United Nations
Office for South-South Cooperation

UNDP

South-South Ideas

Cooperation On Technology and Digital Transformation through the Establishment of Science and Technology Parks under the Belt and Road Initiative

United Nations Development Programme
304 East 45th Street
New York, NY 10017 USA

Disclaimer

The views expressed in this publication are those of the authors and do not necessarily represent those of the United Nations, UNDP or the United Nations Member States. The designations employed and the presentation of materials on maps do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations or UNDP concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

北京大学新结构经济学研究院
Institute of New Structural Economics

South-South Ideas

Cooperation On Technology and Digital Transformation through the Establishment of Science and Technology Parks under the Belt and Road Initiative

September 2022

TABLE OF CONTENTS

Abbreviations and acronyms

AAAA	Addis Ababa Action Agenda
BRI	Belt and Road Initiative
CAD	China-Africa Development Fund
DFI	development finance institution
EIP	eco-industrial parks
EPZ	export processing zone
FDI	foreign direct investment
GDP	gross domestic product
IASP	International Association of Science Parks and Areas of Innovation
ICT	information and communications technology
LDC	least-developed country
M&E	monitoring and evaluation
NSE	New Structural Economics
OEM	original equipment manufacturer
OETCZ	Overseas Economic and Trade Cooperation Zone
R&D	research and development
SDG	Sustainable Development Goal
SEZ	special economic zone
SSC	South-South cooperation
STI	science, technology, innovation
STP	science and technology park
UNCTAD	United Nations Conference on Trade and Development

Acknowledgements

This research was conducted by the Department of International Development Cooperation of the Institute of New Structural Economics (INSE) at Peking University. The research team is composed of two principal investigators (Dr. Wen Chen and Dr. Jia Yu) and three team members (Chenmei Li, Dr. Kokou Wotodjio Tozo and Xinyue Wu). The research team would like to thank the United Nations Office for South-South Cooperation and the United Nations Development Programme for their financial sponsorship. This report has benefited tremendously from comments and suggestions provided by the anonymous referees.

The authors of this research study are extremely grateful to the United Nations Office for South-South Cooperation (UNOSSC) and the United Nations Development Programme (UNDP) for their sponsorship of this research project under the 'South-South Global Thinkers – the Global Coalition of Think Tank Networks for South-South Cooperation' initiative.

Lastly, many thanks to Shams Banihani, Knowledge and Research Specialist at the United Nations Office for South-South Cooperation (UNOSSC) and Qinglan Wang, Operations Specialist at INSE, for excellent coordination and superb administrative support.

Executive summary

Technology has taken centre stage of modern economic growth. In particular, rapid advances in information technology have drastically changed the organization and production of economic activities worldwide. The outbreak of COVID-19 further prompted companies and countries to adopt digital technologies to cope with the pandemic and many of these changes could be here for the long haul or may even be nonreversible. It is of critical importance for countries in the global South to strengthen technology cooperation both with countries from the global North and among themselves. The latter cooperation might be even more important and needed, as the absorptive capacity of developing countries may not allow them to successfully assimilate (frontier) technologies from advanced countries. Joined by over 140 countries around the world (of which 50 come from Africa, the continent with the largest number of developing countries), China's Belt and Road Initiative (BRI) plays a pivotal role in promoting South-South cooperation (SSC) in technology and digital transformation in the contemporary world.

The aim of this research is to explore the avenues of cooperation between China and other countries in the global South on setting up science and technology parks (STPs) under the BRI, which may serve as a cornerstone for contemporary South-South cooperation in scaling up technological transfers and innovation, as well as bridging the digital divide with advanced countries and accelerating digital transformation in the global South. Furthermore, this endeavor could contribute to attainment of the United Nations Sustainable Development Goals (SDGs), as the promotion of SSC in science, technology and innovation is identified as a specific target under Goal 17.

Thus, this study is both timely and critically important for developing countries in an era of innovation- and digital technology-driven growth. This research draws on the theory of New Structural Economics (NSE) and combines desk research with field research (i.e., interviews with representatives from the Ministry of Science and Technology of the People's Republic of China) for analysis. Although it is not exhaustive, a set of targeted policy recommendations are provided to key stakeholders, aiming to set the scene for closer and more successful SSC on technology and digital transformation under the BRI.

First, to bridge the digital divide and promote digital transformation in the global South, **host governments from Southern countries should give priority to foreign investments in sectors that support the use and production of digital technologies**. This is especially important in the wake of the COVID-19 pandemic. Given China's successful experience in using digital technologies fighting against the pandemic and the fact that China has quite a large number of high-tech companies looking for expansion in foreign markets, targeted efforts to attract investments from those companies are likely to pay off.

Second, alternative or complementary sources of funds to the BRI, such as **the involvement of development financing institutions (DFIs), is highly recommended to further advance South-South cooperation**. Most DFIs (e.g., the World Bank, the Asian Development Bank, the Asian Infrastructure and Investment Bank) have flexible financial schemes, and with their own agenda and financial instruments, can assist in incubating innovative businesses and catalyze the process of industrialization in less developed countries.

Third, **STP developers, as well as the International Association of Science Parks and Areas of Innovation, are encouraged to promote interaction and share information with other regional STPs**. To live up to the expectation and stay competitive, STPs need to be evaluated using dynamic performance data, which are currently lacking. In hopes of bridging the data gap, a monitoring and evaluation programme has been launched by the Peking University's Institute of New Structural Economics.

Fourth, to strengthen cooperation on STPs under the BRI, **policymakers from China and the BRI-participating countries could consider upgrading the existing STPs with a special focus on STI cooperation**.

Lastly, while SSC on technology is the central focus of this research and China's BRI plays a pivotal role in this regard, it is also highly important to have countries from the global North and/or international organizations involved in diffusing technologies and reducing digital divides.

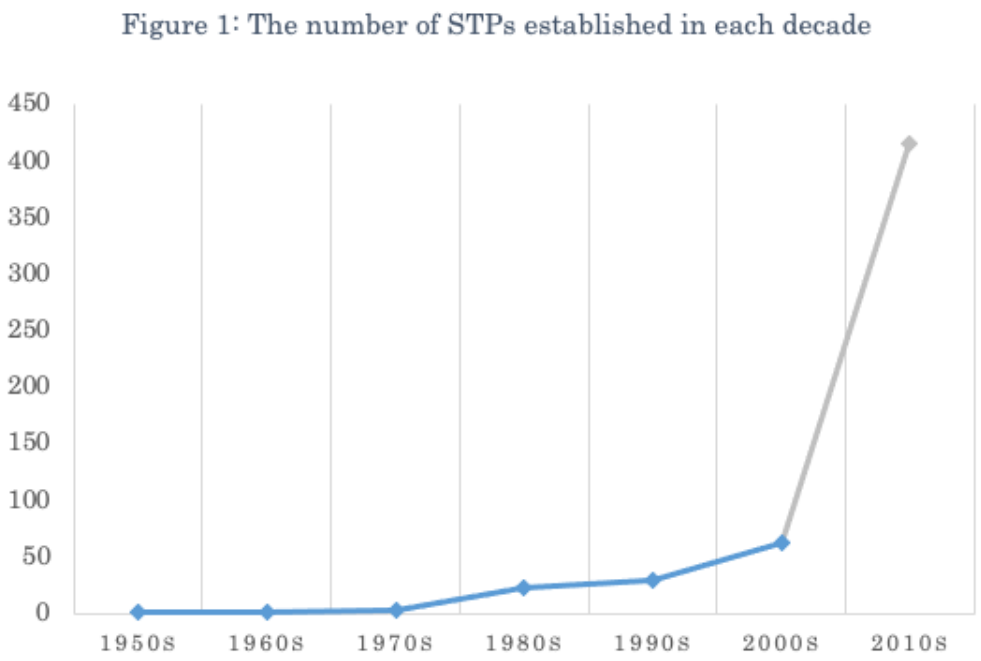
CHAPTER 1. INTRODUCTION

Since the advent of neoclassical growth theory, it has long been recognized that technology is the key driver of modern economic growth (e.g., Solow, 1956; Romer, 1990). Improvements in technology have played a significant role in virtually all economies that successfully moved from low-income to middle- and high-income status in the 20th and 21st centuries. The importance of technology is also central to New Structural Economics (NSE), a newly emerged development theory championed by Justin Yifu Lin, the former Chief Economist and Senior Vice President at the World Bank. NSE holds that modern economic growth is a process of continuous structural transformation, which in turn, is supported by technological innovation that raises labour productivity and industrial upgrading, moving the economy from lower value-added activities to higher value-added ones (Lin, 2016). A key insight of NSE is that economic structures (including the structure of technology and industry) that determine labour productivity and transaction costs are endogenous to the endowment structure, which is given at any specific point in time and changeable over time (Lin, 2012). NSE upholds the notion that developing countries can enjoy the so-called latecomer advantages, which allow 'latecomers' (i.e., late industrializers) to avoid costly innovation by adopting and absorbing technologies that have already been developed elsewhere, thereby leapfrogging to attain high-income economies (Lin, 2009).

Improvements in technology have played a significant role in virtually all economies that successfully moved from low-income to middle- and high-income status in the 20th and 21st centuries.

To spur innovation and achieve sustainable economic growth, the establishment of Science and Technology Parks (STPs) has become fairly widespread around the world. According to a report published by the United Nations (2019a), since the first STP (widely known as Silicon Valley) built in the 1950s in the United States, by 2017 about 534 STPs existed worldwide and the establishment of STPs has accelerated drastically over time. As shown in Figure 1, the number of STPs was growing in single digits before the 1980s, followed by double-digit growth in the next two decades and triple-digit growth in the 2010s. While most STPs are located in advanced countries, developing countries have also increasingly turned to STPs as part of their national development strategy (United Nations, 2019a). Despite the zest of setting up STPs, it should be noted that making STPs work and be successful is a daunting challenge. As reported by the United Nations Conference on Trade and Development (2015), only 25 percent of the STPs in the United States can be regarded as successful in terms of fostering innovation and contributing to economic growth, while the rest either failed or contribute little to the economy. Therefore, cooperating with successful partners on managing STP is both needed and highly recommended, and this is especially true for countries in the global South that are less economically developed and technologically limited.

Figure 1: The number of STPs established in each decade



Source: Data derived from a United Nations (2019) report.
Note: The segment shaded gray is a crude estimate input from the United Nations (2019) report.

Since China's reform and opening-up policy implemented in the late 1970s, the country has become increasingly connected with the rest of the world and has been a firm supporter of international cooperation. The launch of the Belt and Road Initiative (BRI) in 2013 by Chinese President Xi Jinping is an iconic example of China's support and commitment to multilateralism and equal and win-win cooperation with all countries around the world. The BRI is an ambitious development strategy that seeks to connect Asia with Africa and Europe via land and maritime networks to improve regional integration, strengthen trade ties and stimulate economic growth. According to the BRI portal, by December 2020, 50 African countries signed cooperation documents for the BRI (see Figure 2 for a geographical representation), the largest number of countries from any continent in the world.[1] As Africa is also the continent with the largest number of developing countries and China is both acquiring frontier technologies from advanced economies and diffusing (intermediate) technologies to developing countries (Nepelski and De Prato, 2015), the BRI plays a pivotal role in promoting SSC in technology in the contemporary world.[2]

1 The link to the official BRI portal is www.yidaiyilu.gov.cn/.

2 In a news release, the United Nations Development Programme also recognizes that South-South cooperation is more effective under the BRI, signifying the importance of BRI for contemporary SSC. Link: http://ydyl.china.com.cn/2017-09/12/content_41572453.htm.

Figure 2: Mapping the distribution of BRI-participating countries (as of Dec. 2021)[3]

Source: The list of BRI-participating countries is obtained from the BRI Portal.

While infrastructure connectivity remains at the heart of the BRI, it has evolved over time into "a road of science and technology" that places innovation high on the agenda. More specifically, at the opening of the BRI Forum held in May 2017, Chinese President Xi Jinping announced the Science, Technology and Innovation (STI) Cooperation Action Plan for the BRI, which covers four key areas: 1) a science and technology people-to-people exchange initiative; 2) a joint laboratory initiative; 3) a science park cooperation initiative; and 4) a technology transfer initiative. As a key implementer of the Action Plan, the Department of International Cooperation of the Ministry of Science and Technology of the People's Republic of China began piloting cooperation with eight BRI-participating countries on the development of STPs.[4]

The aim of this study is to explore avenues of cooperation between China and other countries in the global South on setting up STPs under the BRI, which could serve as the cornerstone for contemporary SSC in scaling up technological transfers and innovation, as well as bridging the digital divide with advanced countries and accelerating digital transformation in the global South. This research could also contribute to the attainment of the United Nations Sustainable Development Goals (SDGs), as the promotion of SSC on science, technology and innovation is identified as a specific target under Goal

3 Note: BRI-participating countries refer to those that have signed a Memorandum of Understanding with China to be part of the BRI. The list of BRI-participating countries can be found on the official portal: .www.yidaiyilu.gov.cn/. Note: BRI-participating countries, BRI countries, countries under the BRI are used interchangeably in this report.

4 Those eight countries are Egypt, Indonesia, Iran, Israel, Mongolia, the Philippines, South Africa and Thailand.

17. Given the rise of protectionism and the spread of anti-globalization sentiment in recent years, this study is both timely and critically important for developing countries in the age of innovation-driven growth. This research draws on the theory of New Structural Economics and combines desk research (e.g., literature reviews and in-depth case studies) with field research (e.g., interviews with representatives from the Ministry of Science and Technology of the People's Republic of China) for analysis. Although it may not be exhaustive, a set of targeted policy recommendations are provided to key stakeholders, aiming to pave the way for closer SSC on technology and digital transformation under the BRI.

