technological areas. In the future China will continue to play an active role in bilateral economic and S&T co-operation with SEA countries, based on its policy to promote regional economic growth and prosperity.
- In 2004 both sides started to accelerate the process of economic and technological co-operation, including agreements, increased trade and FDI. The expansion of economic co-operation and trade has been mainly realised in the bilateral framework while the expansion of S&T co-operation has been mainly realised in a multilateral framework because both sides' current technological level restricted bilateral S&T co-operation in advanced and high-technology fields. Therefore, they had to rely on the technological strength of a third party, at the multilateral level, to meet the needs of their economic growth.
- Policy attention and recognition of the importance of S&T cooperation, increased funding, and an enlarging technological advantage between China and developing SEA countries will help create improved prospects for future bilateral S&T co-operation or for S&T assistance from China to developing SEA countries.

Notes

- ¹ In 2009, the first ten countries for Chinese students abroad were the United States, Australia, United Kingdom, Korea, Japan, Canada, Singapore, New Zealand, France and the Russian Federation.
- ² According to the Chinese statistical definition, trade in technology covers licensing or transfer of industrial property rights; licensing or transfer of proprietary technology; licensing of computer software; technical services; production line, complete sets of equipment and key equipment. Technical services mean a kind of service provided to settle issues related to technologies.
- ³ In fact, China's total outward FDI stocks in education are very low, compared to other industries. At the end of 2009, they reached USD 21.23 million, of which USD 7.1 million to SEA countries, mainly for Chinese training programmes, etc.

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Statistical appendix

Table A.A1. China's outward FDI flows and stocks into SEA countries by industry, 2009

	China's outward FDI flows to SEA (USD million)	China's outward FDI flows to SEA in total FDI flows to SEA (%)	China's outward FDI stocks to SEA (USD million)	China's outward FDI stocks to SEA in total FDI stocks to SEA (%)	China's outward FDI stocks to SEA in total stocks by industry (%)	Distribution of China's outward FDI stocks to SEA
Power and other utilities	349.3	12.9	1 858.5	19.4	82.4	Si, My, In, Ca
Wholesale and retailing	910	33.6	1 634.1	17.1	4.6	Si, VN, Ma, Th
Manufactory	275.1	10.2	1 486.5	15.5	10.9	VN, Ma, Th, My, LP
Leasing and business services	152.1	5.6	1 051.2	10.9	1.4	Si, VN, LP
Mining	465.5	17.3	915.3	9.5	2.3	-
Construction	182	6.8	675.5	7.1	19.8	Ca, My, Si
Transport, warehousing & postal service	61.3	2.3	669.2	7.0	4.0	Si
Finance	142	5.3	666.4	7.0	1.4	Si, Ma, In
Agriculture, forestry, husbandry, fishery	110.6	4.1	340.5	3.6	16.8	LP, VN, Th, My, Ca, In, Ph
Scientific research, services & geo-survey	5.3	0.2	131.4	1.4	4.6	NA
Real estate	35.5	1.3	59.7	0.6	1.1	NA
IT	2.4	0.1	40.2	0.4	2.0	NA
Residential service & other services	1.6	0.1	15.5	0.2	1.6	NA
Residential & catering trade	0.4	0.0	15.6	0.2	6.4	NA
Education	2.4	0.1	7.1	0.1	33.5	NA
Others	2.7	0.1	4.7	0.0	0.4	NA
Total	2 698.1	100.0	9 571.4	100.0	3.9	NA

Notes: BD (Brunei Darussalam), Ca (Cambodia), In (Indonesia), LP (Laos), Ma (Malaysia), My (Myanmar), Ph (Philippines), Si (Singapore), Th (Thailand) and VN (Viet Nam). NA: not available.

Source: 2009 Statistical Bulletin of China's Outward Foreign Direct Investment.

Table A.A2. Joint publication of papers by authors from the first ten countries or regions

Percentage

	Co-authorship: China, Brunei and other counties or regions		Co-authorship: China, Cambodia and other counties or regions		Co-authorship: China, Indonesia and other counties or regions		Co-authorship: China, Laos and other counties or regions		Co-authorship: China, Malaysia and other counties or regions	
No. 1	Brunei	100	Cambodia	100	Indonesia	100.0	China	91.7	Malaysia	99.9
No. 2	China	100.0	China	100.0	China	98.5	United States	33.3	China	99.7
No. 3	Australia	15.8	Thailand	32.5	United States	32.5	Japan	25.0	Thailand	11.8
No. 4	Germany	10.5	United States	27.5	Thailand	31.1	Thailand	25.0	Singapore	6.7
No. 5	United States	10.5	Viet Nam	27.5	Japan	28.6	India	16.7	United States	6.2
No. 6			Australia	22.5	India	27.2	Lao	16.7	Australia	5.9
No. 7			France	20.0	Philippines	27.2	Philippines	16.7	Japan	5.6
No. 8			India	20.0	Korea	24.8	Chinese Taipei	16.7	Chinese Taipei	5.1
No. 9			Philippines	20.0	Malaysia	22.3	Viet Nam	16.7	Korea	4.5
No. 10			Malaysia	17.5	Viet Nam	21.4			Philippines	4.4

