



International Cooperation and Innovation: Evidence from Asian Countries Trade Facilitation and Economic Cooperation

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Abstract

International business, social and economic international innovation refers to the ability to develop and implement new, unique or improved to create unique value for the Country. It includes incremental or improvements to existing products, processes, services, or solutions. Consistent international cooperation and innovation skills are necessary for a country to realize its full potential and prosperity, but many Countries lack this key skill. International cooperation and innovation are essential for growth and development of every country. While some economies in developing Asia are near the forefront of international cooperation and innovation, but many other economies lag behind. This topic section outlines what policymakers can do to promote greater international cooperation and innovation in Asia. It identifies some key drivers of international cooperation and innovation in Asia. The first is education and R & D, which is not surprising because international cooperation and innovation are essentially a human cause. In a number of Asian economies, many children lack the most basic education and numeracy power skills. Therefore, decision makers must first focus on strengthening basic skills, but they must also turn to learner centered teaching practice, broaden and diversify the skill. The second driving force is entrepreneurship. Although people tend to link entrepreneurship and international innovation, less than 2% of entrepreneurs have created more than half of employment growth and innovation. Therefore, it is essential to formulate policies to promote the potential of these productive enterprises to make better economic development. The last three drivers of international cooperation and innovation are high quality Institutions, strong financial systems and big cities. High quality institutions, including the rule of law and strong property rights, give innovative entrepreneurs the confidence they need to take risks and try new

ideas. The evolution of intellectual property rights in the Republic of China shows that different institutions and types of protection may be more important at different stages of development. A strong financial system can channel resources to innovators. In fact, the analysis shows that the development of financial markets, for both equity and debt, will have a positive impact on patents. Therefore, international cooperation and innovation policy need a meticulous, bottom-up approach to support local innovators. In the final, there is no shortcut to creating an innovative environment for international cooperation and innovation in Asia. The journey of international cooperation and innovation requires long-term commitment and a lot of hard work.

Subject Areas

Business Management

Keywords

International Cooperation, Innovation, R & D, Technology, Investment and Economic Thinking

1. Introduction

Inclusive international cooperation and innovation seek to improvement to essential products, [1] processes, and services, there improving quality of life, and enhancing economic empowerment through knowledge creation, obtain, adaptation, assimilate, and deployment efforts targeted directly at the needs of excluded populations. Inclusive international cooperation and innovation are of high relevance for the Asia, but the concept is new for the Asian countries from both conceptual and policy perspectives. So far Asia has emphasized frontier international cooperation and innovation, it has recognized the importance of inclusive international cooperation and innovation in addressing increasing disparity between the rich and poor countries. In Asia many efforts are being made in the domain of inclusive international cooperation and innovation [2], but there is no clear strategy and implementation plan. This paper is supported by the Key Program of National Social Science Foundation of China (Grant No. 20AJY008) to build up strong & inclusive international cooperation and innovation relation between Asia and the developing world.

This research aims to help build awareness and set the stage for the potential implementation and operationalization of inclusive international cooperation and innovation policy in Asia and possibly in other countries.

1.1. Definition of International Cooperation and Innovation

International cooperation is based on the partial agreement of the mutual interests of international actors. National and international relationship is the basic starting point of national foreign behavior [3]. The interest relationship between countries has both opposition and conflict, as well as coordination and overlap.

Countries have basically or partially consistent interest relations, which constitutes the realistic basis of international cooperation (**Figure 1**).

The essence of international cooperation is the policy coordination of international actors in a certain problem field. Each country formulates its foreign policy based on its own interests. Due to the inconsistency of mutual interests, there are often differences and collisions between the foreign policies formulated by countries, which makes the relations between countries fall into a state of dispute. In order to ensure the realization of common interests, countries need to adjust their foreign policies to make their policies compatible with those of other countries.

1.2. Asia's Location in the World

Asia is located an important place in the world. As geographical location, Asia can be divided into six regions: East Asia, Southeast Asia, South Asia, West Asia, northern arc and Central Asia. China is located in East Asia, and other East Asian countries are surrounded by Mongolia, North Korea, South Korea and Japan. China is adjacent to North Asia in the north, central and West Asia in the west, South Asia in the southwest and Bangladesh located in south Asia which surrounded by India [4].

In terms of location, Asia is a very important place for international innovation, because the labor cost is low in Asia and the environment is relatively natural. Asian countries governments have preferential treatment for international innovators.

1.3. Research Progress of International Innovation

According to the international research and analysis of relevant research materials at foreign countries, the current progress of innovation research can be summarized into the following aspects.

1.3.1. Constantly Expand the Connotation of Innovation

There is no unified definition of innovation in the world. In the early stage, the understanding of innovation was limited to the linear process from research to invention and then to commercialization [5]. At present, the connotation of innovation has been extended to the national and international innovation ecosystem composed of innovation supply and investment, external market demand, policy environment, education and national international infrastructure.

1.3.2. More Diversified Sources of Innovation

Innovation comes from innovative practices such as research and experimental development, cross convergence in the field of science and technology, from innovative resources such as software, human capital, trademarks and knowledge clusters, from innovative mechanisms such as innovative models and scientific research cooperation models, and from tens of thousands of new demands from all corners of the world and consumers (**Picture 1**).

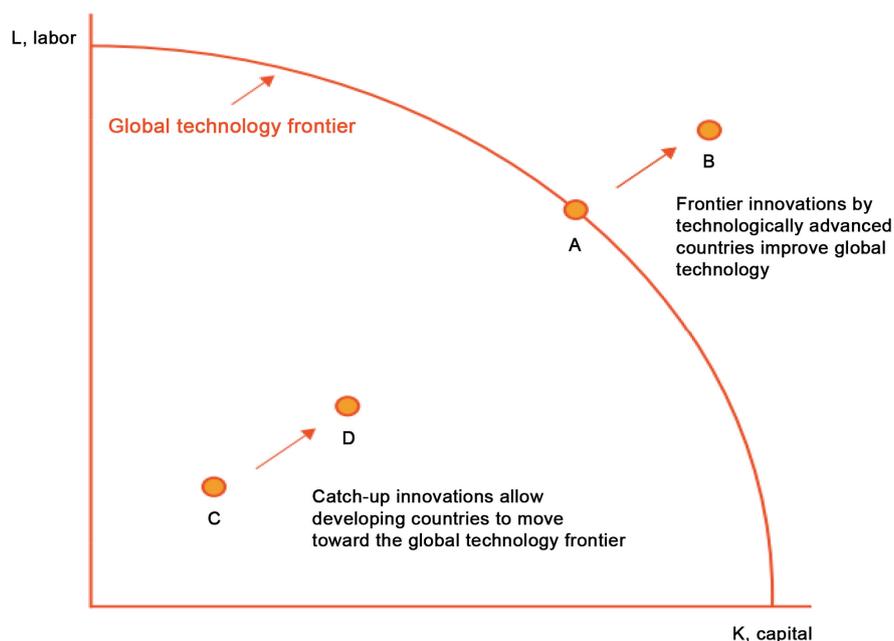


Figure 1. Catch-up versus frontier innovation (Source: Author). Note: International cooperation and innovation is basic starting point of national foreign behavior between countries has both opposition and conflict, this figure try to mention how need international cooperation and frontier innovation.