The rest of the report is organized as follows. Chapter 2 discusses the theoretical background of STI in promoting structural transformation following the theory of NSE and presents three cases of STI cooperation under the framework of SSC. Chapter 3 revisits the role of industrial parks and the importance of STP cooperation, followed by two country case studies. Chapter 4 explores the opportunities in strengthening STP cooperation and proposes five promising areas for future STP cooperation under the BRI. This chapter also discusses the potential and the necessity of triangular cooperation in promoting STPs, as well as sheds light on the role of development finance in STP cooperation. Chapter 5 concludes and provides targeted policy recommendations to stakeholders.

CHAPTER 2.A GENERAL OVERVIEW OF COOPERATION IN INTERNATIONAL SCIENCE, TECHNOLOGY AND INNOVATION

International cooperation on science, technology and innovation needs to be closely aligned with each country's factor endowments and economic structures

2.1 A theoretical framework: Science, technology and innovation cooperation, industrial policy and economic development

Following the theory of New Structural Economics, international cooperation on science, technology and innovation (STI) needs to be closely aligned with each country's factor endowments (e.g. capital and labour) and economic structures such that the technologies applied in each and every country are most suited to its own development level. As mentioned, NSE recognizes that the process of modern economic growth is based on a process of continuous structural transformation, which in turn is supported by continuous technological innovation. By identifying the latent comparative advantage of an economy through "growth identification," the government could design comparative-advantage-following (CAF) industrial policies to remove bottlenecks and facilitate the development of identified industries. In this case, industrial policy is not about selecting winners, it is not a tool of a "planned economy," nor does the government need to have more knowledge and information than entrepreneurs. Instead, it is meant to prioritize the development of industries with the greatest growth potential.

In adopting new technologies, different policies are needed for different industries. For instance, as mentioned, developing countries enjoy the so-called latecomer advantages for most of its industries. Thus, the development path for those industries could be adopting technologies that have already been developed elsewhere but are new to the country itself. Apart from industries that enjoy latecomer advantages, developing countries may also be positioned to develop industries characterized by leading-edge technologies, such as 5G, artificial intelligence and renewable energy. Another consideration is that there are some industries whose development may go against the country's comparative advantage, but are strategically important (i.e., national defense). In general, NSE divides a country's industries into five broad categories and proposes targeted policies to facilitate the development of each category's industries. Table 1 provides an overview of the industry classification based on NSE, as well as the proposed policies for each type of industry.

Table 1: Five industry classifications from the perspective of New Structural Economics

Classification	Meaning and properties
Catching-up industries (e.g., semi-conductors)	Catching-up industries are those that have comparative advantages but face a large gap between frontier technologies and their current status. The advisable STI development strategy is to introduce and absorb advanced technologies, through for example mergers and acquisitions, setting up joint R&D centers or purchasing patents. In addition, the government can boost the technological level by attracting foreign direct investment (FDI) and encouraging technology transfer from FDI firms to local enterprises.
Leading-edge industries (e.g., household appliances)	Leading-edge industries are those already at or near the world's frontier. STI upgrading in these industries can only depend on indigenous innovation.
C**omparative advantage-losing industries** (e.g., manufacture of apparel and footwear)	Comparative advantage-losing industries are those that were once in line with the country's comparative advantages but have lost or are losing their comparative advantages as endowment structures have upgraded. A typical example is labour-intensive manufacturing. The development of these industries often follows the "geese model," moving from one area to new investment destinations which can provide suitable comparative advantages. The role of STI in promoting these industries is played through the process of industrial upgrading from low-value-added to higher-value-added sectors.
Overtaking industries (e.g., information technology)	The emergence of overtaking industries is the result of the emergence of information technologies, which enables developing countries to compete directly with developed countries in specific areas, such as software and mobile devices. Leveraging new technologies, developing countries may create an advantageous position in international competition and establish themselves as having world-class, leading industries. These industries particularly require human capital investment and have relatively short technology development cycles and rapid iterations.
Strategic industries (e.g., aerospace)	Strategic industries are industries with long R&D cycles and large capital investments, which usually is not the comparative advantages of developing countries. However, these industries are closely related with national security and long-term national interests. Thus, the development of these industries requires governmental direct participation, such as providing protections and subsidies. The government may encourage private sector participation through specific channels, for example a military contract.

Source: Lin (2017).

Following this classification, the first step in a successful STI cooperation is to understand the industrial structure of the host country such that investment projects can be tailored to the actual needs of their industrial development. For example, in the infrastructure and construction sectors, China is in a leading position while a large number of BRI-participating countries still have rather poor infrastructure. Labour-intensive manufacturing is currently the major comparative advantage-losing industry in China and, as a result, a window of opportunity has opened up for BRI partners that are unindustrialized and seeking to attract investment and relocation of labour-intensive manufacturing enterprises.

In recent years, China has made significant progress in establishing a number of overtaking industries based on 5G technology, artificial intelligence, big data as well as other groundbreaking technologies. Rapidly developing industries include e-commerce, information processing and identification, renewable energy, AI driving, intelligent robotics and so on, some of which have reached world-class standards. It is perhaps no secret that Chinese enterprises from overtaking industries often face great difficulties entering markets in developed countries but find markets in developing countries relatively easy to enter. This provides an extra incentive for Chinese tech-companies to take part in BRI cooperation, which will help set structural transformation of the host country in motion. Besides, while the exact mode of cooperation in each country may differ, it is also possible to initiate STI cooperation for industries that are at catching-up stage in both China and BRI-participating countries. For BRI-participating countries, it is very likely that they could absorb new technologies through imports of machineries from China or knowledge diffusion through Chinese FDI (Deng, Wang and Liang, 2020). China, on the other hand, could benefit through market expansion among countries located along the BRI. Lastly, strategic industries offer great potential for STI cooperation under the BRI. For example, industries that benefit society as a whole require efforts and contributions from all countries around the world, such as technologies that could tackle the issue of climate change or medical technologies that help fight against disease and save lives. Another rationale for cooperation on strategic industries is the rising nationalism and protectionism in the current global setting.

2.2 A general overview of international science, technology and innovation cooperation

To ground China's development cooperation initiatives in the existing international system and provide ideas for cooperation on STI among BRI-participating countries, this section will review the position, research findings and experiences of existing international cooperation on STI.

International efforts in STI have a cross-cutting nature, as it can support economic development in many different ways and areas.

Overall, as an area of development cooperation, scientific research, technology and innovation itself is a field under development. It should be noted that international efforts in STI have a cross-cutting nature, as it can support economic development in many different ways and areas. The 2030 Agenda for Sustainable Development adopted in 2015 by the United Nations defined 17 SDGs and STI is considered a key enabler to achieve those goals rather than a goal in itself. For instance, STI can make significant contributions to the realization of a number of SDGs, such as food security (Goal 2),

women's empowerment (Goal 5), the future of employment (Goal 4), health (Goal 3), energy (Goal 7), environment (Goal 14) and resilient infrastructure (Goal 9). In attaining the SDGs, the Addis Ababa Action Agenda (AAAA) also recognized the need for more international support in building domestic capacity to harness new technologies and incentivize innovation.

Notable examples include two programmes initiated by the United Nations Conference on Trade and Development (UNCTAD): 1) the "Innovation Policy Learning Programme" that provides training courses (foundation and advanced) to mid- to senior-level policymakers and key figures from academia, industry and civil society[5]; and 2) the "Strengthening National Innovation Systems" programme which created a "Framework for Science, Technology and Innovation Policy Reviews" to be applied on a country-by-country basis, assisting governments to align STI policies with their national development strategies, while at the same time promoting achievement of the SDGs[6].

Given the cross-cutting nature of STI, the United Nations had no specialized agency to promote STI development until 2018. Instead, each United Nations agency had its own mandate and priority. For example, the United Nations Industrial Development Organization (UNIDO) focuses on industrial innovation and technology transfer at the local level, while the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) support science through global partnerships. In 2018, a new United Nations institution dedicated to promoting STI cooperation was established called the Technology Bank for the Least Developed Countries. This agency is mandated to conduct STI reviews and assess technological needs of least developed countries (LDCs). The idea of establishing this dedicated agency emerged in 2011 but did not materialize until the AAAA gave it a new momentum (Ericsson and Mealy, 2019). The AAAA also called for establishing a new multi-stakeholder Technology Facilitation Mechanism (TFM) to scale up cooperation on STI through knowledge sharing. The four components of the TFM include: 1) the United Nations Interagency Task Team on STI for the SDGs; 2) the ten-member Group of High-level Representatives of Scientific Community, Private Sector and Civil Society appointed by the United Nations Secretary-General; 3) the Annual Multi-Stakeholder Forum on STI for the SDGs; and 4) the "2030 Connect" Online Platform on existing STI initiatives, mechanisms and programmes[7].

In addition to this newly built agency dedicated to promoting cooperation on STI, a new framework dedicated to cooperation on digital technology is taking shape. According to United Nations Secretary-General, António Guterres, "digital technology is changing economies and societies at warp speed and scale, but

5 For more information, see https://unctad.org/topic/science-technology-and-innovation/STI4D-Innovation-Policy-Learning.

6 For more information, see https://unctad.org/topic/science-technology-and-innovation/STI4D-Reviews.

7 For more information, see: https://sdgs.un.org/tfm.

today's means of international cooperation are not yet equal to the challenge.[8]"

Therefore, a High-Level Panel on Digital Cooperation was convened by the United Nations Secretary-General in 2018 and 2019 with the mission of "strengthening cooperation in the digital space among governments, the private sector, civil society, international organizations, technical and academic communities and other relevant stakeholders." A resulting report entitled "The Age of Digital Interdependence" provided a set of recommendations which was further refined through a series of discussions with key stakeholders into a "United Nations Secretary-General's Roadmap for Digital Cooperation[9]."

This document is poised to become a central reference in international cooperation on STI and was published in June 2020, in the midst of a global pandemic which further exposed the world's reliance on digital technologies to stay connected, keep economies afloat and manage large-scale crises. The report defined the following set of actions for digital collaboration: 1) achieve universal connectivity by 2030; 2) promote digital public goods to create a more equitable world; 3) ensure digital inclusion for all, including the most vulnerable; 4) strengthen digital capacity-building; 5) ensure the protection of human rights in the digital era; 6) support global cooperation on artificial intelligence; 7) promote trusts and security in the digital environment; and 8) build a more effective architecture for digital cooperation.

The choice of the first four actions above signify the current focus of the international community, namely bridging digital divides across and within countries. A widely used indicator of digitalization is internet connectivity, measured by the rate of internet penetration. In developed countries, 87 percent of the population have access to the internet vis-à-vis 47 percent in developing countries and 19 percent in the LDCs[10]. This means that not only are the majority of people in developing countries deprived of the advantages of being digitally connected (e.g., communication, access to information, work opportunities, services, entertainment), but they also lack the infrastructures and skills required to meaningfully participate in the digital era. This, in turn, implies that new technologies might be more difficult to absorb for these countries[11].

8 For more information, see: www.un.org/en/digital-cooperation-panel/.

9 For more information, see: www.un.org/en/content/digital-cooperation-roadmap/.

10 For more information, see: www.un.org/en/content/digital-cooperation-roadmap/assets/pdf/Roadmap_for_Digital_Cooperation_EN.pdf.

11 Note that another main concern of the international community in digital cooperation is to curtail the use of these technologies for mass surveillance of citizens by the State (Goal 5), and that Chinese projects in that field almost automatically come under other donors' scrutiny in that regard. See for instance: www.jstor.org/stable/resrep28771?seq=1#metadata_info_tab_contents.

2.3 The existing practices of South-South Cooperation and triangular cooperation on science, technology and innovation

By looking at past experiences, this sub-section illustrates the various ways in which technology and innovation can be conducive to socio-economic development. The goal is not to define a fixed model for STI cooperation, but rather to highlight the heterogeneity and versatility of STI cooperation projects.

2.3.1 The "Eco-Industrial Parks Framework" and potential collaboration with the Monitoring and Evaluation Framework

There were about 250 self-styled EIPs operating or under development worldwide in 2018, five times the number in 2000.

In terms of international cooperation on special economic zones (SEZs), the most notable initiative is the creation of an "Eco-Industrial Parks Framework" jointly developed by the World Bank, the German Agency for International Cooperation (GIZ) and the United Nations Industrial Development Organization (UNIDO). According to the World Bank, eco-industrial parks (EIPs) are on the rise. There were about 250 self-styled EIPs operating or under development worldwide in 2018, five times the number in 2000[12].

However, the lack of international standards implied that the self-given labels of being ecological were not really meaningful and hampered the development of truly sustainable SEZs. In a report published by the World Bank in 2017[13], an EIP framework was provided that specified performance requirements for EIPs across four categories: park management performance; environmental performance; social performance; and economic performance. Both new parks and existing parks can apply for this EIP status, characterized by different grading scales. The minimum requirement is that parks that apply for the EIP status must comply with all local and national regulations and satisfy the minimum expectations laid out in the EIP framework. This framework is universal, as it is applicable to parks in developing and developed countries alike.

It is logical that SEZs specialized in STI development are likely to apply for EIP status, such as the Saigon Hi-Tech Park in Vietnam, but it is not limited to this specific type of zone. However, the higher standards called for means that the conception and construction of an entire zone would be technology intensive, as they strive to incorporate the latest engineering and management solutions (e.g., in terms of energy and waste efficiency). Besides meeting commitments to social and environmental sustainability, zones and their tenants have a direct interest in obtaining EIP status because global buyers are increasingly leaning towards green procurement and sustainable supply chains (Villena and Gioia, 2020).