Table A.A2 (continued)

	Co-authorship: China, Myanmar and other counties or regions		Co-authorship: China, Philippines and other counties or regions		Co-authorship: China, Singapore and other counties or regions		Co-authorship: China, Thailand and other counties or regions		Co-authorship: China, Viet Nam and other counties or regions	
No. 1	Myanmar	100.0	Philippines	99.5	China	99.8	Thailand	100.0	China	100.0
No. 2	China	100.0	China	99.0	Singapore	98.1	China	99.6	Singapore	100.0
No. 3	Thailand	38.9	United States	32.1	United States	12.0	United States	24.1	Viet Nam	100.0
No. 4	Viet Nam	33.3	Thailand	21.3	Australia	4.4	Malaysia	17.4		
No. 5	Japan	27.8	Japan	21.0	England	3.3	Japan	14.8		
No. 6	Cambodia	22.2	India	20.3	Chinese Taipei	2.4	Australia	12.1		
No. 7	Nepal	22.2	Korea	19.1	Japan	2.3	Korea	11.9		
No. 8	United States	22.2	Singapore	17.6	Canada	2.1	Singapore	11.4		
No. 9	Malaysia	16.7	Malaysia	15.2	Germany	1.9	Chinese Taipei	10.0		
No. 10	Philippines	16.7	Chinese Taipei	15.0	Korea	1.8	India	9.5		

Source: Science Citation Index Expanded (SCI-EXPANDED)

Table A.A3. Top ten subjects of co-authored scientific and technological publications by authors from China, SEA countries, 1999-2010

Percentage of total co-authored publications

	Co-authorship: China, Brunei and third party		Co-authorship: China, Cambodia and third party		Co-authorship: China, Indonesia and third party		Co-authorship: China, Laos and third party		Co-authorship: China, Malaysia and third party	
No. 1	Ecology	26.3	Infectious diseases	32.5	Environmental sciences	6.8	Meteorology & atmospheric sciences	25.0	Crystallography	60.2
No. 2	Mathematics, interdisciplinary applications	21.1	Immunology	20.0	Infectious diseases	6.8	Public, environmental & occupational health	16.7	Chemistry, inorganic & nuclear	12.2
No. 3	Engineering, multidisciplinary	15.8	Virology	17.5	Public, environmental & occupational health	5.8	Tropical medicine	16.7	Chemistry, multi- disciplinary	3.3
No. 4	Mechanics	15.8	Tropical medicine	10.0	Multidisciplinary sciences	5.3			Chemistry, physical	2.9
No. 5	Plant sciences	15.8	Biochemistry & molecular biology	7.5	Plant sciences	5.3			Chemistry, organic	2.2
No. 6	Automation & control systems	10.5	Parasitology	7.5	Gastroenterology & hepatology	4.9			Materials Science, multidisciplinary	2.0
No. 7	Engineering, electrical & electronic	10.5	Biology	5.0	Immunology	4.9			Infectious diseases	1.4
No. 8	Evolutionary biology	10.5	Dentistry, oral surgery & medicine	5.0	Agronomy	4.4			Environmental sciences	1.2
No. 9	Mathematics, applied	10.5	Microbiology	5.0	Microbiology	4.4			Chemistry, applied	1.1
No. 10	Mycology	10.5	Pathology	5.0	Ecology	3.9			Endocrinology & metabolism	1.0

Table A.A3. (continued)