Picture 1. Note: The connotation and characteristics of national innovation ability, innovative country and scientific and technological power, comprehensively analyzes the relative position of international innovation ability in the world.

1.3.3. The Innovation Mode Continues to Evolve

From the perspective of historical evolution, the innovation mode has developed from the first generation of technology driven mode to the current sixth generation of open innovation network mode. The open innovation network, which emphasizes the broader attributes of innovation, focuses not only on research and development (RD) and technological innovation, but also on Non-technical innovation or user driven innovation and other forms of innovation [6].

1.4. Industrial Innovation Brings New Development Opportunities

The scientific research paradigm is undergoing profound changes, the interdisciplinary integration continues to develop, the penetration and integration of science and technology and economic and social development are accelerating, and the breadth, depth, speed and accuracy of scientific and technological innovation have reached an unprecedented level. The new generation of information technology represented by information technology and artificial intelligence is opening the era of intelligent interconnection of all things. The life sciences represented by gene editing, brain science, regenerative medicine, etc. are pregnant with new changes [7]. The advanced manufacturing technology integrating robots, digitization and new materials is accelerating the transformation of manufacturing industry to intelligent, service-oriented and green. Deep space, deep sea and deep earth exploration are opening up space for human development.

In the stage of high-quality development, the construction of a new development pattern with the domestic big cycle as the main body and the domestic and international double cycles promoting each other has been accelerated. The conditions supporting development are changing, the cost of factors is rising, and the traditional driving force for development is weakening. New driving forces, new models and new advantages must be cultivated, and scientific and technological innovation is more important to development.

1.5. Innovation Turns to Encourage Original Innovation

The shift from integrated innovation to original innovation requires strengthening basic research and applied basic research, improving the ability of original innovation, driving major breakthroughs in leading original achievements and strategic technological products with breakthroughs in basic research, and becoming an international leader in more fields. Whether building local advantages or forming the innovation ability of intermediate products, we need to strengthen the original innovation ability. To start from the source of original innovation, we should strengthen forward-looking basic research and applied basic research, and significantly increase investment in basic research. Asia is still short of high-level scientific and technological talents, especially the leading talents in science and technology. We should strengthen the training of basic research talents and create more world-class scientific and technological leading talents and innovative teams. We will implement a more open talent policy and build a scientific research and innovation highland that gathers outstanding talents at home and abroad [8]. We should strengthen the connection between the construction of research universities and national strategic goals and tasks, and cultivate more outstanding talents. Innovate the talent evaluation mechanism, change the current situation that the talent evaluation system is unreasonable and the talent “hat” flies all over the sky, strengthen the training of basic research talents, and create more world-class science and technology leading talents and innovation teams.

2. International Cooperation and Innovation in Asia: Past and Present

The latest “Boao innovation forum for Asia 2020 report” comprehensively analyzed the current situation and trend of innovation development in Asia and highly evaluates of the continuous improvement of innovation capacity of Asian countries. Experts suggested that Asian countries should continue to increase R & D investment at the government and enterprise levels, deepen bilateral and multilateral innovation cooperation, continue to improve their comprehensive international innovation capacity and build an innovation driven economy (Table 1).

2.1. Increase Investment under the Guidance of Science and Technology

At present, the global overall ability of international cooperation and innovation in science and technology has been significantly enhanced. From 2000 to 2015, about 90% of the global research and development (R & D) investment was concentrated in North America, Europe and Asia. The proportion of North America

Table 1. Trade statistics between China and Asian countries 2021-2019.

Country	Import Export 2021			Import Export 2020			Import Export 2019		
	Total	Export	Import	Total	Export	Import	Total	Export	Import
Japan	3714	1658.5	2055.5	3175	1426.4	1748.6	3150	1432.4	1717.6
Korea	3623	1488.6	2134.4	2852	1125	1727	2845	1109.5	1735.5
ASEAN	8782	4836.9	3945.1	6846	3837.2	3008.8	6415	3594.4	2820.6
Vietnam	2302	1379.3	922.7	1923	1138.3	784.7	1620	978.7	641.3
Malaysia	1768	787.4	980.6	1312	564.5	747.5	1239	521	718
Thailand	1311	693.2	618.1	986	505	481	917	455.4	461.6
Singapore	940	525.3	387.7	891	575.5	315.5	899	547	352
Bangladesh	251	241	10	159	150.9	8	184	173.5	10.5
India	1256	975.1	281	876	667.4	208.6	928	748.3	179.7
Pakistan	278	242	35	175	153.8	21.2	180	162	18
Sri Lanka	59	52.5	6.5	41	38	3	45	41	4
Nepal	20	19.50	0.50	12	11.8	0.2	15	14.6	0.4
Indonesia	1244	606.4	637.6	783	410	373	797	456.4	340.6
Philippine	820	573	247	611	418	193	609	407	202
Myanmar	186	105.2	80.8	189	125.6	63.4	187	123.1	63.9
Laos	44	17	27	35	14.4	20.6	39	17.4	21.6

Source: Ministry of Commerce of the People’s Republic of China. Note: Increasing the Export and Import figure year by year in Asian countries and increasing the innovation investment.

and Europe in global R & D investment shows a gradual downward trend, from 40% to 28%, while the proportion of East Asia, Southeast Asia and South Asia increases from 25% to 40% (source: WB, ADB). This trend is expected to continue global overall ability of international cooperation and innovation in science and technology [9].

South Asia is an important place for international cooperation and innovation in future but East Asia, represented by China, Japan and South Korea, has entered the first echelon in the world in terms of enterprise research and development (R & D) investment. Information and communication technology, health and automobile have become the focus of R & D investment. According to the Boao report, Asia especially South Asia and East Asia are becoming one of the most international innovative and dynamic regions in the world.

2.2. Trends and Countermeasures of Global Scientific Innovation

The world today is undergoing great changes that have not been seen in a century. A new round of scientific and technological revolution and industrial reform are developing in depth, the international balance of power is profoundly adjusted, and the medium and long-term situation of the development of global scientific and technological innovation is also undergoing major changes. In the process of formulating a new round of medium- and long-term scientific and technological development plan, it is crucial to accurately grasp the development trend of global scientific and technological innovation. At present, some important trends of global scientific and technological innovation deserve attention.