In Turkey, for example, the national government is working with the World Bank to develop a country wide EIP framework, and a number of industrial zones showed strong

12 For more information, see: www.worldbank.org/en/news/feature/2018/01/23/eco-industrial-parks-emerge-as-an-effective-approach-to-sustainable-growth.

13 For more information, see: https://documents1.worldbank.org/curated/en/429091513840815462/pdf/122179-WP-PUBLIC-AnInternationalFrameworkforEcoIndustrialParks.pdf.

interest in applying for EIP status as it would offer them new revenue streams and an opportunity to gain national and international recognition as centres of manufacturing excellence. Considering Turkey has 284 industrial zones in operation, the potential impact of devising and adopting an EIP framework in response to addressing climate change is promising. It is reported by the World Bank that the development of Turkish EIPs will rely heavily on the joint global framework but adapted to local conditions[14].

Another example is Vietnam where the government is seeking to make better use of resources and enhance environmental, economic and social performance through the development of EIPs. Aided by the International Finance Corporation and a Swiss consulting company called Sofies, national guidelines on the development of EIPs have been drawn up based on the international framework. In addition, this tripartite collaborative project is testing and implementing industrial symbioses and other resource optimization measures in two SEZs, including capacity building of park authorities, operators and tenants. The other aim is to design a roadmap for scaling up the initiative into to a nation-wide EIP programme, which calls for appropriate institutional structure, financing mechanisms and regulatory improvements[15].

In 2020, China joined the trend of working with the World Bank through its project to strengthen Jiangxi Province's institutional and regulatory framework in order to fit its zones within the international EIP framework and demonstrate its implementation in the Fuzhou New Industries Zone[16].

Despite the general consensus that industrial zones have played a significant role in economic growth and development in developing countries, it is almost impossible to evaluate their actual performance and quantify their exact contributions. Without a well-established evaluation framework, industrial parks are self-certificated which, as mentioned earlier, may not be meaningful and may hamper their development. The successful experience of some EIP projects suggests that the provision of well-defined standards or requirements is key to the success of EIPs and prevents Gresham's Law from being applicable to EIPs[17].

Starting in 2018, a research team from the Institute of New Structural Economics at Peking University started a Monitoring and Evaluation (M&E) project to establish a unified system of performance indicators for industrial parks, especially those located in LDCs. The main mission of the M&E project is not just to provide policy recommendations to governments,

14 For more information, see: https://blogs.worldbank.org/psd/eco-industrial-parks-20-building-common-global-framework.

15 For more information, see: https://sofiesgroup.com/en/projects/eip_vietnam/.

16 For more information, see: www.worldbank.org/en/news/loans-credits/2020/06/18/china-jiangxi-eco-industrial-parks-project.

17 Gresham's Law is a jargon used in monetary economics, implying a situation where "bad money drives out good." In this case, industrial park developers will not be motivated to invest in infrastructure that improves sustainability before such behaviour can be recognized and rewarded following well-defined standards. Without the EIP system, industrial parks that do not actually meet the level of sustainability may survive better.

but also to observe and monitor what is being done and report along lines and indicators relevant to the developer/operator of the park. Moreover, the M&E project bridges information gaps among stakeholders. For example, zone developers and managers may receive direct feedback from tenants, and policymakers may get feedback from zone managers and tenant firms, along with receiving an accurate picture of the current state of development in each zone. In practice, the M&E project is a tool to examine elements that are considered to be particularly important, such as the selection of industries in the zone.

The M&E project started with a comparative analysis of industrial parks in Bangladesh, China, India and Pakistan. The analysis reinforces the idea that it is critically important to have a dynamic approach to track the development of industrial zones. It is important to note that a dynamic development of the zone does not only imply growth of incumbent companies and industries, but also upgrading to other higher value-added industries.

For industrial parks in India, the project found that different implementation modes of the same programme could lead to drastically different outcomes. Forty years after establishing export processing zones (EPZs), those zones ended in failure as they were not given any special framework and ran against the national strategy of import substitution industrialization. After paying an official visit to China, India switched to the establishment of SEZs in 2005. Once given a proper status, SEZs flourished in the country and attracted large inflows of foreign direct investment. While India has a decentralized governance structure and each state could implement its own SEZ policies, few chose to do so.

Bangladesh was actually very successful in using industrial parks at the beginning. In 1979, the country followed an export-oriented development strategy and the "Foreign Investment Act" as well as the establishment of EPZs were adopted in 1980. With a dedicated authority and incentive scheme, land, administrative and logistical obstacles were quickly fixed. Since then, EPZs have been an effective catalyzer for the garment industry, generating quick wins (e.g., FDI, jobs and exports) and facilitating structural changes with capital accumulation, the formation of industrial clusters and technology transfers in garment manufacturing. However, in stark contrast to Chinese zones established during the same period, Bangladeshi EPZs did not develop further and were stuck in a low value-added segment of the industry and in exploiting cheap labour. If a successful zone is considered one that not only entails quick wins, but also achieves structural transformation, then it could be argued that EPZs in Bangladesh are unsuccessful, as they become export-oriented enclaves with limited linkages to the rest of the economy. One could thus see EPZs as having reached their goals in term of the country's structural transformation needs in the 1980s but having then failed to upgrade and move beyond these initial patterns.

Using a comparative analysis approach, pilot fieldwork was conducted in Bangladesh and Senegal on industrial parks. Surveys and interviews were used to collect information from stakeholders regarding which indicators are considered relevant for different stakeholders. For example, local governments mostly care about the amount of FDI, the number of jobs created and export and tax revenues. Zone developers pay close attention to economic performance of their tenants and their daily complaints. Tenants tend to

follow land policy, tax incentives and infrastructure improvements. Non-governmental organizations, on the other hand, are concerned about sustainability, number of jobs created for women and vulnerable populations, population management and poverty reduction. The wide range of feedback collected was later organized by the research team into multiple sets of indicators that covers not only economic factors, but also social and environmental impacts.

A second round of fieldwork is planned to use this set of indicators to collect data in selected countries with the hope of extending the data collection to other countries. Data is expected to be collected from stakeholders on a regular basis to create a cross-country time-series dataset. Once established, this dataset could significantly contribute to the general knowledge of industrial parks and provide valuable insights to various stakeholders. However, the data collection encountered obstacles in Bangladesh as the parks in Bangladesh were under poor management at the time, making it impossible to collect sufficient data. In Senegal, the data collection was successful, but the number of parks included was limited due to its small economic base.

While countries in the global South are still exploring the best strategies for industrial parks, or STPs in the context of this report, the establishment of a monitoring and evaluation system could be of significant value. It can easily fit into the EIP framework and potential indicators to track the performance of industrial parks include, for example, the application of green technology and level of technological improvement. Moreover, a relatively recent study by the World Bank (2017) shed light on factors behind the successes and failures of SEZs. With coverage of 553 zones in 51 countries, this was the first research to go beyond the case study approach and to provide insights with a high degree of generalizability. A highly relevant finding or insight to the present study is that the attempt to "upgrade the technological component or value-added of SEZs is challenging because zones focused on high-tech sectors are found to have performed worse than those in low-cost, labour-intensive sectors" (World Bank, 2017). This finding seems to underscore the importance of establishing monitoring and evaluation systems to assure healthy and sustainable development of high-technology zones (i.e., STPs in the context of this paper).

2.3.2 CocoTech in the Philippines: Science and technology park cooperation based on homegrown innovation

The Philippines has been observing the worsening plight of local coconut farmers, who represent 4 percent of the population but 20 percent of the country's poor. A local innovation team convinced the government to undertake research on the productive use of coconut husks, which are normally burned as waste after harvest, and discovered that coconut fiber can be extracted and weaved into nets with excellent capacity for soil erosion control and reforestation. With this discovery, CocoTech, a community-based project, employing mostly women and out of school youths, was successfully established to transfer this fiber technology to other firms (Ganchero and Manapol, 2007). This local innovation project has proven to be impactful on multiple development fronts, including: 1) environment protection as the fully biodegradables nets absorb water and help

prevent soil erosion; 2) natural risk prevention as the nets help minimizing the effect of typhoons, such as flooding and landslides; 3) poverty alleviation as the project creates new jobs and is particularly beneficial to poor coconut farmers; 4) economic inclusion as most employees have been women who had otherwise no possibility to join the labour force and thus gained more economic and financial independence; and 5) industrial development and upgrading as this local innovation created a local value chain based on a local product with comparative advantages.

Cooperation on STI can go both ways. It does not only imply technology transfers to the partner country, but the home country can also harness homegrown innovations.

There is a strong domestic demand as well as international interest and potential to diversify the use of this geomaterial. For instance, CocoTech received an order from a German bioengineering company producing car seats for clients such as Mercedes Benz and formed a joint venture with a Dutch company to produce doormats. It also successfully partnered with a company in Guangzhou, China, to replace plastic nets with coconut fiber nets, which helped transform a Chinese landfill into a green park. Beside nets, there is a growing demand in the West for natural coconut-based food and cosmetic products. However, CocoTech faced various obstacles, which prevented the local innovation from having a larger impact. The Filipino government, a major client of CocoTech, often delays payment due to the lack of government budget. Despite the potential in global markets, the Philippines' small-scale coconut production cannot face competition from Indonesia and Vietnam. An experimental cooperation with the Ministry of Agriculture of China using coconut fiber nets for anti-desertification also did not receive funding.

This example is meant to show that cooperation on STI can go both ways. It does not only imply technology transfers to the partner country, but the home country can also harness homegrown innovations. In fact, in developing countries, a significant number of indigenous innovations like CocoTech have emerged in the form of community projects, which often received technical and financial assistance during the start-up phase from international agencies and non-governmental organizations. Some of them have developed rapidly and even shown great commercial potential. However, due to macro conditions in developing countries, many indigenous STI projects have not reached their full market potential. International STI cooperation can play a role to take these local innovations further through the establishment of STPs that specialize in incubating start-ups in terms of commercializing new technologies, providing venture capital, offering management assistance, among other specializations. CocoTech, for example, developed coconut fibers as materials for high-end car accessories, furniture accessories and anti-desertification products, but encountered bottlenecks which could have been eliminated through the successful establishment of STPs.

2.3.3 Japan's *kaizen* training in Ethiopia: An innovative bilateral cooperation programme for the diffusion of management know-how

Following a request from Ethiopia's late Prime Minister Meles Zenawi, the Japan International Cooperation Agency (JICA) initiated a training programme in 2009 based on kaizen, the renowned Japanese concept of continuous productivity and quality improvement. The programme had a private component destined for managers of Ethiopian firms, as well as an "industrial policy dialogue" component for government officials. As

a multi-sector and multi-ministerial task, industrial policy demands very high organizational capacity to coordinate the various stakeholders. Previously, the government had already embarked on an ambitious civil service reform supported by international donors to build up its bureaucratic capacities (Brautigam, et al., 2018: 160). The JICA programme allowed the Ethiopian ministries to learn coordination mechanisms from East Asia and private manufacturing firms to successfully experiment with strategic administration and management methods that the government decided to incorporate in its new five-year plan.

This example is meant to expand the scope of STI cooperation and technology transfer. In addition to joint ventures and joint research for new technologies and vocational training for the labour force, which are common forms of international STI cooperation, technology transfer and skills training can also take the form of firm and policy management training. This echoes the current initiatives of UNCTAD to train officials and other stakeholders in designing STI policies presented in the first section. How to set the right conditions for technology absorption and incentivize upgrading and innovation could be one of the most valuable aspects of know-how that China can share with other developing countries. The importance of intangible know-how and working practices is particularly emphasized in industrial development studies, most notably by the industrial economist John Sutton from the London School of Economics and International Growth Centre who coined it "capabilities" (Sutton, 2005). Another term is "managerial human capital" (Sonobe and Otsuka, 2011).

Technology transfer and skills training can also take the form of firm and policy management training.

This case exemplifies the cross-cutting nature of STI, which makes it more difficult, and less relevant, to narrow down "cooperation on STI" to a single approach or field. On the other hand, it leaves a wide margin to formulate various STI projects in many different fields depending on partner country needs and capacities. Based on current research and calls for cooperation, China has the potential to play an important role and benefit from joint development in several areas linked to STI, in particular e-commerce, e-manufacturing, public health and green growth and agricultural development.

CHAPTER 3. SCIENCE AND TECHNOLOGY PARK COOPERATION UNDER THE UMBRELLA OF THE BELT AND ROAD INITIATIVE

This chapter discusses the role of industrial parks in STI cooperation, and then demonstrates the necessity of focusing on science and technology parks, as these parks are expected to be the main mechanism for fostering STI cooperation between China and BRI-participating countries. For illustration purposes, two country case studies, Egypt and South Africa, are presented.

3.1 Revisiting the role of industrial parks and cooperation on industrial parks

What role can industrial and science and technology parks play in the context of STI cooperation? In general, industrial parks, or SEZs, have played an important role in the development of many of the successful East Asian economies, including China. Since its late 1970s policy of reform and opening up, China managed to attract a large inflow of foreign direct investment, mainly through SEZs. In recent years, SEZs have risen to the top of the economic agendas in many other parts of the developing world. In Africa, for instance, Ethiopia has achieved remarkable growth rates through state-led development, albeit from a very low starting point. The country has sought to build a light manufacturing industry by relying on SEZs. Similarly, as one of the greatest success stories of Africa in terms of economic growth, Mauritius has pioneered tactical use of EPZs to attract FDI (Hausmann and Rodrik, 2003).

Countries in the global South could leapfrog and converge to high-income economies through participation in global value chains.