	Co-authorship: China, Myanmar and third party		Co-authorship: China, Philippines and third party		Co-authorship: China, Singapore and third party		Co-authorship: China, Thailand and third party		Co-authorship: China, Viet Nam and third party	
No. 1	Immunology	16.7	Plant sciences	21.7	Engineering, electrical & electronic	14.1	Mycology	9.8	Mathematics , applied	100.0
No. 2	Infectious Diseases	16.7	Agronomy	20.8	Physics, applied	11.2	Crystallography	8.2	Mathematics	66.7
No. 3	Tropical medicine	16.7	Genetics & heredity	8.9	Materials science, multidisciplinary	9.8	Infectious diseases	6.0		
No. 4	Biochemistry & molecular biology	11.1	Biochemistry & molecular biology	7.7	Optics	8.4	Immunology	5.0		
No. 5	Entomology	11.1	Environmental sciences	7.7	Chemistry, physical	6.6	Public, environmental & occupational health	4.2		
No. 6	Genetics & heredity	11.1	Horticulture	7.0	Physics, condensed matter	4.6	Plant sciences	4.0		
No. 7	Public, environmental & occupational health	11.1	Infectious diseases	6.3	Nanoscience & nanotechnology	4.1	Microbiology	3.7		
No. 8			Gastroenterology & hepatology	4.6	Chemistry, multidisciplinary	3.9	Oncology	3.6		
No. 9			Public, environmental & occupational health	4.6	Mathematics, applied	3.5	Environmental sciences	3.3		
No. 10			Soil sciences	4.1	Computer science, artificial intelligence	3.3	Astronomy & astrophysics	3.2		

Source: Science Citation Index Expanded (SCI-EXPANDED).

Table A.A4. International conferences attended by China and SEA countries

	Conferences	Participating countries	Feature	
Chinese Academy of Sciences	1998	China-Singapore Seminar on Life Science and Technology	China-Singapore	Bilateral
	2004	APEIS (Annual Conference on Asia-Pacific Environmental Innovation Strategy Plan)	China, Japan, Singapore, Australia, Mongolia, Russia, Viet Nam and India	Multilateral, annual
	2005	Bilateral Academic Seminar by the Institute of Genetics and Developmental Biology and Temasek Life Sciences Laboratory Singapore	China-Singapore	Bilateral, annual since 2005
	2005	The first meeting of partners on Asian flu study	China, Thailand, Viet Nam, Cambodia, Indonesia, and multilateral institutions	Multilateral
	2005	International Conference on Global Natural Disasters and Disaster Reduction	China, the United States, Sweden, Cuba, Indonesia, Bangladesh, Thailand and multilateral institutions	Multilateral
	2005	The 4th Network Conference of Biosphere Reserves in South East Asia	China, Laos and other countries	Multilateral
	2007	International Symposium on Medicinal Plants and Aromatic Plants	Thailand, China and 19 countries	Multilateral
	2007	The 2nd Seminar on co-operation between the Chinese Academy of Science and the Minister of Science and Technology of Thailand	China and Thailand	Bilateral
	2007/10	Summary on Cambodia's National Botanic Gardens reconstruction projects	China and Cambodia	Bilateral
	2008	PRAGMA (Pacific Rim Applications and Grid Middleware Assembly)	Malaysia, China and other countries	Multilateral
2009	China-Singapore bilateral seminar on energy plant	China-Singapore	Bilateral	
State Forestry Administration of China	2003	International Symposium on Asia-Pacific community forestry in the role of poverty reduction	China and 15 Asia-Pacific countries, including 7 SEA countries, and international institutions	Multilateral
	2004	China-ASEAN Seminar on Conservation of Tropical Biology and Biotechnology Application	China and SEA countries	Bilateral
	2005	China-ASEAN Seminar on sustainable development of bamboo industry	SEA countries and China	Bilateral
Chinese Academy of Engineering	2006	International Symposium on influenza pandemic prevention and control in developing countries	China, Viet Nam and other countries	Multilateral
	2007	The Eighth Qingdao International Symposium on Ophthalmology	China, Singapore and other countries	Multilateral
	2007	International seminars on prevention of new and re-infectious diseases and control measures	China, Malaysia, Thailand and other countries	Multilateral
	2008	Tenth Conference on Orthopaedics of the Chinese Medical Association and the third International COA	China, Myanmar, Singapore and other countries	Multilateral
	2008	The 3rd Great Wall International Andrology Forum (GIAF 2008)	China, Singapore and other countries	Multilateral meeting
	2009	11th International Conference on Isolation from and Control of Energy Dissipation on Earthquake	China, Singapore and other countries or regions	Multilateral
	2009	China Qingdao: International Forum on Blue Economic Development	China, Thailand, Singapore and other countries	Multilateral
2009	Symposium on Computational Structural Engineering	China, Malaysia, Singapore, Viet Nam and other countries	Multilateral	

Source: Chinese Academy of Science, State Forestry Administration of China and Chinese Academy of Engineering.



From:
Innovation in Southeast Asia

Access the complete publication at:
<https://doi.org/10.1787/9789264128712-en>

Please cite this chapter as:

OECD (2013), “Annex. China and Southeast Asia: A Chinese Perspective”, in *Innovation in Southeast Asia*, OECD Publishing, Paris.

DOI: <https://doi.org/10.1787/9789264128712-13-en>

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