Emerging digital technologies have greatly reduced the cost of data circulation and utilization, and also promoted the exploration of the value of data resources. Data resources are generated and spread to all fields of economy and society, which is conducive to the improvement of productivity. As a new key factor of production, it also helps to reduce the input of traditional factors. More and more devices are connected to the network, and production is increasingly dependent on data [10]. The development of science and technology also shows obvious characteristics of big science and quantification, and innovation will increasingly rely on scientific data. As data has gradually become a strategic resource for enterprises, industries and even countries, data-driven technology R & D and application innovation capabilities will directly affect a country's long-term competitive advantage. At the same time, the proportion of digital added value in the value chain will increase significantly, and countries and regions that only rely on low-cost labor factors to participate in the global value chain may be impacted.

2.2.1. The Pattern of International Innovation is Being Reshaped

The global innovation landscape dominated by developed countries in Europe and the United States has also changed accordingly, and some R & D and innovation activities have gradually shifted to emerging economies. This trend has appeared since the beginning of the 21st century and will continue in the future

[11]. With the increasing investment in scientific and technological innovation, the innovation capacity of emerging economies has increased significantly, and the leading edge of developed countries has declined relatively. Asia has become an important destination for the transfer of global high-end production factors and innovation factors, especially East Asia, which will become a global R & D and innovation intensive area, and is likely to produce several innovation centers with world influence in the future [12].

2.2.2. The Globalization of Science and Technology Faces Challenges

The global dissemination and diffusion of knowledge and international scientific research cooperation are the main manifestations of scientific globalization, and this trend is difficult to reverse. In particular, a new round of technological revolution is in the ascendant, the need for international scientific and technological exchanges and cooperation is more urgent, and the trend of innovation globalization will not change fundamentally, but the technological competition in frontier fields will be more intense [13]. At the same time, we should also see that international scientific and technological cooperation has always been an important way to meet the common challenges of mankind and grasp the dividends of the new technological revolution and industrial change. In the context of the rising demand for scientific and technological cooperation in emerging economies, new space for international scientific and technological cooperation will continue to expand, and a more diversified opening-up situation is taking shape [14].

2.2.3. The Impact of the Global Science and Technology Governance System

The influence of global rules and rules of procedure on innovation activities is deepening day by day. Fair competition and coordinated development have become the evolution trend of global innovation governance. In the field of technology trade, the relevant WTO rules, especially the agreement on trade related aspects of intellectual property rights (TRIPS), play an important regulatory role in the global flow of knowledge. The impact of international standards on the direction of emerging technological innovation and industrial competition is also becoming increasingly important. At the same time, new technologies have triggered a series of new problems, including fair competition, tax system, social ethics, network security and so on. It is urgent for countries to formulate relevant rules for coordinated development in various fields and meet challenges [15]. For strategic and security reasons, major economies have begun to plan their own technical standard system in key digital technology fields. In the future, the global technology and standard system in some key digital technology fields may show a trend of diversification.

2.3. The Government Guides Enterprises to Make Efforts

In recent years, South Asia and East Asia economies have made every effort to promote scientific and technological international cooperation and innovation,

and their industrial structure has become increasingly perfect. They have gradually become the world manufacturing center of scientific and technological products such as automobiles, computers, smart phones and robots [16]. Scientific and technological international cooperation and innovation is the main driving force of economic growth. More and more Asian countries have promoted international cooperation and innovation as a national strategy, increasing support for scientific and technological innovation at the government and enterprise levels, increasing investment in scientific and technological innovation and enterprise R & D, deepening bilateral and multilateral innovation cooperation and improving comprehensive innovation capacity.

In early 2016, Singapore launched the “research, innovation and enterprise 2020 plan” and the government announced to allocate S \$19 billion (US \$1, about S \$1.3) to the plan, focusing on supporting advanced manufacturing technology, biomedicine, services and digital economy and urban programs; Another S \$2.5 billion is used to prepare for future emerging scientific research needs.

South Korea’s R & D investment this year reached 24.2 trillion won (about 1084.4 won for one dollar), which was increase to 27.2 trillion won in 2021. South Korea will also expand the construction of smart factories and industrial parks, cultivate excellent software and artificial intelligence talents, increase investment in 5G, actively cultivate Unicorn enterprises, and strengthen the role of public procurement in promoting innovation and growth.

Bangladesh government has realized the “Golden Bangladesh Dream” and launched a series of economic and social development plans, including: Infrastructure, IT, energy and power, transportation, communication, chemical industry, textile and garment industries, and made great efforts to implement the industrialization strategy [17]. Actively encourage and attract domestic private enterprises and foreign investment by establishing economic zones, high-tech parks and export processing zones. The government of Bangladesh plans to build 100 new economic zones by 2030, and the construction of relevant economic zones is being actively promoted. It is a really very good announce from Bangladesh government in South Asia.

The Bangladesh government is promoting the Dhaka Chittagong high speed railway project. At present, the feasibility study has been completed and the detailed design is under way. The total length of the project is 227 km, the design maximum speed is 300 km per hour, there are 6 stations in the whole process, and the whole journey is about 73 minutes. The total investment of the project is about TK 970 billion, or USD 11.3 billion. China Railway Design Group is carrying out detailed design for the project, which is expected to be completed in 2023. Despite the opposition of insiders, the Bangladesh government still promotes the development of high-speed rail project with the support of high-level officials [18]. It can also be seen that the current ruling party and government leaders do not completely follow the western style “step-by-step” development thinking, but are more willing to try the Chinese style “leapfrog” development mode (Table 2).

Table 2. Bridge, elevator and high speed train project in Bangladesh.

Projectname	Project place	Project amount in USD	project length
Dhaka Chittagong high speed railway	Dhaka to Chittagong	\$11.3 billion	227 km
Padma bridge project	Dhakato south BD	\$1549 million	6.15 km
Padma Bridge Rail Link Project	Dhakato south BD	\$313,875 million	170 km
Dhaka inner ring road project	Dhaka city	\$1.2478 billion	88 km
Dhaka Ashulia Elevated Express way	Dhaka	\$1359 million	24 km
Elevated road project	Muktapur to panchabati	\$260 million	20 km

Source: CREC, BBD, Bangladesh railway, Bangladesh highway.

AIIB is interested in financing Dhaka inner ring road, with a total investment of 124.78 billion taka.

According to BD media, the Asian infrastructure investment bank (AIIB), a multilateral development bank initiated and led by China, agreed to provide funds for the 88 km Dhaka inner ring road project, which aims to ensure rapid traffic at both ends of Dhaka city.

2.4. Broad Prospects for International Business Innovation and Cooperation

In recent years, China has developed rapidly in the fields of artificial intelligence, mobile payment, 5G and new retail, attracting other Asian economies to deepen cooperation and jointly improve the level of scientific and technological innovation. Asian cities are competing to become international innovation centers, and there are broad prospects for regional innovation cooperation.