Historically, one of the ways in which countries in the global South could leapfrog and converge to high-income economies is through participation in global value chains (OECD, 2015). Developing countries usually do so by specializing in labour-intensive manufacturing activities that require little capital and skill. However, there are several mechanisms at work that make this development path more complex than before. First, manufacturing technologies are improving rapidly. This means that technological barriers to entry are becoming higher and higher. As a result, developing countries need a higher level of technological development and skills to enter manufacturing industries. Second, industrial production without the application of environmental technologies has become less attractive for developing countries as producers and consumers. Sustainability is an important concern and technologies are needed to make green manufacturing possible. Finally, the outbreak of the COVID-19 pandemic has exposed the fragility of international production networks and the importance of automation and digital work.

Industrial parks, or SEZs, can be an effective development tool through three broad channels. First of all, upgrading soft and hard infrastructure is a prerequisite for structural transformation. However, developing countries often lack the fiscal space to upgrade infrastructure on a

nationwide scale. As a result, localized investment in an SEZ with high quality infrastructure can be a cost-effective alternative (Zeng, 2015). Second, SEZs can help attract FDI to developing countries (Chakraborty, Gundimeda and Kathuria, 2017). There is extensive literature on the effects of FDI on development and a key conclusion is that FDI can provide capital, create jobs, lead technology transfers and generate productivity spillovers. Finally, SEZs are conducive to the formation of industrial clusters characterized by economies of scale (Newman and Page, 2017).

With this background in mind, industrial parks that focus specifically on technological upgrading have greater potential to help with technological upgrading in developing countries. This can be realized by attracting advanced technologies, which in turn is more feasible through cooperation in STPs under the SSC framework. In the past decades, it has mostly been developing and emerging economies that have used STPs as part of their national development strategy. In China, but also in other countries in the global South, public policymakers, firms and think-tanks have accumulated a wealth of knowledge on the development of successful STPs. Developing countries with less experience in the establishment of zones could benefit greatly from information exchange and technical support.

Industrial parks that focus specifically on technological upgrading have greater potential to help with technological upgrading in developing countries.

3.2 The necessity of focusing on science and technology parks

In the course of expanding overseas investment and solving the issue of poor land conditions and insufficient infrastructure construction, Chinese enterprises began to explore the construction of industrial parks abroad since 1995. In 2006, the Ministry of Commerce of China started an accreditation programme by labeling qualified industrial parks abroad as "Chinese Overseas Economic and Trade Cooperation Zones" (OETCZs). This accelerated the development of overseas industrial parks. By 2014, the number of OETCZs along the BRI route had increased to 77, and the number as well as the quality of OETCZs continue increasing over time[18].

Moreover, significant improvements have been achieved with respect to the financing mode, operation mode and industrial planning. In recent years, the development of OETCZs has been considered to be of "high quality" in terms of sustainability and their impact on technology diffusion and facilitating local structural transformation. In 2019, research jointly conducted by the United Nations and the Ministry of Commerce of China found that the OETCZs along the BRI route had not only promoted the growth prospects of the host country, but also helped achieving sustainability by ensuring environmental and social development[19].

18 The 77 OETCZs are spread across 23 countries along the BRI route, of which 35 are located along the Silk Road Economic Belt (e.g., Belarus, Hungary, Kazakhstan, Kyrgyzstan, Romania, Russia, Serbia), and 42 zones are located along the route of the 21st-century Maritime Silk Road (e.g., Cambodia, Indonesia, Laos, Malaysia, Myanmar, Thailand and Vietnam,). For more information, see: www.scio.gov.cn/ztk/wh/slxy/31200/Document/1389161/1389161.htm.

19 For more information, see: www.southsouth-galaxy.org/report-on-fostering-sustainable-development-through-chinese-overseas-economic-and-trade-cooperation-zones-along-the-belt-and-road/.

The common framework of STP cooperation include setting up joint innovation centres as well as startup incubators and accelerators. By the end of 2020, more than 20 projects had been launched under the STP cooperation framework, covering healthcare, food processing, new materials, renewable energy and environmental protection. Key achievements include the provision of four training courses on the design and management of STP, such as China's experience of developing National High-Tech Zones. These training courses attracted nearly 100 participants from countries in the global South. Moreover, government delegations from Egypt, Iran, South Africa and other countries were invited to visit China's leading STPs, such as Beijing Zhongguancun Science Park and Shanghai Zhangjiang Hi-Tech Park, to explore opportunities for cooperation with those STPs. Chinese delegations also conducted field research in those partner countries to explore the potential for cooperation. It is worth noting that those efforts are not only carried out at state level, but also at provincial level with policy incentives provided by China's Ministry of Science and Technology.

Despite these achievements, STP cooperation under the BRI framework also face severe bottlenecks. The establishment of STPs generally requires large amounts of upfront investment as well as a long-term implementation planning that involves coordination across institutions at different levels of government. As a result, STP cooperation between China and BRI member countries has been mostly on the "soft" side, such as maintaining international dialogue and sharing experiences. Although China has been quite successful in running its own STPs and gained extensive experience in building and managing industrial parks overseas (OETCZs), the vast majority of those parks are focused on labour-intensive manufacturing, agriculture, extraction and processing of natural resources and logistics. By the end of 2019, the value of China's investment in OETCZs among BRI-participating countries reached US $36.1 billion, with only a few parks strategically positioned to develop high-tech industries that can be considered STPs[20]. It is worth noting that cooperation on STP does not exclusively imply establishing a STP from scratch, it also includes the application of modern technologies to transform or upgrade existing OETCZs, for instance, through transforming producer service industries in parks via electronic commerce (e-commerce) and the digitalization of customs services.

Challenges of STP cooperation under the BRI are multifaceted. First, the majority of BRI-participating countries are low-income or middle-income countries lacking sufficient resources to support the promotion of STI or develop STPs on their own. Those countries lag behind in terms of the attractiveness of the business environment, government capacities and industrial park development. Although STP cooperation is a top priority of Chinese-led South-South cooperation under the BRI, how to institutionalize it remains a puzzle for different stakeholders. Second, China is considered highly successful in attracting foreign investment to its own STPs and leveraging STPs as a catalyst for innovation and economic growth. Nonetheless, China is inexperienced in

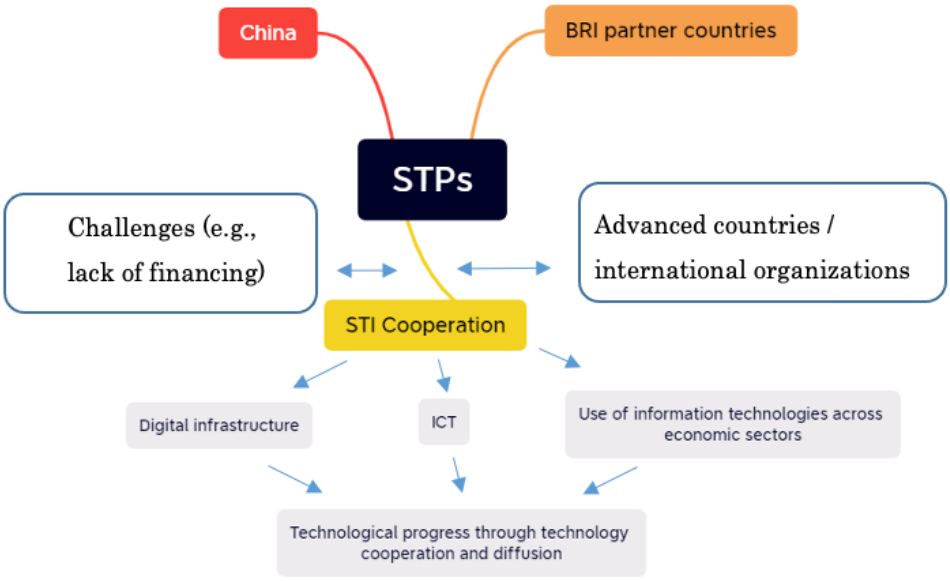
20 At the moment, parks that can be considered as STP among BRI-participating countries include the Green Stone China-Belarus Industrial Park, China-Indonesia Science and Technology Industrial Park the China-Mongolia GBC High-Tech Industrial Park.

jointly establishing STPs in other countries. For instance, China and Indonesia signed a cooperation agreement in 2019 to co-establish two STPs, with one located in China and the other located in Indonesia. The one in China, the APP Science and Technology Park in Suzhou, has already attracted investments from Germany, Japan and Switzerland in the field of biopharmaceuticals and next-generation information technology[21]. Meanwhile, the China-Indonesia Belt and Road Science and Technology Park in West Java made very little progress. This poor performance in overseas markets is in part due to the lack of in-depth and targeted studies to better understand the localities of the host country prior to the decision of establishing an STP. Third, countries from the global South vary significantly in terms of their technological status and absorptive capacity. Some may lie close to (or not too far away from) the technology frontier and focus on catching up to the frontier, while others may fall far below the frontier. As a result, objectives in developing technologies may intrinsically differ from one country to another, requiring extra effort and resources to coordinate needs in technology cooperation through the establishment of an STP. Fourth, the use of digital technologies will be accompanied by the generation of large volumes of data. The majority of, if not all, countries from the global South lack appropriate legislation regarding the use, protection and storage of the data generated. Without a clear and consistent guide at the legislative level, the advances of SSC for digital transformation and STPs may be hampered.

Before proceeding to the country case studies, it is helpful to visualize SSC (and triangular cooperation) on STP in a graph. As shown in Figure 3, the key players involved in SSC on technology and digital transformation under the BRI are China and the BRI partner countries. The channel through which cooperation takes place is the establishment of STPs, which may involve a third player from advanced countries or international organizations to form triangular cooperation. As discussed earlier, STP cooperation under the BRI faces various challenges, such as lack of financing. Sectors involved in cooperation can be classified into three broad categories, namely digital infrastructure (e.g., fixed broadband), information and communication technology (ICT) (e.g., manufacture of computer and communication equipment), and all the other economic sectors that intensively use ICTs. As shown in the last panel of Figure 3, regardless of the channels, the intended outcomes are technological progress in the form of reduction in digital divides and acceleration of digital transformation through technology cooperation and diffusion among countries from the global South.

21 For more information, see: http://sipac.gov.cn/english/news/201901/t20190124_978507.htm.

Figure 3: South-South cooperation and triangular cooperation on STPs



Source: Authors' own design

3.3 Country case studies

The research team selected two BRI-participating countries, Egypt and South Africa, which have signed STP cooperation documents with China as country case studies. Following the discussions in the preceding chapter and to highlight a practical framework to identify opportunities for implementing STP cooperation, the case studies will first look at the domestic economic status, identify the leading industries and then classify them into five categories following NSE theory. Taking into account the current status of these industries in China, and the existing BRI cooperation between China and selected countries, specific opportunities for fostering STP cooperation in each country are proposed. By considering the comparative advantages of both China and BRI-participating countries, the last section identifies five key avenues for future STP cooperation under the BRI.

3.3.1 Egypt

In this section, we look at some historical reforms undertaken by the Egyptian government as well as the development of SEZs and the performance of the industrial sector in Egypt. The section also provides details on the importance of the BRI and STI cooperation in catalyzing industrialization in Egypt.

Overview of the country

Egypt is the second largest economy in Africa and the 33rd largest economy in the world. Historically, Egypt's economic system was highly centralized. Starting with the

administration of President Gamal Abdel Nasser (1954-1970), the government pursued an economic development policy focusing on import substitution. In 2014, when President Abdel Fattah al-Sisi took office, Egypt embarked on a broad macroeconomic reform, launching "Egypt Vision 2030" which aims to diversify the economy, with a particular focus on the development of digital industries. Over the past two decades, the government has undertaken a series of structural reforms and developed a reformed fiscal, monetary and sectoral policy framework, supported by a $12 billion loan from the International Monetary Fund. Egypt's structural economic policy reforms have significantly boosted a market-based economy and increased investor confidence. Overall, Egypt has focused on the role of the private sector in achieving economic growth and job creation in recent years. Prior to the outbreak of the COVID-19 pandemic, Egypt was one of the fastest growing emerging markets and gradually became a popular investment country favoured by foreign investors. FDI inflows increased by 11 percent in 2019, reaching $9 billion. UNCTAD ranked Egypt as the top FDI destination in Africa for the period 2015-2019. The outbreak of the COVID-19 pandemic is estimated to have a significant negative impact on the Egyptian economy through reduction in tourism and payments received from the Suez Canal. The estimation suggests that the national GDP of Egypt could contract between 0.7 and 0.8 percent for each month that the crisis continues (Breisinger, et al., 2020). Leveraging its geographical location linking the Middle East, Africa and Europe and the launch of the Industrial Investment Map,[22] Egypt aims to become a regional hub for trade and investment and a leading industrial economy in the Middle East and Africa. In particular, the Egyptian government attempts to strengthen domestic industrialization, expand value-added industries and promote high technological components, ultimately creating an attractive climate for Egyptian and foreign investments.[23]

Egypt has a long history of using industrial parks to promote economic growth since 1973, however with limited economic impact. Industrial parks in Egypt evolved from Free Zones to Special Economic Zones (SEZs) and lastly to Investment Zones, reflecting different policy priorities of the country over time.[24] As the first attempt of applying industrial zones in Egypt, Free Zones were designed to welcome all kinds of investment, which suggested the urgency of economic development but a lack of clear priority in terms of industrial policy in Egypt. Free Zones attracted 1,160 projects in total in 2009. The number of projects leveled off, registering 1,112 in 2013. Free Zones employed 207,000 workers, of which 83 percent were in industry, 16 percent in services and 1 percent in warehousing.[25] About one-third of the production in Free Zones was for export, and the FDI

22 The Industrial Investment Map is a development strategy launched by the government to promote Egyptian industry and enable Egypt to become a leading industrial country in the Middle East and Africa.

