

SWOT Analysis on the Belt and Road Innovation Cooperation between Guangdong and Brazil

Jiaming Liang, Jing Huang, Haibin Huang*

Guangdong Science and Technology Evaluation Center, Guangzhou 510070, China

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Abstract: As China-US relations and COVID-19 situation are getting more and more serious, the cooperation between the Guangdong and Portuguese-speaking countries may also be affected. This article starts with the research on the cooperation mechanism and situation between China and Brazil under the Belt and Road Initiative. It uses SWOT to analyze Brazil's innovation advantages and shortcomings, the opportunities brought by scientific and technological cooperation and how to handle to the corresponding threats. This article attempts to propose areas and suggestions for the development of scientific and technological cooperation between the two sides.

Keywords: The Belt and Road Initiative; Guangdong, Brazil; Science and technology cooperation

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***Corresponding author:** Haibin Huang, leungkaming@qq.com

1 Introduction

Brazil's international strategy consists of four main aspects: promoting regional integration to achieve the integration of South America; giving priority to the development of "South South cooperation" to build a community of shared future for developing countries; carrying out North South dialogue based on the principle of equality and independence; broadening the international dimension of Brazil diplomacy through multilateral participation.(Zhou, 2019) Among the strategies, China is an important

part of South South cooperation and multilateral participation. In addition, Brazil is China's largest trade partner in Latin America. With the bilateral trade volume reaching U.S. \$111.18 billion in 2018, Brazil has also become the first Latin American country with a trade scale of more than U.S. \$100 billion with China. The Belt and Road Initiative (BRI), the world's largest public goods cooperation, was further promoted in the eleventh meeting of the BRICS leaders in Brasilia, Brazil, in November 13, 2019.(Deng, 2019) Guangdong is a metropolitan area proposed to develop bay area economy, considering Brazil's international strategy and its trade relations with China, the cooperation is an opportunity to help creating the common destiny of mankind and facing the challenges brought by COVID-19.

2 General situation of scientific and technological cooperation

In May 2017, BRI international cooperation summit, President Xi Jinping said Latin America would be included in the "natural extension of the maritime Silk Road". BRI has fully covered Asia, Europe, Africa, South America and Oceania. This is the largest platform for public goods cooperation provided by the largest emerging economy to the world. In January 2018, the second ministerial meeting of the China-Latin America and Caribbean Community Forum held in Chile adopted and issued the BRI Special Statement. China issued an official invitation to 34 Latin American countries, which opened the prelude to the extension of the BRI.

2.1 BRI projects and scientific research cooperative projects in Brazil

Although up to now, Brazil has not signed the Memorandum of Understanding with the Chinese government on the BRI, at least 4 BRI infrastructure projects have been implemented in Brazil. Among them, the Port of St. Louis project attempted to build a smooth channel, to conduct more extensive integration of Latin American infrastructure, and the other projects are power infrastructure projects, similar to the situation in Portugal, the participation of Chinese power companies in the construction of Brazil's power grid shows that Chinese companies have advanced technological competitiveness especially in ultra-high voltage transmission. Brazil is rich in water resources, and ultra-high voltage power transmission technology has solved the problem of power transmission. The cooperation between China Three Gorges Corporation (CTG) and Eletrobras Furnas has started since 2011, now CTG holds three hydroelectric power plants and 11 wind power plants in Brazil, with a total installed capacity of 687 MW. If Brazil officially accepts the BRI invitation, larger-scale and more favorable cooperation can be established.

The Shanghai Institute of Applied Physics of the Chinese Academy of Sciences and the Brazilian National Research Center for Energy and Materials have carried out cooperation focusing on high-energy particle accelerators and synchrotron radiation and applications. In 2013, the institute undertook the complete machine project of SIRIUS light source linear accelerator in Brazil; in July 2017, the 150 MeV electronic linear accelerator developed by the Chinese side has been sent to Brazil by sea. (Tong and Sun, 2018) This cooperation is the first case of the Chinese Academy of Sciences to output high-tech products in the field of synchrotron radiation, and the cooperation is of great significance.