China-Thailand cooperation in digital technology has yielded fruitful results. Thai Deputy Prime Minister Somqi said that China's successful use of network digital technology has greatly helped to improve the living standards in rural areas, and Thailand is using this technology to upgrade the fields of education and public health [19]. In 2020, Huawei Thailand signed a memorandum of understanding with Siriraj Hospital Affiliated to Mahachulalongkornrajavidyalaya University in Thailand to accelerate the application of Huawei cloud, artificial intelligence and 5G technologies in the hospital. This cooperation will boost the transition of medical services in Thailand to the 5G era (**Picture 2**).

Gu Qingyang, (associate professor of Lee Kuan Yew School of public policy, National University of Singapore) believes that in recent years, the scientific and technological content of Singapore and China cooperation has become higher and higher, such as China Singapore (Tianjin ECO city), China Singapore (Chongqing) strategic connectivity demonstration project, China Singapore (Guangzhou Knowledge City) etc. The two countries are expected to cooperate in scientific research, education, talents, climate change and clean energy in the future. At present, the Asia Pacific region is the most active and fastest growing region in



Picture 2. Note: Technological innovation to improve the product structure of international trade. The most significant change in technological innovation is the change in the structure of international trade products. Stimulated by technological innovation, international trade products have gradually developed from the product structure of low value and low added value to the direction of high added value and high technology content. High tech products are rapidly promoted in scientific and technological innovation.

the world economy, which brings opportunities for the transformation and application of scientific and technological achievements. There is great potential for cooperation between China and other Asian countries in scientific and technological innovation [20].

According to Bangladesh's Financial Express report, the world bank will provide a loan of US \$515 million for Bangladesh to upgrade its power transmission system.

The interest rate is generally 2.0% and the term is 30 years. However, the funds borrowed through the facility expansion fund are loans with interest rates determined according to the London Interbank Offered Rate (LIBOR). The term is 20 years.

The loan will provide for the strengthening of power grid construction and the establishment of substations, improve the capacity of Dhaka and maimenshin regional power bureaus, and upgrade the power transmission system. Officials from Bangladesh Agricultural Development Authority said that 31,000 kilometers of transmission lines and 157 transformer stations will be upgraded and 25 power facilities will be built. Bangladesh Agricultural Power Authority will also strive to expand the installation and use of solar power generation facilities in rural areas.

3. Economic Thinking on the Value of International Cooperation and Innovation

International cooperation and Innovation is the engine of long-term economic growth. It is not only the "driver" of a nation's development and progress, but

also the “driver” of “leadership”. Like the Polaris in the sky, it gives positioning and guidance to any nation pursuing modernization and the future. It not only reflects the multiple structure of the logical analysis of the causes of the formation of the international cooperation and innovation market, but also shows the cultural connotation of economic analysis.

How people can use their innovation ideas and can change society?

How can improve scientific and technological innovation ideas to change people?

In addition, scientific and technological innovation also includes system innovation, concept innovation, business model innovation, and intellectual property protection of innovation. Ideas cannot directly change society, but ideas can change people, and people can change society. The cultural concept variables into the analysis of international innovation market function may be the humanistic connotation and value judgment given to economic research [21]. It endows a certain unique quality owned by the subject of innovation, people with the value of production factors, which not only endows the “critical spirit” with economic connotation, but also finds the source of culture for us to understand Schumpeter’s explanation of the driving force of innovation with “entrepreneurial spirit” [22]. The new ideas and creating new methods are inseparable from the spirit of criticism. In fact, criticism as a constructive dispute, has become a necessary procedure for innovation and an indispensable bridge for the generation of new ideas and methods, which is also the basic spirit of creative culture or innovative culture. Innovative culture is rooted in reflective ability and critical spirit, provides innovation consciousness and innovation self-confidence, forging entrepreneurship, cultivating innovative and creative class, and creating an atmosphere of “encouraging innovation and tolerating failure”, which is the fundamental driving force of innovation.

3.1. The Current State of Innovation in Asia: A Firm-Level Perspective

An extensive empirical literature highlights the positive impact of innovation in individual firms, including R & D (research and development), on firm performance and productivity (Hall, Lotti, and Mairesse 2009) [7], Harrison *et al.* 2008 [8]. The literature shows that knowledge capital investments to boost productivity do not occur solely in advanced countries. However, the nature of innovation in developing countries is somewhat different and best characterized as piecemeal improvements to processes or products. This is a process of technology adoption, imitation, and adaptation that takes place far from the technology frontier, where firms adopt incremental changes.

The in-depth analysis of the survey data summarizes the innovation prospects of developing Asia. Outstanding features include the relatively strong degree of innovation at the enterprise level in the region, the higher innovation rate in low-income countries, and the dominance of minor improvements to existing products rather than launching new products in new markets. These and other findings are discussed below (Table 3).

Table 3. Sample composition by region and country.

Region	Country (survey year)	Firm size			Total
		Small (<20)	Medium (20 - 99)	Large (100+)	
Central and West Asia (n = 2875)	Armenia (2013)	170	138	47	355
	Azerbaijan (2013)	215	145	34	394
	Georgia (2013)	246	88	28	362
	Kazakhstan (2013)	310	220	75	605
	Kyrgyz Republic (2013)	115	120	38	273
	Tajikistan (2013)	200	125	37	362
	Uzbekistan (2013)	152	143	95	390
East Asia (n = 3285)	People's Republic of China (2012)	625	1084	991	2700
	Mongolia (2013)	200	126	34	360
South Asia (n = 13,845)	Afghanistan (2014) Ban	275	115	30	420
	gladesh (2013)	510	515	422	1447
	Bhutan (2015)	152	80	18	9260
	India (2014)	3070	4000	2190	482
	Nepal (2013)	293	140	49	1247
	Pakistan (2013)	536	451	260	610
	Sri Lanka (2011)	322	179	109	
	Cambodia (2016)	194	118	61	373
	Indonesia (2015)	484	451	385	1320
	Lao People's Democratic	217	104	47	368
Southeast Asia (n = 7125)	Republic (2016)	347	343	310	1000
	Malaysia (2015)	363	160	84	607
	Myanmar (2016)	464	504	367	1335
	Philippines (2015)	400	324	276	1000
	Thailand (2016)	376	352	268	996
The Pacific (n = 1061)	Viet Nam (2015)				
	Papua New Guinea (2015)	85	88	55	228
	Solomon Islands (2015)	170	167	120	457
	Timor-Leste (2015)	145	130	101	376
Total		10,768	10,556	6676	28,191

Source: Author & Khatiwada and Arao, forthcoming (a).