23 For more information, see www.investinegypt.gov.eg/ENGLISH/Pages/industrial-investment-map.aspx.

24 Note, established by the United States Congress in 1996 to build economic ties between Israel and its neighbours, the notion of Qualifying Industrial Zones (QIZ) is also used in Egypt. The QIZ initiative allows Egypt and Jordan to export products to the United States duty-free, as long as such products contain inputs from Israel.

25 Figures cited here are obtained from information shared by the Ministry of Science and Technology of

attracted by Free Zones in total reached $1.9 billion. Free Zones provided investors a list of standard incentives which practically exempted the firms from all taxes except a 1 percent annual sales payment.

In 2002, with the hope of taking advantage of Egypt's strategic location, the government identified its potential as an export-oriented economy by introducing the concept of SEZs through the "Economic Zones Law." Under the new framework, the first SEZ in the Suez area was established to promote export. To encourage enterprises in SEZs to increase exports, the government offered more favourable incentives than in the Free Zones for enterprises exporting more than 50 percent. It is worth pointing out that the Egyptian government stipulates those projects operating in SEZs cannot be seized and their assets cannot be frozen or confiscated. The exporters in SEZs were allowed to freely set prices without government intervention. The employment regulations were also largely simplified for SEZs. These three targeted SEZ provisions show on the one hand the government's determination to encourage industrial development, while on the other hand suggest governance and labour conflicts are two significant obstacles in Egypt.

Following the SEZs, in 2007, Egypt introduced a system of "Investment Zones," and established a total of 13 Investment Zones in seven regions (Alexandria, Cairo, Dakahlia, Fayoum, Giza, Kalioubia and Sharkia). Compared to Free Zones and SEZs, the principle and development model of Investment Zones clearly suggest a deepened understanding of industrial parks in Egypt. For example, Investment Zones are designed to attract the private sector and aim to reduce industrial production costs through the development of industrial clusters. Investment Zones are equipped with non-bureaucratic boards of ministries. The government makes an effort to identify local comparative advantages and set the leading industries for each Investment Zone accordingly, such as construction materials, engineering, textiles, nanotechnology and biotechnology, higher education and scientific research, information technology and business services. To further promote economic growth and expand exports, the government introduced the New Investment Law in 2017, which states explicitly that for Investment Zones, "the Prime Minister may designate geographic areas for specific developments, including logistics, agriculture and industry. In areas designated for communications and information technology, equipment for these enterprises will not be subject to taxes or customs duties."[26]

Egypt and the Belt and Road Initiative

Egypt is an important and indispensable focal point in the BRI. With the implementation of the Egyptian government's "Suez Canal Economic Corridor" development plan, China and Egypt face historical opportunities for economic cooperation. Since the official signing of the BRI cooperation document in 2014, Egypt and China together planned a total of 109 projects under BRI in the infrastructure sector, with a total value of $100 billion,

the People's Republic of China during an interview.

26 For more information, see: http://amcham-egypt.org/Egypt_Investment_FactSheet_081117.pdf.

ranking Egypt's BRI projects second in number and seventh in value among all BRI countries. Currently, China's FDI in Egypt reached over $1.2 billion, 90 percent of which has been invested in the last five years, providing 40,000 jobs and contributing tax revenues of $58 million. Oil and gas are the main sectors for Chinese FDI, while advanced manufacturing, such as electric vehicles, agriculture and AI transportation, are also showing strong potential.

The Suez Economic and Trade Cooperation Zone (Suez-TEDA Industrial Park) is undoubtedly one of the most notable achievements of China-Egyptian BRI cooperation. This cooperation started early in 1994 when Egypt first proposed the establishment of a joint economic free zone. During the China-Africa Cooperation Conference Beijing Summit in 2006, it was confirmed by the two countries to co-establish the Suez-TEDA industrial park under the existing framework of the Suez Special Canal Economic Zones (SEZ). In 2008, the TEDA Egypt Investment Company (TEDA Egypt) was established as a joint venture to develop the Suez-TEDA Industrial Park. Funding came from multiple stakeholders including Chinese state-owned enterprises (SOE), Egyptian SOEs and later the China Africa Development Fund. After more than ten years of development, the zone is now considered the most successful industrial park in Egypt, as well as a flagship project for industrial park cooperation under BRI. As of March 2021, the zone has attracted 104 enterprises, with total sales of over $2.5 billion, creating 4,000 jobs directly and 36,000 indirectly. After the outbreak of COVID-19 in 2020, Suez-TEDA played an important role in assisting China's aid to Egypt, including providing supplies and technical support, co-establishing hospitals and establishing local production lines for supplies.

Science and technology park cooperation between China and Egypt

According to the NSE framework, Egypt's existing industries mostly fall into catching-up industries, including the oil and gas industry, the steel industry, export-oriented agriculture, light manufacturing, tourism, international logistics, etc. In addition, Egypt has made efforts in recent years to develop new industries that have the potential to overtake the leading role in global market, especially in applied sectors of IT industries, such as e-commerce, games and online service platforms.

For the industries that are catching up in Egypt, but have gradually lost their comparative advantages in China, a suitable STP cooperation model might be to equip existing industrial parks with technology transfer centres, start-up incubators, risk investment, etc. The goal is to use FDI as the key channel for Egypt to adopt new technologies in catching-up industries. China has become the largest investor for Egypt, especially in the oil and gas and textile industries. Currently, up to 21 Chinese firms are investing in the Egyptian oil and gas industry, which, accounted for 24 percent of Egypt's GDP in 2020. As the oil and gas industry is one of the country's economic heavyweights, the Egyptian government planned to upgrade the industry's business model following its Oil and Gas Industry Modernization Project Plan. Specifically, the programme applies STI to human resources management, energy efficiency and data organization. There are several reasons why the Egyptian government may consider associating China with the

plan's implementation. China's own domestic oil and gas sector has already accumulated experience in modern exploration, high-efficiency commercial development, digitalization and use of machinery and equipment. Similarly, the textile industry, which employs more than one-third of the industrial population in Egypt, is another key area that needs upgrading. Therefore China-Egypt cooperation should be envisaged. The Suez-TEDA Industrial Park has become the main platform hosting Chinese textile firms with another China-Egypt-Mankai Textile Park under construction. In such a scenario in which industrial parks are already operational, establishing STP cooperation implies attracting Chinese investors specialized in STI, but applied or adapted to textile manufacturing.

Egypt is one of the fastest growing emerging economies and therefore exhibits a relatively high absorptive capacity for some overtaking industries, such as the new generation of technology like AI, 5G and Big Data. One of these industries is e-commerce which has great potential to be developed through STP cooperation between China and Egypt. Moreover, the general IT industry is highly promising and has been indicated as a leading industry for several existing Investment Zones. According to data from the Egyptian Ministry of Information Technology Industry Development, the IT industry was the fastest growing industry over several years, increasing from 3.8 percent in 2019 to 4.4 percent of GDP in 2020. In 2020, the IT sector exported $4.1 billion, with an annual growth rate of 13 percent. The major contributing subsectors to this performance include e-commerce, online games, online design services and digital payments. These businesses can further expand and be extended with assistance from China where the use of the new generation technologies, such as AI, 5G and Big Data is rapidly gaining ground.

China has extensive experience in establishing e-commerce industrial parks. As of 2020, the country had more than 2,000 e-commerce parks nationwide. In Zhejiang Province manufacturing industrial clusters are highly developed and more than 400 e-commerce parks have been established and have contributed to the development of local clusters. In e-commerce, China's logistics and express delivery, "sharing economy," online payments and other supporting industries have incubated a number of leading enterprises. Enterprises such as Alibaba have been actively exploring developing markets along the BRI. In 2017, China and Egypt held a roundtable on the construction of the "Online Silk Road," to strengthen cooperation in the construction of an Online Silk Road and promote information connectivity. In 2017, China was already the largest source of international online purchases for Egypt, accounting for 14.2 percent of Egypt's total online purchases. Egypt's demographic structure shows significant potential for e-commerce industry and has attracted cross-border e-commerce enterprises such as e-Panda from China and fostered local online shopping firms like NOON. With e-commerce as a starting point, China and Egypt can continue exploring STP cooperation in cross-border logistics, cross-border settlement and other supporting fields.

Another main area of application of new technologies in China is public services. For example, technological innovation to support port management, fast customs clearance, cargo tracking and fast inspection have been widely used in China. Sharing this experience could allow China to play a significant role in helping Egypt attempt to be an

international trade hub. To improve Egypt's government capacity and business environment, China's existing technology and experience in digitizing public services could be applied through STP cooperation. In addition to e-commerce, Egypt's "Vision 2030" has made digital development of the country an important policy goal. To support this, digital public services are an ideal starting point. In developing countries, including China, public services are commonly used as a pilot scenario for promoting new technologies. Using governmental contracts, the public service sector provides market demand for emerging STI products before they grow to be commercially beneficial. Under the BRI framework, public services can serve as a pilot sector for STP cooperation through existing industrial park cooperation projects, such as the Suez-TEDA zone.

It is worth mentioning that in both countries supporting the private sector as a main participant in STP cooperation is critical. This also coincides with the BRI strategy to promote the participation of enterprises, especially private enterprises. Looking at the development model of existing industrial parks in Egypt, a distinctive characteristic is flexibility and diversity of activities and sector participants. Private enterprises have been taking the lead and successfully creating a variety of financing and operation models. These leading enterprises and the diversity of their activities are manifested through occupations that include not only professional park developers and capital investment companies, but also construction companies, power generators and manufacturers. For example, the developers of the Pyramid Industrial Park include: Elsewedy, a manufacturer in the energy sector; SIAC, a construction and engineering company; and El Consorici, a professional IP developer from Spain. On the contrary, China's experience in developing overseas parks has suggested a need for exploring diversified financing and development modes. It is out of bilateral interest to place the private sector in both China and Egypt in STP cooperation.

3.3.2 South Africa

As in the preceding case, this section gives an overview of South Africa's economic performance, the impact of the COVID-19 pandemic and the government's position and actions regarding the development of SEZs and other policies affecting the development of its industrial sectors. The section also sheds light on the importance of the BRI and STI cooperation.

Overview of the country

South Africa was one of the first countries in Africa to achieve industrialization. However, in recent years, South Africa's economic growth has decelerated significantly, with unemployment, poverty and inequality remaining the main challenges. Its real GDP growth was only 0.2 percent in 2019. The economy declined further due to COVID-19, reducing real GDP by 8.2 percent in 2020. Industries that suffered the most included construction, transport and communications, manufacturing and mining. The decline on the demand side of the economy is even more significant; South Africa's domestic investment stock decreased by 32.4 percent in 2020. As a result, the government budget deficit also increased significantly, accounting for 14 percent of 2020's GDP. In terms of employment,

the unemployment rate before the epidemic was already 23.3 percent, with another 2.6 million people losing jobs after March 2020. Although the South Africa government expects the real GDP growth rate to rebound to 3 percent in 2021, it is commonly predicted that the economy of South Africa may continue slowing down, as the structural constraints, such as an unstable power supply, fraught labour relations, high exchange rates and social conflicts haven't been overcome. According to an African Development Bank forecast, the pace of South Africa's economic recovery will be slow, with about 1.6 percent GDP growth in 2022, accompanied by a higher inflation rate.

In terms of industrial structure, South Africa's economy is relatively diversified, with leading industries including mining, agriculture and fisheries, automobile manufacturing, food processing, apparel and textiles, energy, financial and business services, real estate, tourism, information technology, transportation, wholesale and retail trade. The mining industry used to be the main force driving South Africa's industrialization. However, mining's contribution to GDP declined from 21 percent in 1970 to 8.3 percent in 2019, while industries and services contributed 26 percent and 61.2 percent, respectively, in 2019. Agriculture in South Africa suffers from the weather and land limitations, producing only 1.88 percent of GDP, however the sector employs 7 percent of the population, or 8.5 million people. Mining and manufacturing are expected to play a strategic role in structural transformation of South Africa.

The development of industrial parks in South Africa began in 2000 with the implementation of the "Industrial Development Zones Program," that aimed to attract FDI and promote exports in non-primary goods. By 2007, South Africa had released several macroeconomic strategies, among which the National Industrial Policy Framework and the New Growth Path were the two most influential plans. A new set of industrial park programmes were announced in 2007, taking into account previous experiences in South Africa. The new strategies included: 1) expanding the pace of industrialization and focusing on regional development needs; 2) providing industrial parks with clearer industrial objectives and investment promotion plans; 3) expanding government functions from providing hard infrastructure to zone governance, investment promotion and zone management; and 4) providing long-term financing and policy support for zone development.

South Africa made efforts to increase private sector participation in the development of special economic zones through the SEZ Act and SEZ Strategy, by establishing a series of flexible public-private partnership models. A dedicated SEZ fund was established to provide long-term financial support for infrastructure within the park and for park developers to upgrade their operations. In 2014, the Industrial Policy Action Plan further identified industrial parks as major contributors to economic development and the engine of industrialization, regional development and job creation. There are various types of industrial parks in South Africa, including Industrial Development Zones, Free Ports, Free Trade Zones and Sectoral Development Zones. Industrial Development Zones are those designed to host export-oriented industries by attracting domestic and foreign direct investment. Sectoral Development Zones are areas where specific industries are developed through the provision of targeted industrial infrastructure, policy incentives,

technology and business services. These two types of zones are more in line with what is referred to as industrial parks in common practice, and thus will be the main objects of this discussion.

South Africa and BRI

South Africa is China's largest trading partner in Africa and the first African country to sign the cooperation document for the BRI. In 2019, bilateral trade between China and South Africa reached over $42 billion, accounting for one-fifth of China-Africa total trade. South Africa is also a key destination for China's FDI, registering more than $25 billion by 2020. It is worth noting that China and South Africa have make substantial progress in financial cooperation with most major Chinese financial institutions setting up branches in Johannesburg. The Chinese currency, Renminbi (RMB), has officially become a reserve currency of South Africa.

China and South Africa have been exploring cooperation on industrial parks since 2016, starting with a training programme initiated by Ministry of Trade and Industry of South Africa. The training programme brought 20 government officials from South Africa to attend capacity building courses in representative SEZs in China. Cooperation on the Musina Mukhado SEZ, which will be financed primarily by Chinese investors, was signed in 2016 and implemented in 2017. The zone was planned to be managed by Hong Kong investors with mineral and agriculture products processing as the leading industries. It is expected that more than 20,000 jobs will be created within five years.

STP cooperation between China and South Africa

Compared with other BRI partner countries, South Africa has a relatively higher economic development level, which is creating more opportunities for STP cooperation between the two countries. In fact, South Africa is the first and only country that has successfully delivered on expectations, achieving significant outcomes after signing STP cooperation agreements with China. In December 2020, as an important activity of the South Africa Science Forum, the Liancai Incubator from the Xi'an High-Tech Zone signed a Memorandum of Understanding with the Gauteng International Innovation Park in South Africa to launch the online "China-SA STPs Cross-border Incubator" project, marking solid progress on STP cooperation between the two countries. On 7 April 2021, under the coordination of the Science and Technology Department of the Embassy of South Africa in China, the Ministry of Science and Technology of the People's Republic of China and the Department of Science and Innovation of South Africa jointly organized an online exchange meeting on experiences of the Joint Research Centre. This online exchange reflected the importance and diversity of cooperation between China and South Africa in STI and reaffirmed a mutual commitment and responsibilities on further steps in STP cooperation.

Economic sectors most affected by COVID-19 urgently need support from STI cooperation. In fact, as previously suggested, South Africa is among the countries most affected economically by COVID-19 in the world, as its leading industries, including tourism,

international transportation and entertainment, were hit hard. Although other major economies in the world also suffered similar blows due to the pandemic (e.g. China), it managed to pull through and mitigate the overall impact by successfully leveraging digital technologies to bring the virus under control. Currently, South Africa ranks number 20 in the world in ICT development with 52 percent of its population having access to the internet. Such preconditions position the country on a level in which digital technologies can be and should be better used to cope with COVID-19, contain the spread of the virus and get the economy back on a sustainable growth track.

For overtaking industries, renewable energy is a potential area for initiating successful STP cooperation. Facing significant environmental pressure, China has been developing renewable energy industries for two decades and has established world-class industries in solar and wind power. South Africa is the largest energy producer in Africa, producing more than 40 percent of the energy for the whole continent. However, 90 percent of the energy is produced by coal, which does not satisfy the needs of sustainable development. In November 2017, the Dea wind power project developed by the China National Energy Group was officially put into operation. This is China's first wind power project in Africa, as well as the largest wind power project in South Africa at present. It is also the first integrated package through which Chinese enterprises provide investment, construction and operations, which to some extent suggests that China has accumulated a certain level of capacity to export both finance and technology in the wind power industry. The project can supply about 760 million kWh of clean and stable electricity to the local area every year, meeting the electricity demand of 300,000 households, which is equivalent to saving 215,800 tons of standard coal and reducing 619,900 tons of carbon dioxide. In 2019, a joint China- South Africa clean energy research lab was established in South Africa. Hydrogen technology is another key area for STI cooperation in the energy sector. In October 2020, the Ministry of Science and Innovation of South Africa announced a "White Gold Valley Plan" to establish an industrial cluster in hydrogen technology.

Renewable energy technology can reshape almost all industries, among which the automotive industry is a major application area and, with its great potential in both China and South Africa, is a suitable sector for STI cooperation. South Africa is currently among the main producers of automobile parts for the global market while China has the most automotive manufacturing in the world and at the same time is the largest single market.

CHAPTER 4:
OPPORTUNITIES TO STRENGTHEN SCIENCE AND TECHNOLOGY PARK COOPERATION UNDER THE BELT AND ROAD INITIATIVE

This chapter explores opportunities to foster more effective STP cooperation under the BRI. The research suggests that there are five key avenues in which China has the greatest competitiveness and from which BRI partner countries in the global South could benefit; these are e-commerce, e-manufacturing, public health in the post-COVID era, green growth and agricultural development. Moreover, it is argued that triangular cooperation and engagement with development finance institutions may bring opportunities for STP cooperation under the BRI.

4.1 Five key avenues for science and technology park cooperation between China and Belt and Road Initiative countries

This section will highlight potential areas for development cooperation in STI between China and BRI countries based on current calls for cooperation in certain areas and on China's fields of interest and expertise. With an internet penetration rate of around 64 percent,[27] China is well above the average of developing partners along the BRI route in terms of connectivity, especially Africa where only 28 percent of the population is connected, but also the Asia-Pacific region with a 48 percent connectivity rate. While China still suffers from a digital divide at home between rural and urban areas, digital habits in many aspects of life such as shopping, working, banking and accessing private and public services are already deeply entrenched for a large part of the population. Beside digitalization, China has successfully absorbed productive technologies at a rapid pace in the past decades and its coastal economic hotspots once developed through SEZs are now aspiring to becoming world-class Bay Areas championing innovation and modern urbanization. China thus has the potential to both play an important role and benefit from joint development of STP in a wide array of areas.

4.1.1 E-commerce

The rise of e-commerce has been profoundly reshaping economies and opening avenues for leapfrogging for late developers.

The rise of e-commerce has been profoundly reshaping economies and opening avenues for leapfrogging for late developers. The nomination of Alibaba's founder Jack Ma, together with Melinda Gates, as co-chair of the United Nations Secretary-General's High-Level Panel on Digital Cooperation indicates that the international community is looking up to the Chinese economy in terms of digital development and innovation, an area of

27 For more information, see: www.globaltimes.cn/content/1187036.shtml.

great interest for developing and developed countries alike. The advent of ICTs and the emergence of the digital economy has redefined the way products and services are being sold as well as the realm of possibilities regarding the modes of (self)employment in commercial activities. Given the double objectives to bridge digital divides and create jobs for large youth bulges in developing countries, a wide margin for cooperation exists with Chinese actors in the e-commerce field.

4.1.2 E-manufacturing

Bridging digital divides is essential for developing countries to not be left out of the "Fourth Industrial Revolution,"

Digitalization is also transforming productive sectors by bringing about a "digital transformation of the economy, achieved through an interaction of digital technologies such as cloud computing, artificial intelligence (AI), Internet of Things (IoT), etc., with physical ICT infrastructure" (Banga and Welde, 2018). Bridging digital divides is thus also essential for developing countries to not be left out of the "Fourth Industrial Revolution," which is having a major impact on manufacturing processes globally with the use of advanced technologies, such as 3D printing and robotics. According to research by the United Kingdom's Overseas Development Institute, the decreasing cost of replacing workers by machines in manufacturing industries is shortening the window of opportunity for developing countries to attract industrial transfers and increasing the urgency for them to rapidly catch up with the basics and move into higher value-added activities. High tech industrial parks can create an optimal environment for development in that direction.

4.1.3 Public health in the post COVID-19 era

COVID-19 highlighted the need for more cooperation and coordination among countries.

Health, both a research-intensive field and a basic human need, has been one of the main areas of focus in STI and development cooperation. The devastating impact of the COVID-19 outbreak highlighted the need for more cooperation and coordination among countries. China was among the countries to pioneer solutions such as digital tracking to curb propagation and supporting vaccine development. There is a demand from developing countries for cooperation in public health, not only Chinese help to fix shortages but, most importantly, to help develop local pharmaceutical and medical capacities to build long-term health and economic resilience. At the international level, active research from multilateral institutions, such as the Organization for Economic Co-operation and Development (OECD), led to calls for harmonizing regulations of clinical trials of potential treatments, for using AI to accelerate research and monitor crisis recovery and for rethinking global governance of scientific research toward more open science (OECD, 2020).

4.1.4 Green growth

Mitigating climate change and decoupling economic development from environmental degradation is one of the biggest challenges faced by nations and the international community.

Mitigating climate change and decoupling economic development from environmental degradation is one of the biggest challenges faced by nations and the international community. Dealing with acute pollution and desertification issues at home, China has both progress to make and experiences to share, for instance in supporting renewable energies and prototyping green cities. The Chinese government is committed to developing a Green BRI (i.e., BRIGC), a coalition that brings together the environmental expertise

of all partners to ensure that the BRI brings long-term green and sustainable development in support of the 2030 Agenda for Sustainable Development.[28] SEZs could be an interesting tool in that regard, like the Xiongan New Area in Hebei which is meant to receive Beijing's non-essential administrative and economic functions but also to act as an eco-friendly smart urbanization demonstration area, running on 100 percent renewable energy and featuring isolated buildings able to maintain temperature in winter without heating (Mark, 2018). Most partner countries along the BRI also face severe issues linked to unbridled urbanization and industrialization and are looking for ways to ease congestion and pollution.

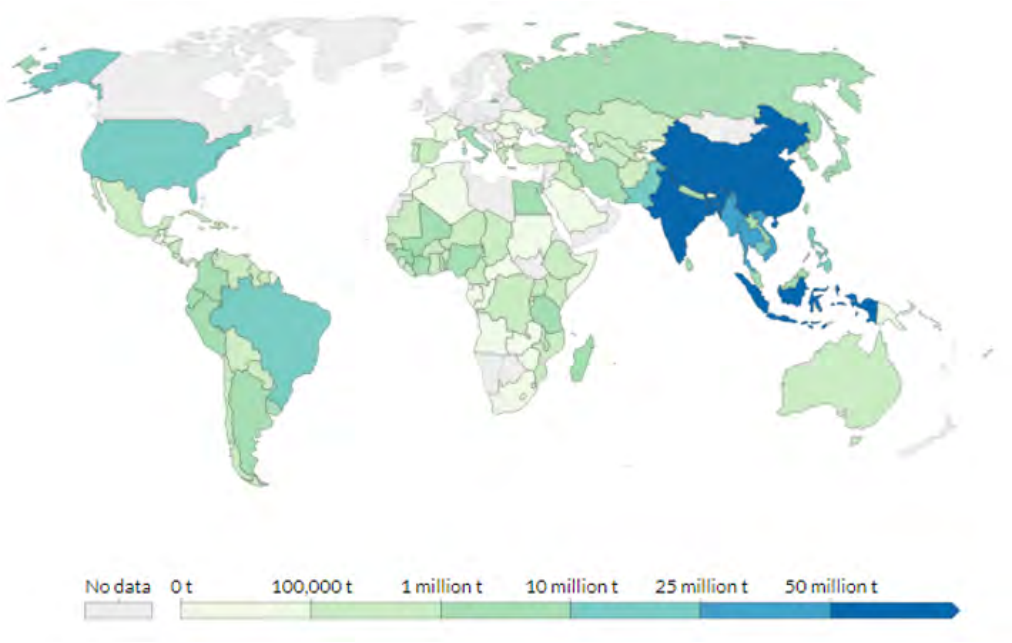
4.1.5 Agricultural development

Along with health, agriculture is a long-standing area of focus for international development and technology transfers. African countries are still highly dependent on this sector, not only for food security but also people's livelihoods and national exports (see Figure 4 for the distribution of the global production of rice, as an example). China managed to feed the world's second largest population on a limited amount of arable land and is already trying to share its techniques through agricultural demonstration centres in Africa, initiated by China's Ministry of Agriculture. There is, however, room for diverse and innovative approaches to cooperation in this area, and the growing trend is to focus on "AgTech" or the development of agricultural techniques through new technologies. According to the Overseas Development Institute study, "the growth of mechanization, bio-technology, nanotech and digitalization are changing agricultural production, with greater interactions than ever before with manufacturing and services" (Krishnan, 2018). SEZs are well positioned to play a role in linking agriculture, industrialization and technology together since "agro-industrial parks" are also on the rise on the African continent (Kladaki and Cai, 2020).

The growing trend is to focus on "AgTech" or the development of agricultural techniques through new technologies.

28 For more information, see the official portal of BRIGC at http://en.brigc.net/.

Figure 4: Global production of rice by region, 2018



Source: Our World in Data (2018).

In terms of engagement modes, STI cooperation in the above five fields can take various forms, for example research and academic cooperation, financing and technical support for local project and infrastructure development, private investments and joint-ventures, public-private partnerships, equipment and technology transfer and capacity building through training of private and public sector staff. Overall, the three main needs of developing countries to realize progress on STIs are finance, ecosystem enablers and skills. SEZs could be favourable grounds to address these shortcomings. The zones, supported by Chinese financing on the BRI, could incorporate tech hubs, incubators linked with universities and training programmes to foster an innovative ecosystem. At the same time, they could help address the basic requirements for industrial development which are still lacking. As reminded by the Overseas Development Institute's study on digital economic transformation in Africa, while aiming for improvement through STI, it remains important to "first address standard constraints facing the manufacturing sector such as electricity costs and management practices. Improvements in basic infrastructure–a reliable power supply, telecommunications and roads–combined with a targeted approach to building industrial capabilities is needed" (Banga and te Velde, 2018).

4.2 The potential and necessity of triangular cooperation under the Belt and Road Initiative

This section is divided into two parts, starting with a comprehensive review of the origin and framework of triangular cooperation and an extension of it in the context of STP cooperation under the BRI. The goal is to explore the role of triangular cooperation and potential cooperation modes. STI is the most important component of STPs and a fundamental source of economic growth. Therefore, cooperation of STPs built under the

framework of triangular cooperation can better promote collaborative innovation and commercialize cooperation in STI.