3.2. High Innovation in Enterprise in Developing Asia

The first feature of innovation in developing Asia is high growth number of innovative enterprises. Average innovation rate in developing Asia, the proportion of companies introducing new or significantly improved products or processes in the past three years is 53.1%. Innovation is the highest in the Pacific region,

with 73.0% of companies reporting the introduction of new or significantly improved products or processes, followed by 65.1% in South Asia, 59.6% in East Asia, 37.1% in Southeast Asia and 21.2% in Central Asia (Figure 2).

In addition, 34.1% of Companies in developing Asia reported new products. Product innovation is the highest in the Pacific, East Asia and South Asia, with more than 40%. This figure is significantly lower in Central Asia and Southeast Asia, 13.6% and 20.8% respectively.

Developing Asia, how will increase production and scientific innovation compared with Central Asia?

Compared with product innovation, the proportion of companies reporting process innovation is higher, with an average of 48.1% in developing Asia. 60% or higher and such innovations are the most powerful in the Pacific, South Asia and East Asia.

3.3. Relatively Strong Innovation in Manufacturing

The third feature, the comparison of industrial innovation models shows that the innovation rate of manufacturing enterprises is high, Among them, 36.5% reported the introduction of new products, 50.8% reported the introduction of new processes, and 56.0% reported the introduction of one or another (Figure 3). The difference between manufacturers and other companies in retail or other service industries is statistically significant.

3.4. Innovation in Information Technology and High-Tech Manufacturing

In high-tech manufacturing industries such as information technology and mechanical equipment, electronic products and chemical products seems to be the highest, and the number of companies involved in innovation. Similarly, the share of these companies is much larger and more competitive than other companies that innovative products and processes (Figure 4).

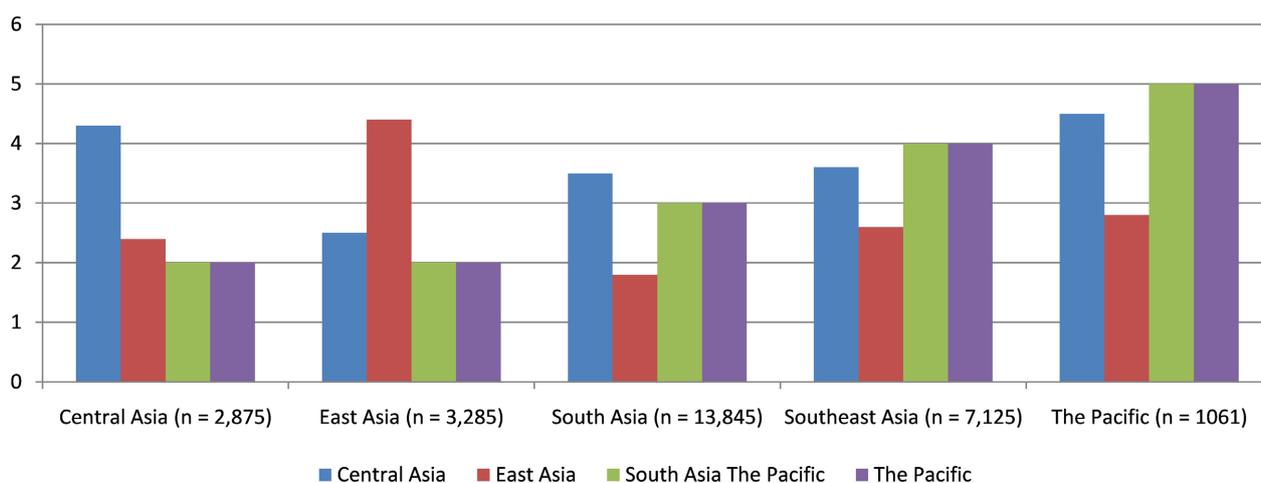


Figure 2. Share of firms reporting a new product or process, by region. Source: WB, ADBI, author & Khatiwada and Arao, forthcoming (a) [1].

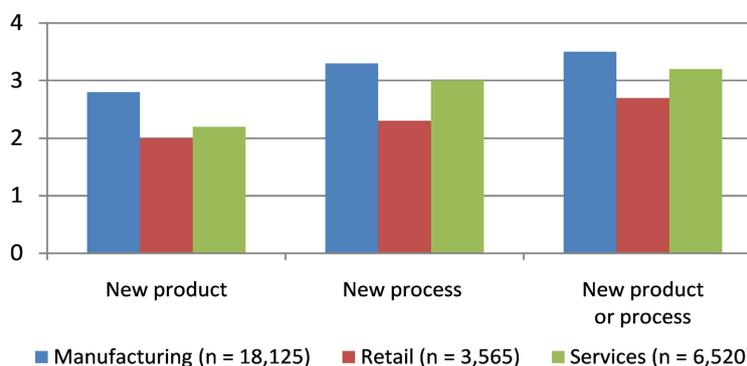


Figure 3. Share of firms reporting a new product or process, by industry. Source: Author & Khatiwada and Arao, forthcoming (a) [1].

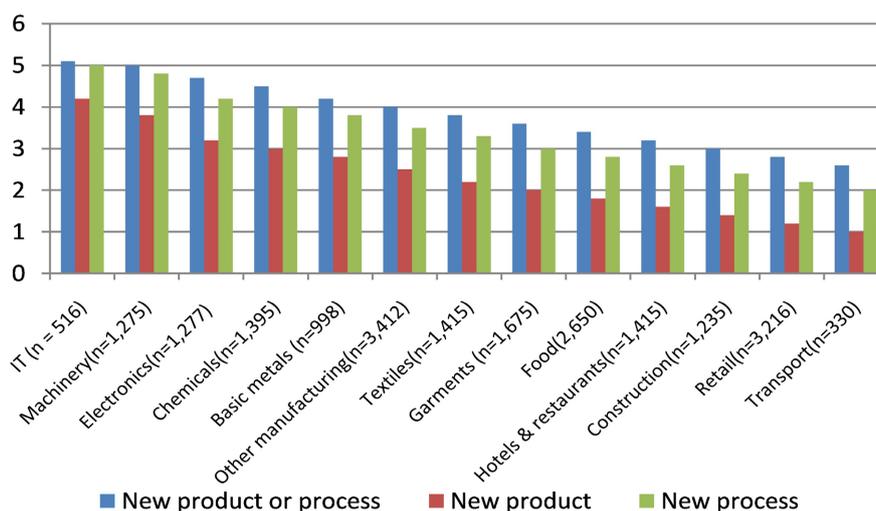


Figure 4. Share of firms reporting a new product or process, by industry. Source: Author & Khatiwada and Arao, forthcoming (a) [1].

3.5. Higher Innovation Rates in Exporting Firms

The study found that the product and process innovation rate of export enterprises was higher than non-export enterprises, 68.2% of exporters adopted product or process innovation, while only 51.1% of non-exporters (**Figure 5**). The difference in process innovation rates is much greater, with exporters at 61.5%, compared with 46.1% in other countries.

4. The Relationship between Technological Innovation and International Competitiveness of Enterprise

The organization for economic cooperation and development defines technological innovation as: “Technological innovation includes new products and new processes and significant technological changes in products and processes [23].” The definition of innovation theory in Asia is: Technological innovation, which refers to enterprises apply innovative knowledge, technology and new processes, adopt new production methods and business management modes, and improve product quality, develop new products.

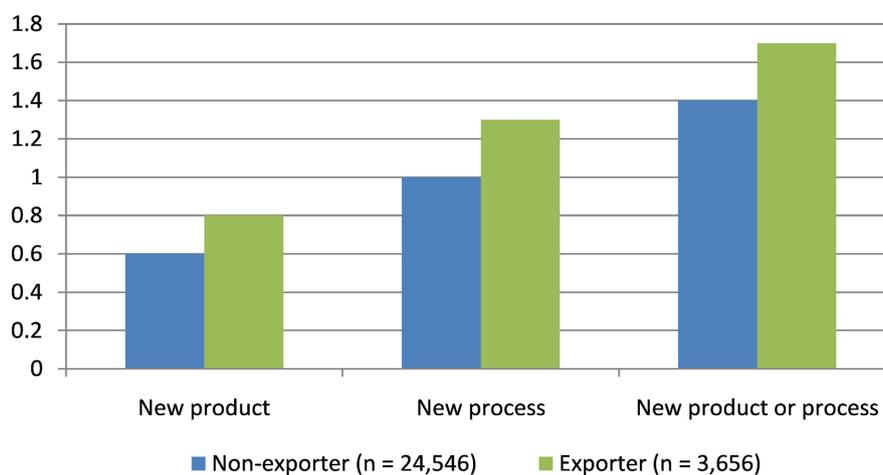


Figure 5. Share of enterprise reporting a new product or process, by exporting activity. Source: Author & Khatiwada and Arao, forthcoming (a) [1].

4.1. Technological Innovation and International Competitiveness

Technological innovation is the only way for a country or a nation to change its backwardness and develop successfully avenue. Specifically, the relationship between technological innovation and international competitiveness can be arbitrarily summarized as follows:

a) Technological innovation helps to create the advantage of low product cost. In the era of knowledge economy, the basis of high-quality products the foundation is technological innovation. Only through continuous technological innovation can develop a leading market in the international market with high-quality products and high quality can gain the advantage of market competition. Technological innovation improves the international competitiveness of products [24] (Picture 3).

b) Technological innovation is an effective way to expand the market which any product is accepted in the market and sales situation have to go through the process of “birth, growth, maturity and decline”. When the market of a product launches after the development to a certain extent, there will be a situation of oversupply, which will lead to maturity. Regardless of product market whether it is in the stage of maturity or substitution will directly affect the market. Only through continuous technological innovation can it provide new products to the market [25]. Due to its new functions with new characteristics, it is higher than the market value of previous commodities and easier to meet the needs of consumers, so it can grasp the country and take the initiative in international market competition and establish the core competitiveness of international trade.

c) Technological innovation helps to build competitive product brands. Technological innovation is the foundation of famous brand strategy, technological innovation is a hard work behind the creation of famous brand products and provides technology and material assurance.

d) Technological innovation helps to improve the efficiency of resource use and added value of enterprises. International competitiveness of enterprises one



Picture 3. Note: Innovation ability is the comprehensive embodiment of multiple factors, and national innovation ability is the embodiment of the overall innovation system (idea, creative) ability of the whole society.

of the main characteristics is value, it helps enterprises realize the core values that customers pay attention to and create value through technology, new enterprises use advanced production processes and technologies improve and update services.

e) Technological innovation helps to reduce the transaction costs of enterprises [26]. For an enterprise, its participation in international the higher transaction efficiency and the lower transaction cost of the market, the higher its international trade competitiveness will be constant skill technological innovation provides a solid material foundation for enterprises to adopt advanced transaction methods and reduce transaction costs.

4.2. International Innovation Capability Measurement

The European Innovation Score board (EIS) was established by the European Union (hereinafter referred to as the EU) in 2001. It annually evaluates EU Member States and targets some non EU countries (including the United States, Japan, China, etc.). The indicator system of EIS consists of three primary elements (dynamic factors, enterprise activities and innovation output) and eight secondary innovation indicators (human resources, research system, finance and public funds, enterprise investment, cooperation and entrepreneurship, knowledge assets, innovators, and economic impact). EIS divides member countries into innovation leading countries, innovation powerful countries, medium innovation countries and moderate innovation countries according to the total innovation index score of the year [27].

The global innovation index (GII) has been published by the World Intellectual Property Organization and others since 2007. The GII index system consists of three primary elements (innovation input, innovation efficiency and innovation output) and eight secondary innovation categories (system, human capital and research, infrastructure, market maturity, business maturity, knowledge and

technology output and innovation output). GII evaluates the innovation capacity of more than 100 countries/regions in the world every year according to the above indicators, and compares, analyzes specific strengths and weaknesses [28].

4.3. Current Situation of Technological Innovation in Asian Enterprises

The international competition situation faced by technological innovation of our enterprises is an all-round innovation competition and at the same time competition on different starting lines. Compared with foreign enterprises, Chinese enterprises response sensitivity and adaptability to the market the gap is very obvious. Except for a few countries such as China, foreign enterprises are all regarded as market economy the main body of the enterprise has a truly independent legal person status and the enterprise behavior is only subject to market rules and is not subject to other administrative restriction and interference of power. Although the enterprise system of Asia has been reformed for 30 years, the modern enterprise system it has not really been established in Asian market. There have some shortcomings (Asian some countries): First, property rights are not clear. Second, there is no real separation between government and enterprises [29]. Third, internal selection of enterprises the holding mechanism and supervision mechanism are imperfect and mere formality. Fourth, it is difficult for entrepreneurs to give full play to their talents. Therefore, for Asian enterprises, technological innovation, institutional reform and construction is fundamental. If this problem is not solved, technological innovation will have little significantly effect due to institutional constraints. Therefore, it is urgent to speed up the technological innovation of enterprises.

How can speed up the technological innovation of enterprises in Asia?

How can recover above shortcoming in Asian innovation and cooperation?

4.4. Accelerating the Technological Innovation of Enterprises

Firstly, we should learn to innovate independently because independent innovation refers to the innovation subject based on its own research and development, and promote the follow-up links of innovation, realize the commercialization, industrialization and internationalization of scientific and technological achievements and obtain commercial benefits innovation activities. Independent innovation has the characteristics of taking the lead. The core technology needed for independent innovation comes from enterprises technological accumulation and breakthroughs within the industry, such as the computer microprocessor of Intel corporation in the United States [30].