4.2.1 Science and technology park cooperation under the Belt and Road Initiative from the perspective of triangular cooperation

The core objective of triangular cooperation is to fully exploit comparative advantages of each participant so as to generate synergies and mutual benefits.

Triangular cooperation can be seen as an expansion and extension of South-South cooperation. According to the United Nations Office for South-South Cooperation (UNOSSC), "triangular cooperation" refers to a model of cooperation in which traditional donors and multilateral international organizations promote SSC by providing funding, training, management and technical expertise. That is, cooperation between two or more developing countries supported or assisted by developed countries or international organizations.[29] The core objective of triangular cooperation is to fully exploit comparative advantages of each participant so as to generate synergies and mutual benefits. To be specific, during the process of cooperation, traditional donors and developing countries learn from each other and share knowledge. This model of international cooperation is not only in line with the development trend of globalization and diversified global governance, but also helps to improve the effectiveness of development cooperation and significantly enhanced the role of emerging development cooperation players, developing countries and LDCs.

Triangular cooperation can be of great importance and value to successful STP cooperation. First, it has been extensively studied in the literature that a diverse culture in the workplace is highly conducive to the generation of innovative ideas (Levine, 2020; Gassman, 2001). By definition, triangular cooperation is more culturally diversified than SSC and north-south cooperation. Moreover, the innovation opportunities that have been available to international organizations and countries in the North are, by and large, greater than have been available to countries from the South. As a result, SSC cooperation on technology can be significantly enhanced if third parties from the North or international organization are involved.

29 It is worth noting that triangular cooperation has been defined and interpreted by different international organizations and governments. For instance, OECD defined triangular cooperation as a partnership between Development Assistance Committee member countries and countries of the South to implement development programmes or projects in recipient countries (OECD, 2009). The German government further defined triangular cooperation as the joint planning and implementation of cooperation projects between Development Assistance Committee donors, emerging donors and recipient countries. Although there is no globally proscribed definition of triangular cooperation, by nature it is a cooperation mechanism involving three or more parties from traditional donors, multilateral international organizations, SSC participants and recipient countries. For a more thorough discussion on triangular cooperation, see: www.unsouthsouth.org/about/about-sstc/.

4.2.2 Leveraging triangular cooperation for science and technology park cooperation under the Belt and Road Initiative

This report hopes to promote a triangular cooperation model to enhance STP cooperation under the BRI. Specifically, this would mean one of the parties is from the countries along the BRI route, one from the world's largest developing country (i.e., China) and the third party is from Northern countries or multilateral international organizations, which are dominated by Europe and the United States. Two models of triangular cooperation in STPs are proposed below.

Model 1: Develop STPs from scratch and engage triangular cooperation with developed countries or multilateral organizations

BRI STP cooperation may take place with the development of industrial parks with high-tech enterprises as the main channel, and STI as the driving force. This cooperation would involve planning, design, construction, capital attraction, marketing and operation management of STPs. China's successful experience in promoting rapid economic development through the establishment of various types of parks (such as industrial parks, high-tech development zones and special economic zones), and its strong infrastructure capacity accumulated over the past four decades, have given China a clear comparative advantage in advancing cooperation of STPs under the BRI (i.e. cooperating with countries located along the BRI). The construction of STPs and related infrastructure requires large and continuous investment, and traditional aid countries have established special funds for improving infrastructure in developing countries, such as the China Prosperity Strategic Programme Fund, established by the United Kingdom Foreign and Commonwealth Office. One of the main targets of this fund is to provide financial support to Chinese infrastructure-based enterprises to improve the infrastructure of developing countries, helping them to remove development bottlenecks and achieve the British government's foreign policy objective of "creating the conditions for global growth." Therefore, this cooperation model led by China can combine the financial advantages of traditional donors with China's advantages in infrastructure construction capabilities to jointly develop STPs in countries along the BRI. Such a model does not only meet the capital needs of Chinese enterprises for overseas investment and reduce the risk of overseas investment, but also improves the effectiveness of financial assistance from traditional donors to developing countries, as good infrastructure can ensure sustainable development and industrialization. This is especially true for countries that are in the early stages of development and have not yet industrialized. Although the countries along the BRI are at different stages of development, ranging from high-income developed countries to LDCs, the vast majority are developing countries and emerging economies.

Multilateral organizations could also serve as a key third player in forming triangular cooperation and in advancing SSC on technology. For example, China, Ghana and UNDP have been involved in a triangular project on renewable energy technology transfers. China and Ghana are leading the substantive work in this project with the goal of diffusing technologies from China to Ghana so as to help the country reduce greenhouse gas

emissions, while the UNDP provides support with donor relations, project management and facilitation through its country offices.

Model 2: Triangular cooperation with multinational companies

Large multinational enterprises can also be important players in triangular cooperation models. Since the 1980s, thanks to the rapid development of ICT, communication costs and transaction costs have continued to fall, and the global economy has entered an era of deep integration. Large multinational enterprises have organized their production activities globally according to the comparative advantages of each region. Products can be manufactured or assembled separately, forming global value chains that have dominated global economic development since the beginning of the 21st century. Generally speaking, a main feature of global value chains is that large multinational enterprises from developed countries, such as Europe and the United States, have a strong voice and dominant power over the different production stages.

According to field research conducted in major labour-intensive manufacturing clusters in China, many large Original Equipment Manufacturers (OEMs) located in the Pearl River Delta and the Chang Jiang River Delta regions have been asked to move their production sites out of China (Xu et al., 2017), preferably to Southeast Asia and Africa, where costs of production factors are lower. The decision-making behind the relocation has been a long process. The bargaining power of OEMs is generally low in the decision-making process. In most cases, OEMs can only cooperate with the strategic planning of international buyers that are mainly from countries in the North. As a result, multinational companies, like international buyers, which occupy an important position in value chains, have a dominant power and voice in the process of the global distribution of production. Therefore, introducing large multinational enterprises with dominant positions in global value chains into the framework of triangular cooperation and BRI STP cooperation is an important means to connect the host country with the international market. In other words, under the directive of international buyers from the North, Chinese OEMs can relocate production to an unindustrialized country from the global South. This mode of cooperation can combine the comparative advantages of multinational enterprises in innovation, management and international operation experience with China's advantages in manufacturing capacity, thereby promoting industrial development in developing countries. It should be noted that Chinese OEMs are usually not considered high-tech enterprises, which seems to be different from the objectives and positioning of technology parks. Chinese enterprises in this cooperation model are more likely to help the host country to cultivate manufacturing capacities, provide jobs and generate foreign exchange through exports, while the circulation, absorption, transformation and application of innovation factors are more likely to come from large multinational companies with a dominant position in global value chains.

Whichever of the two models is used, STPs established in host countries should actively apply for membership in multilateral international organizations, such as the International Association of STPs (IASP). As the oldest STP association in the world with the largest number of member companies and countries, IASP is the best platform to

strengthen science and technology exchange, sharing and cooperation between STPs in the host country and STPs around the world, which is important for deepening the co-operation of STPs under the BRI.

The aim of DFIs is to generate development impact while at the same time deliver a financial return.

4.3 The potential and necessity of involving Development Finance Institutions

This section will discuss the potential and necessity of development finance for STI cooperation under the framework of the BRI, and SSC in general. The main difference between development finance and commercial finance is their underlying mission. Commercial finance focuses on profit maximization, while development finance takes the long-term route and prioritizes development impacts on the local economy. Institutions that specialize in development finance activities are defined as Development Finance Institutions (DFIs). The main character of DFIs is that they mainly represent governments to invest in sustainable and profitable businesses in less developed countries. The aim of DFIs is to generate development impact while at the same time deliver a financial return. DFIs also seek to promote responsible corporate governance and to uphold social and environmental standards in the projects in which they are involved (Dalberg, 2011). An institution can be classified as a DFI if it satisfies the following five criteria: 1) a separate legal personality and financial account; 2) deployment of financial instruments; 3) funding sources beyond government transfers; 4) a public policy-oriented official mandate; and 5) government sponsorship. Typical DFIs include: a) international finance institutions, such as the International Finance Corporation and International Monetary Fund; b) multilateral development banks, such as the World Bank and Asian Development Bank; c) national development banks, such as the China Development Bank and Bank aus Verantwortung; and d) investment funds and guarantee funds, such as the China-Africa Development Fund. Using the Asian Infrastructure and Investment Bank as an example, it released a "Digital Infrastructure Sector Strategy" to play a catalytic role in financing the growth of digital infrastructure in Asia and to bridge the digital divide in the region.[30] Apart from these government-sponsored institutions, private finance institutions may also be involved in development finance. They might be motivated to do so due to a pure wish to shoulder a share of social responsibility, the need to polish one's public image or because of pressures from policy burdens. In addition, if DFIs manage to crowd-in private capital by incubating a profitable market or innovating effective financial instruments targeting specific development issues, private institutions may also want to participate for profit making purposes.

Xu et al. (2021) identified three key functions of DFIs for contributing to global development: fixing market failure, incubating markets and speeding up industrialization. Infrastructure is perhaps one of the most representative areas where market failures

30 For more information, see: www.aiib.org/en/policies-strategies/operational-policies/digital-infrastructure-strategy/.content/_download/AIIB-Digital-Strategy.pdf.

occur, and it is also one of the largest obstacles faced in the global South. A sizable population[31] in developing countries is still without basic access to the internet and digital devices, which is essential for kick-starting the digitalization process and participation in STI cooperation in any form. UNCTAD (2018) identified communication networks, software packages and data platforms as the three major components of digital infrastructure. Lack of such infrastructure in the global South has proved a bottleneck to digitalization progress.

DFIs have already started to play a role in closing the infrastructure gap, which directly contributes to international STI cooperation. For example, the African Development Bank (AfDB) established the Africa Digital Financial Inclusion Facility (ADFI) in 2019 to address systemic barriers to the growth and uptake of digital financial services by making strategic and catalytic investments. Digital infrastructure is a key working pillar for ADFI, which committed 60 percent of its investments to support national and regional digital financial services-related infrastructure and data platforms in particular. In February 2021, AFDI invested $2.33 million in the EthSwitch Share Company to build a payment platform that will ensure digital financial services interoperability for multiple services in Ethiopia. As a result, financial inclusion in Ethiopia is expected to increase from 22 percent in 2017 to 60 percent by 2025.

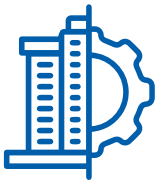
STPs are also projects that require large-scale initial investment. Previously, the finance source for industrial parks was either state or private sectors, both of which have their own merits and limitations. While government-financed parks are likely to be weak in commercial sustainability, private-sources are often too small and unstable to invest in STI industries. DFIs, however, can close the market gap. It is worth noting that DFIs do not only provide financial support to developing countries, but also technology assistance to ensure sustainable development of projects.

Industrial parks have been used as a major policy tool for China's SSC cooperation. Previously, industrial parks that qualified to be part of the BRI projects were mainly funded through state loans, aid or private investments. There were experimental actions to use DFIs to support China's overseas industrial parks, such as the China-Africa Development Fund (CAD Fund). CAD is the first fund focused specifically on large scale investment in Africa. A major Chinese DFI, the China Development Bank, is a shareholder in the CAD Fund, and provides resources and support. CAD has supported the development of industrial parks in countries like Ethiopia and Nigeria.[32] The engagement of CAD has not yet shown clear success, as the general profitability and sustainability of industrial parks in less-developed countries remains to be an unsolved issue. However, this does not diminish the potential of DFIs to facilitate the development of industrial parks.
Another two main functions of DFIs, incubating markets and speeding up industrialization,

31 According to a report in 2016 conducted by Facebook, the largest social media platform in the world, in emerging economies, especially in rural and remote areas, more than four billion people remain unconnected to the internet.

32 Information collected by INSE fieldwork in Ethiopia (2016) and Nigeria (2019).

are both highly relevant to STI cooperation. Mazzucato (2016) defined an "entrepreneurial state" as one in which the government plays the leading role in mission-oriented investments. In this framework, DFIs provide a concrete mechanism for fulfilling missions pre-defined in bold public policy plans, such as motivating green innovation (Mazzucato and Penna, 2016). This mechanism may also work in the case of digitalization and STI development in developing countries.



DFIs could enhance STI cooperation by closing the infrastructure gap, supporting industrial policies towards STI-related industries and providing financial and technical support for start-ups in developing countries.

The private sector, especially start-ups, could play a key role in bridging the digital divide, making digital technologies more accessible and inclusive to help achieve the SDGs.[33] In a developed economy, high-tech start-ups are usually supported by sophisticated venture capital systems. In developing countries, however, the role of venture capital in supporting start-ups has often been taken by government. DFIs, on the other hand, could potentially be more suitable than government in fostering start-ups in economies without an advanced venture capital system. DFIs, especially international ones, often have close relationships with different stakeholders and are in a strategic position to foster multi-cooperation and to promote South-South cooperation.

To sum up, DFIs could enhance STI cooperation by closing the infrastructure gap, supporting industrial policies towards STI-related industries and providing financial and technical support for start-ups in developing countries.