Electronic publishing systems are typical examples as the first innovation, independent innovation has a series of advantages: First, it is conducive to the innovation subject to master and control the core technology of a product or process within a certain period of time influence the development of the industry to a certain extent, so as to win competitive advantage; second, independent innovation in some technical fields it can often lead to a series of technological

innovations, drive the birth of a number of new products, and promote the development of emerging industries. Third, it is conducive to innovative enterprises to accumulate production technology and management experience earlier experience in product cost and quality control; fourth, independent innovative products are in a completely unique position at the initial stage occupy a monopoly position, which is conducive to enterprises to establish a raw material supply network and solid sales channels earlier, and obtain super profit.

4.5. Innovation Ability is the Concentrated of New Advantages in International Competition

Today, the new advantages of international competition are increasingly embodied in innovation ability. In today's world, whoever leads the "bull nose" of scientific and technological innovation and takes the first step of scientific and technological innovation can occupy the advanced and win the advantage. Innovation has always been the first driving force to promote the development of human society [31]. Innovation determines the changes in the balance of world political and economic power, as well as the future and destiny of all countries and nations. We should focus on the current key points, hot spots and difficulties, adhere to the "Three Combinations" of theory and practice, upper and lower feelings, subjective and objective, grasp the current outstanding problems, pay attention to finding out the reasons from the working mechanism, establish and improve the working mechanism to adapt to the new situation and new tasks through reform and innovation, and seek the fundamental solution to the problems (Picture 4).

4.6. National Innovation Capability and Its Core Elements

National innovation capability is an important aspect of building an innovative country. Furman defined national innovation capability as a country's long-term ability to develop and commercialize technology, and built a framework of national innovation capability by combining the theory of creative drive and national competitive advantage model [32]. The framework takes the general infrastructure, the innovation environment of national industrial clusters, and the connection between general infrastructure and industrial clusters as the three core elements of national innovation capacity. OECD believes that the innovation ability of economies is "the ability to manage creative knowledge that reflects market demand and other social needs". Malgorzata believes that the national innovation ability largely depends on the country's progressiveness in technology, the scale of science and technology labor force, investment in science and technology and innovation, productivity of research and development activities, and the government's innovation strategy and policy choices.

4.7. Innovative Country and Its Characteristics

The national innovation index report believes that the most important feature of an innovative country is that the country's socio-economic development mode



Picture 4. Note: Innovation globalization has become the inevitable trend of the world economic development. Technological innovation plays an important role in promoting the development of international trade. Technological innovation continues to accelerate and promote the continuous upgrading of the international trade structure.

has undergone fundamental changes compared with the traditional development mode, and takes “whether socio-economic and wealth growth is mainly driven by factors (traditional natural resource consumption and capital) input, or mainly driven by innovative activities marked by knowledge creation, dissemination and application” as the judgment basis. In 2008, the British Department of innovation, universities and skills (DIUS) released the white paper “innovation country”, which emphasizes the construction of an innovation system with the government as the guide. The participation of enterprises, institutions, individuals and the whole society from the perspective of the role of the government, demand innovation, supporting enterprise innovation, international innovation, innovative talents and public sector innovation. In 2013, France issued and implemented the “France Europe 2020” strategy for scientific research and innovation development at the national level. The improvement of national strategic planning processes and coordination mechanisms to further promote technological research. Vigorously build digital infrastructure and training facilities, promote the implementation of the new policy of transfer and transformation, and improve the overall scientific and technological level of France [33]. In addition, the aforementioned innovation evaluation indicators such as the global competitiveness report, the World Competitiveness Yearbook, and the global innovation index often take the policy environment, infrastructure, R & D investment, human resources, etc. as the evaluation dimensions.

4.8. Scientific and Technological Power and Its Characteristics

The road to building a strong scientific and technological country, it has syste-

matically summarized the characteristics and elements of a strong scientific and technological country from the aspects of science and technology, economy, industry, education, talent, society, culture and so on. That is, the connotation of “powerful country in science and technology” is related to the transfer of the world science center in the history of science. The main core elements include the combination of science and technology, the system and system of science and technology, the team of scientific and technological talents, and the key factors (politics, military, economy, society) to promote the development of science and technology.

A country/region how can the key factors to promote the development of science and technological power and its characteristics?

Experts in science and technology policy research and innovation capability assessment generally believe that a strong scientific and technological country has the following three characteristics: First, the goal of building a “scientific and technological power” is synchronized with the trend of world scientific and technological development, which can deal with major problems in national economic development and solve other strategic problems of the country; second, mechanisms and measures for independent construction of innovation capacity, high-level strategic research and development, high-level service to the needs of social and economic development, equal emphasis on institutional innovation and scientific and technological innovation, and continuous training of high-level talents; third, we should pay full attention to the role of scientific and technological elements in national development, the contribution of scientific and technological innovation to productivity, the rational distribution of scientific research institutions, and the construction of an innovation friendly environment.

4.9. Advantages and Disadvantages of Asian Innovation Capability in the World

By comprehensively analyzing different international innovation evaluation systems and their evaluation results, we can judge the relative position, advantages and disadvantages of Asian innovation ability in the world.

4.9.1. Comparative Advantage

In recent years, Asia has made significant progress in many key indicators of innovation capacity-building, mainly in the following aspects.

a) The overall macroeconomic indicators performed well with obvious market advantages. According to the World Competitiveness Yearbook, Asia’s “Economic performance” factor indicators in the past five years rank among the top five in the world. In the global competitiveness report, Asia ranks first in the world in terms of market size. This shows that Asia’s large-scale economic aggregate and market capacity can provide strong support for innovation activities.

b) Accelerating the innovation of systems and mechanisms such as the property right incentive of scientific and technological achievements and enabling innovative talents to share the benefits of achievements is an effective way to

stimulate the innovation vitality of scientific and technological personnel and promote the solution of the “bottleneck” problem of key core technologies. We should continue to explore the incentive system for the property rights of scientific and technological achievements of scientific and technological personnel. At the beginning of or before the establishment of scientific research projects, agreements should be signed between scientific research teams and units, as well as within scientific research teams, to clarify the disposal methods of intellectual property rights and the proportion of equity distribution of scientific and technological achievements within the R & D teams and their units. So as to fully reflect the value of knowledge and innovation in the distribution of income, let the output of scientific and technological achievements be directly linked to the benefits of scientific and technological personnel [34]. On the basis of pilot projects, we will gradually expand the scope of implementation of equity and dividend incentive policies, improve the legal system for the transformation of scientific and technological achievements and job invention, release the innovation potential of scientific and technological personnel, and improve the quality and efficiency of scientific and technological supply.

c) The ability of scientific and technological innovation has been significantly improved (source: Global innovation index 2018) Asian knowledge and technology output (which includes three secondary indicators such as knowledge creation, knowledge impact and knowledge dissemination) ranks fifth in the world. The proportion of net high-tech exports in total trade in the dissemination of knowledge ranks first in the world.