33 For more information, see: www.weforum.org/agenda/2020/09/sdi20-united-nations-sdg-digital-cooperation/.

CHAPTER 5. CONCLUSION AND POLICY RECOMMENDATIONS

Technology has taken centre stage of modern economic growth. In particular, rapid advances in information technology have drastically transformed the organization and production of economic activities. The recent outbreak of the COVID-19 pandemic further propelled companies and countries to adopt digital technologies to cope with the pandemic and many of these changes could be here for the long haul or may even be non-reversible. As advanced countries are the leading players in technological innovation and the less developed ones may be left far behind in the age of innovation-driven growth, there is an urgent need for countries in the global South to strengthen technology cooperation both with countries in the global North and among themselves. The latter type of cooperation is arguably even more important and needed, as the absorptive capacity of less developed countries may not allow them to successfully assimilate (frontier) technologies from advanced countries (Griffith, Redding and Van Reenen, 2004). After four decades of fast economic growth, China has gradually transformed form a low-income technologically backward country to a rising star in global innovation and will soon join the ranks of high-income economies. Joined by over 140 countries around the world, of which 50 come from Africa, the Belt and Road Initiative launched by China plays a pivotal role in promoting South-South cooperation (SSC) in technology in the contemporary world.

There is an urgent need for countries in the global South to strengthen technology cooperation both with countries in the global North and among themselves.

The aim of this study is to explore avenues of cooperation between China and other countries in the global South in setting up STPs under the BRI, which could serve as the cornerstone for contemporary SSC in scaling up technological transfers and innovation as well as bridging digital divides with advanced countries and accelerating digital transformation in the global South. Given the rise of protectionism and the spread of anti-globalization sentiment in recent years, this study is both timely and critically important for developing countries in the age of innovation-driven growth. This research draws on the theory of New Structural Economics and combines desk research with field research (i.e., interviews with representatives from the Ministry of Science and Technology of the People's Republic of China) for analysis. Although they may not be exhaustive, a set of targeted policy recommendations for key stakeholders are provided below as a means to pave the way for closer and more successful SSC on technology and digital transformation under the BRI.

First, Chinese investors and their stakeholders should consider carrying out projects in accordance with the green BRI guidelines, as well as conducting prior due diligence to understand the localities of the host country. Project managers, especially private firms that are profit-oriented, must demonstrate skills and have a high sense of accountability. In other words, private firms should not only have full knowledge and understanding of BRI green practices, but also be capable of adhering to them. Furthermore, knowledge

of local conditions, such as the availability of raw materials, skills, labour laws, culture, stability, market mechanisms and potential investment incentives, will provide valuable information on how to optimize resource allocation, evaluate feasibility and predict the viability of investment projects. Subcontracting to or partnering with local stakeholders is a great channel to build trust and to diffuse technology and knowledge to local partners.

Second, to bridge digital divides and promote digital transformation in countries from the global South, host governments should give priority to foreign investments in sectors that support the use of digital technologies. This is especially important in the wake of the COVID-19 pandemic as countries increasingly turn to digital technologies for economic activities and social connections. While China was the epicentre of the pandemic when it broke out, the containment measures taken by the Chinese government were highly effective and the timely use of digital technologies helped the country to become the only major economy in the world achieving positive economic growth in 2020. Given China's successful experience in using digital technologies during the pandemic and the fact that China has a fairly large number of high-tech companies looking for expansion in foreign markets (e.g., Huawei, Tencent), targeted efforts to attract investments from those companies are more likely to pay off.

Third, the use of digital technologies and digital transformation at large will be accompanied by the generation of large volumes of data. Issues at the legislative level regarding the use, protection, storage and property rights of those data remain unresolved and are rapidly evolving. Countries from the global South should work closely with and learn from those that have made significant breakthrough on this front. For example, China released its first Data Security Law in June 2021, which became effective in September 2021. In addition, the recent launch of the African Continental Free Trade Agreement (AfCFTA) in early 2021 is helpful for developing unified regulatory standards for the use and protection of data. As the continent with the largest number of developing countries, a unified market created under AfCFTA will provide extra incentives for foreign investors (e.g., China) to come to Africa, further advancing South-South cooperation.

Fourth, alternative and complementary sources of funds to the BRI, such as the involvement of DFIs or the inclusion of a Northern stakeholder to form triangular cooperation, are highly recommended. In addition to cooperation built on the back of the BRI, DFIs are called to step in and help reduce the digital divide. China, through the BRI agenda, is already committed to investing in construction of ports, roads, railways, airports, power plants and telecommunications networks in recipient countries. This undoubtedly gives BRI countries an important advantage over non-recipient countries. However, to diversify their SPT financial portfolio and mitigate liabilities vis-à-vis the Chinese government, BRI countries may need other funding entities, such as DFIs and venture capital. Most DFIs (e.g., the International Monetary Fund, the World Bank, the Asian Development Bank, the China-Africa Development Funds) have flexible financial schemes, and with their own agenda and financial instruments, can assist in incubating innovative businesses and speeding up industrialization.

Fifth, STP developers and the International Association of Science Parks and Areas of

Innovation (IASP) are encouraged to promote interaction, share information with other regional STPs and follow up on delivery. Sharing experiences between STPs in the South can help with efficient troubleshooting and staying proactive. The mission of IASP is to keep all STPs around the world connected and ensure their exposure on the global scene. SSC countries can network at the regional level. Furthermore, to deliver on expectations and stay competitive, STPs need to be evaluated using dynamic performance data, which are currently lacking. In the hope of helping to solve data issues, a monitoring and evaluation programme has been initiated by the Peking University's Institute of New Structural Economics. STP stakeholders can support and help promote this initiative since it closes the data gap through the collection of time series on different aspects of SEZ programmes and their performance.

Sixth, to strengthen cooperation on STPs under the BRI, policymakers from China and BRI-participating countries could consider broadening the concept and framework of STP cooperation. The upgrading of the existing Chinese overseas industrial parks to focus on science, technology and innovation is one possible channel. CocoTech in the Philippines presents a good case in point, showing that homegrown innovation projects in developing countries can be further developed and expanded into full-blown STP projects. Moreover, STP cooperation could also be fostered through co-establishing institutional frameworks for the development of STPs, such as the framework of eco-industrial parks. Lastly, to better leverage China's unique role in promoting SSC on technology, current STP cooperation projects on the "soft" side (e.g., dialogues and sharing experiences) can be further improved. Learning from Japan's Kaizen training programme in Ethiopia is a good case in point.

Lastly, it is worth noting that although SSC on technology is the central focus of this research and the BRI launched by China plays a pivotal role in this regard, it is also important to have countries from the global North and/or international organizations involved. Having a third party from the global North and/or international organizations in SSC can help forge triangular cooperation, which is likely to boost the efficacy of South-South cooperation on technology and digital transformation in the global South. Traditional donors and countries from the global North can help alleviate the financial burden and can assist with building capacity and technology transfer.

References

African Development Bank (2021). Entrepreneurship and free trade: Africa's catalysts for a new era of economic prosperity.

Banga, K., and te Velde, D. W. (2018). Digitalization and the future of manufacturing in Africa. Available from: https://set.odi.org/wp-content/uploads/2018/03/SET_Digitalisation-and-future-of-African-manufacturing_Final.pdf.

Brautigam, D., Weis, T. and Tang, X. (2018). Latent advantage, complex challenges: Industrial policy and Chinese linkages in Ethiopia's leather sector. China Economic Review, 48, 158-169.

Breisinger, C., Abdelatif, A. and Raouf, M., and Wiebelt, M. (2020). COVID-19 and the Egyptian economy: Estimating the impacts of expected reductions in tourism, Suez Canal revenues, and remittances. IFPRI Regional Program Policy Note 04. Available from: https://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/133663/filename/133874.pdf.

Chakraborty, T., Gundimeda, H. and Kathuria, V. (2017). Have the Special Economic Zones Succeeded in Attracting FDI? — Analysis for India. Theoretical Economics Letters, 7(3), 623-642.

Deng, F., Wang, Y. and Liang, X. (2020). China's technology spillover effects in the countries along the Belt and Road – Evidence from 49 BRI Countries. Applied Economics, 52(51), 5579-5594.

Ericsson, F. and Mealy, S. (2019). Connecting official development assistance and science technology and innovation for inclusive development: Measurement challenges from a development assistance Committee perspective. OECD Development Cooperation Working Papers No.58.

Ganchero, E. G. and Manapol, P. (2007). Coco technologies: Providing livelihood opportunities for poor coconut farmers through value-adding. Available from: www.value-chains.org/dyn/bds/docs/739/Philippines_CocoTech%20FINAL.pdf.

Gassmann, O. (2001). Multicultural teams: Increasing creativity and innovation by diversity. Creativity and Innovation Management, 10(2), 88-95.

Griffith, R., Redding, S. and Van Reenen, J. (2004). Mapping the two faces of R&D: productivity growth in a panel of OECD industries. Review of Economics and Statistics, 86(4), 883-895.

Gutierrez, E., Rudolph, H. P., Homa, T. and Beneit, E. B. (2011). Development banks: Role and mechanisms to increase their efficiency. World Bank Policy Research Working Paper 5729.

Hausmann, R. and Rodrik, D. (2003). Economic development as self-discovery. Journal of Development Economics, 72(2), 603-633.

Kladaki, S. and Cai, J. (2020). Rise of Special Economic Zones in Africa: Can Agricultural Processing Be the Next SEZ Success Story? Available from: https://developmentreimagined.com/2020/12/28/rise-of-special-economic-zones-in-africa-can-agricultural-processing-be-the-next-sez-success-story/.

Krishnan, A. (2018). How AgTech is changing East African economies. Available from: www.odi.org/blogs/10693-how-agtech-changing-east-african-economies.

Levine, S.R. (2020). Diversity Confirmed to Boost Innovation and Financial Results. Available from: www.forbes.com/sites/forbesinsights/2020/01/15/diversity-confirmed-to-boost-innovation-and-financial-results/?sh=d2a491fc4a6a.

Lin, J. Y. (2009).Economic Development and Transition: Thought, Strategy, and Viability. Cambridge: Cambridge University Press.

Lin, J. Y. (2012). New Structural Economics: A Framework for Rethinking Development and Policy. Washington DC.: World Bank.

Lin, J. Y. (2016). The latecomer advantages and disadvantages: A New Structural Economics Perspective. In Andersson and Axelsson (editors), Diverse Development Paths and Structural Transformation in the Escape from Poverty, Cambridge: Cambridge University Press.

Lin, J. Y. (2017). Industrial policies for avoiding the middle-income trap: anew structural economics perspective. Journal of Chinese Economic and Business Studies, 15(1), 5-18.

Mazzucato, M. (2016). From market fixing to market-creating: A new framework for innovation policy. Industry and Innovation, 23(2), 140-156.

Mazzucato, M. and Penna, C. C. (2016). Beyond market failures: The market creating and shaping roles of state investment banks. Journal of Economic Policy Reform, 19(4), 305-326.

Nepelski, D. and De Prato, G. (2015). International technology sourcing between a developing country and the rest of the world. A case study of China. Technovation, 35, 12-21.

Newman, C. and Page, J. (2017). Industrial clusters: The case for Special Economic Zones in Africa. WIDER Working Paper Series wp-2017-15.

OECD (2015). Participation of developing countries in global value chains. Available from: www.oecd.org/countries/mali/Participation-Developing-Countries-GVCs-Summary-Paper-April-2015.pdf.

OECD (2020). Greater harmonization of clinical trial regulations would help the fight against COVID-19. https://read.oecd-ilibrary.org/view/?ref=135_135577-5gnj8yvrlg&title=Greater-harmonisation-of-clinical-trial-regulations-would-help-the-fight-against-COVID-19.

OECD (2020). Why open science is critical to combatting COVID-19. Available from: https://read.oecd-ilibrary.org/view/?ref=129_129916-31pgjnl6cb&title=Why-open-science-is-critical-to-combatting-COVID-19.

Romer, P. M. (1990). Endogenous technological change. Journal of Political Economy, 98(5), S71–S102.

Solow, R. (1956). A Contribution to the theory of economic growth. Quarterly Journal of Economics, 70(1), 65-94.

Sonobe, T. and Otsuka, K. (2011). Cluster-based industrial development: A comparative study of Asia and Africa. UK: Palgrave Macmillan.

Sutton, J. (2005). Competing in capabilities: An informal overview. Available from: personal.lse.ac.uk/sutton/competing_capabilities_informal_washington.pdf.

United Nations Conference on Trade and Development (2015). Policies to promote collaboration in science, technology and innovation for development: The role of science, technology. Available from: https://unctad.org/system/files/official-document/ciid30_en.pdf.

United Nations (2019a). Establishing science and technology parks: A reference guidebook for policymakers in Asia and the Pacific. Available from: www.unescap.org/resources/escap-stp-2019.

United Nations (2019b). The Age of Digital Interdependence. Available from: www.un-.org/en/pdfs/DigitalCooperation-report-for%20web.pdf.

United Nations (2020). Report of the Secretary-General roadmap for digital cooperation. Available from: www.un.org/en/content/digital-cooperation-roadmap/assets/pdf/Roadmap_for_Digital_Cooperation_EN.pdf.
Villena, V.H. and Gioia, D.A. (2020). A more sustainable supply chain. Harvard Business Review, March/April, 84-93.

World Bank (2017). Special Economic Zones: An operational review of their impacts. World Bank, Washington, DC. Available from: https://openknowledge.worldbank.org/handle/10986/29054.

Xu, J., Gelb, S., Li, J., and Zhao, Z. (2017). Adjusting to rising costs in Chinese light manufacturing: What opportunities for developing countries? Overseas Development Institute: Research Reports and Studies.

Xu, J., Marodon, R., Ru, X., Ren, X. and Wu, X. (2021). What are public development banks and development financing institutions? Qualification criteria, stylized facts and development trends. China Economic Quarterly International, 1, 271-294.

Zeng, Z. (2015). Global experiences with special economic zones – With a focus on China and Africa. Journal of International Commerce, Economics and Policy, 7(3), 1-27.

United Nations
Office for South-South Cooperation