4.9.2. Relatively Insufficient

In terms of innovation environment indicators, the ranking of the difficulty of obtaining venture capital support for enterprise innovation projects is declining, indicating that the financing difficulty of enterprise innovation projects is increasing; the world ranking of intellectual property protection is also declining. Infrastructure indicators rank and the innovative institutional environment ranks relatively low in Asia. A solid and efficient infrastructure is an important part of a country’s innovation capacity. All these show that the institutional environment for innovation and entrepreneurship in Asia needs to be further improved. Although significant progress has been made in scientific and technological innovation in Asia, compared with the requirements of building a world power in science and technology, there are still some weaknesses.

a) Due to the obvious lack of investment in basic research and applied basic research, the lack of source technology reserves to support industrial upgrading and lead cutting-edge breakthroughs, and the supply of key core technologies is difficult to meet the requirements of industrial upgrading, the situation in which key core technologies in some industrial fields, especially high-end chips, aero-engine, robot core components, energy storage technology, high-end medical equipment, biopharmaceutical and so on, are controlled by people has not been fundamentally changed. The original innovation ability is not strong, especially

the lack of major breakthrough and disruptive technological innovation, making many key core technologies still subject to developed countries.

b) Although the investment in scientific and technological research and development has increased rapidly in recent years, the innovation performance is still low and the output efficiency is not high. A number of major projects and key tasks have been deployed, but major breakthroughs have not been as expected. From the perspective of tripartite patents that reflect the quality level of patents, the gap between China and developed countries is still relatively large. Generally, the tripartite patents applied for in the United States, Japan and the European Union at the same time are considered to have high scientific and technological content and economic value, reflecting the overall level of a country's technological invention and its competitiveness in the international market.

c) Insufficient talent incentives and structural imbalances are prominent factors that restrict innovation driven development. Various talent plans have multiple levels and overlap, and the implementation of policies and measures needs to be further strengthened. The incentive measures for scientific researchers and highly skilled talents are not in place. The value created by scientific researchers is not fully reflected, and innovation is difficult to obtain corresponding returns, which inhibits the enthusiasm of scientific researchers [34]. There is still a big gap between the introduction of talents and the construction of talent environment, the scientific research atmosphere in line with international standards, the guarantee of sustainable scientific research facilities, and the unavoidable registered residence, housing, children's education, medical and other public services in some big cities.

5. Analysis on the Influencing Factors and Mechanism of International Cooperative Innovation in Asia

International cooperation and innovation is a key driver of long-term economic growth and development for every country. As we know, the central planned economy lacks an incentive structure to promote international cooperation, innovation and an organizational mechanism to transform scientific and technological resources into industrial or commercial products or innovation. Before the market-oriented reform for international cooperation and innovation, there were many problems and challenges with low-income countries in Asia. Low-income countries how to solve problems and challenges for international cooperation and innovation?

First, most talented scientists involved in science and technology work in military research laboratories and research universities, creating self-sufficient ivory towers and inaccessible for the part to industrial enterprises. Second, although the industrial research institutions under the ministries and bureaus of industry are designated to serve industrial needs, they are usually trapped within the vertical power of their respective ministries or bureaus. There is almost no direct horizontal channel between research institutions and enterprises across the authority boundary of various ministries and bureaus. Third, within the same ad-

ministrative authority, the communication between research laboratories and enterprises is more or less carried out through the vertical channels of high-level administrative institutions. The direct horizontal link between laboratories and enterprises is usually secondary.

In general, the economic and enterprise reforms of the past 20 years have greatly changed the structure and dynamics of Asian specially China's international cooperation and innovation system. Therefore, the system is no longer characterized by strict division of departments, and the labor between functional specialized organizations. The new policy and institutional reform have fundamentally changed the decision-making mode of resource creation and distribution in the process of innovation. In addition, operational and strategic decisions have been decentralized.

At the same time, an initiative has been put forward to force organizations to increasingly compete with each other to carry out their activities more effectively according to their ability to perform their functions.

6. Opportunities for International Cooperation and Innovation Development in Asia

The Asia clearly faces challenges of a rapidly globalizing economy, there exist some potential opportunities that, when appropriately leveraged, can be used to offset the existing disadvantages.

In particular, by pursuing what we call a globalized fast follower international innovation mode—which emphasizes an upgrading of both product and process technologies, coupled with an export orientation—the Asian countries can foster an environment that allows its SMEs to be competitive in the global economy.

Asian countries are considering include providing a positive regulatory environment for international cooperation and innovation in which private enterprises can operate effectively; Promote inter enterprise cooperation through policies such as tax incentives and benchmarks; Addressing the problem of information asymmetry through advisory services and training, human resource management, coupled with financial reform at the micro level; Promote domestic and international technology transfer through institutional infrastructure that supports such transfer.

At present, Asian enterprises organized in clusters usually do not participate in inter enterprise international cooperation. When the cluster has several competitive companies, maybe even world-class manufacturers, these companies have the opportunity to play the role of best practice demonstration, and other companies in the cluster may follow these best practices.

Of course, such changes are very hard for low-income countries in Asia. Companies acting independently would not easily turn to the mode of close international cooperation in the past; it was not only because of lack of trust, but also because participation in international cooperation may involve high fixed and transaction costs, especially at the beginning. However, if government policies can highlight the advantages of international cooperation in network, per-

haps by providing tax incentives, the discount value of participating in international cooperation may exceed their adherence to the current situation. Alternatively, decision makers can adopt benchmarks for enterprises elsewhere which may let enterprises know how far they are from industry leaders.

7. Conclusions

R & D (research and development) is not only an important mechanism of international cooperation and innovation, but also an important link of international policy, because incentive mechanisms exist in many countries. The first variable is the indicator of the company's R & D expenditure, whether it is internal or external contracts. It covers the most traditional types of R & D, but needs to be supplemented in developing countries, because enterprises are often limited by resources and find it difficult to use it directly for R & D. However, this does not mean that they are not involved in international cooperation and innovation. The second indicator has a wider range, which reflects the time allocation of employees to participate in incremental training and international innovation activities. Similarly, this mechanism may be particularly important in developing countries and highlight the wide range of international cooperation and innovations that even enterprises with limited resources must undertake.

This article tries to focus on international cooperation and innovation's importance, higher innovation rates, current state of innovation in Asia, government guides, challenges and opportunities in Asia. Also help to build awareness for the potential implementation and operationalization of inclusive international cooperation and innovation policy in Asia.

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Conflicts of Interest

The authors declare no conflicts of interest.

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