2.2 Cooperation projects attempted in the past

The "China-Brazil Climate Change and Energy Technology Innovation Center" established in 2009 has a goal to establish innovations in climate and energy technologies in the field of technical and scientific cooperation; by encouraging exchanges of highly educated students, professors and researchers between the two countries, training professionals, and developing detailed strategies and plans to

help the progress in engineering and environment. the center is committed to developing wind power between the two countries, and China is a world leader in technology development and wind and solar equipment production. At the same time, China is the world's largest producer of solar energy equipment and has the largest installed capacity of wind energy, which means that Brazil can benefit from learning technology.

In terms of biofuels, Brazil is not only a leader in technology, but also unique in terms of policy, industrial chain and financial support, and is willing to transfer technology and share some technology patent rights with China. As the first country in the world to achieve sustainable use of biofuels, Brazil has outstanding practical experience in the development of bioethanol and biodiesel. (Wang, 2017) However, there is currently no large-scale application of biofuels in China. The main reason may be that unlike Brazil, China itself is a grain importer and does not have the conditions to develop biofuels.

2.3 Main cooperation mechanism

The China-Brazil High-level Coordination and Cooperation Committee established in 2006 is the general mechanism for advancing policy coordination and cooperation in various fields between the two countries. There are more than a dozen special subcommittees to carefully plan the cooperation policy arrangements between the two countries in different fields. (People's Daily, 2015) At present, the committee is the most comprehensive and efficient bilateral cooperation mechanism among those between China and Latin American countries. In the author's opinion, in Guangdong, there are 2 special economic zones and many cities of Guangdong Province, it requires a high level mechanism for coordinating the cooperation.

In the "Joint Action Plan of the Government of the Federal Republic of Brazil and the Government of the People's Republic of China from 2015 to 2021", the two countries decided to promote scientific and technological cooperation by constructing technology districts, funding business models, carrying out R&D project, constructing value chains and supply chains. Guangdong has many national high-tech zones, and as a frontier of reform and opening up, the business atmosphere is strong, the technology level is high,

and it is also the birthplace of the world factory, that's why the industry chain is well-equipped, and can respond well to the requirements of scientific and technological cooperation.

3 General situation of innovation of Brazil

The Ministry of Science, Technology, Innovation and Communications (MCTIC) is of great importance in the innovation strategy of Brazil, and its subsidiary Department of International Affairs and Cooperation is mainly responsible for international cooperation in the field of science and technology. By understanding the structure and functions of the department, the author believes that the innovation system has set up corresponding departments from basic research to market transformation, from the formulation of funding budgets to ex-post evaluations. Although too many departments may have coordination problems, they are comprehensive covering every aspect of innovation is necessary to establish an innovation system.

3.1 Strengths in Brazil's scientific and technological innovation

From the perspective of basic research, Brazil's elite education is excellent, and a number of qualified scientists and engineers have been trained. In 2016, Brazilian researchers published 46,230 SCI papers, accounting for half of the papers published in Latin America. Among them, the disciplines with the highest citation rates were physics, space science (including astronomy), spiritual psychology, mathematics, and environmental ecology. (Tong Sun, 2018) From the perspective of applied research, there has been a major breakthrough in nuclear fuel field (Liu, 2018), and there have been space science cooperation with NASA and China, such as China-Brazil Earth Resources Satellite (CBERS).

3.2 Weaknesses in Brazil's scientific and technological innovation

The six aspects that restrict science and technological innovation in Brazil are: short planning cycles due to macroeconomic fluctuations, financial constraints, weak intellectual property system, low level of

private sector research institutions, low mobility of government resources for technological innovation and dependence on natural resource development.

Data analysis from recent years: First, the investment in innovation is low. It can be seen from Figure 1 that Brazil's R&D investment accounts for 1.183% of GDP on average. Although Latin America and the Caribbean are already the countries with the highest proportions, Brazil's R&D investment accounts for a relatively low proportion of GDP compared to developed countries.

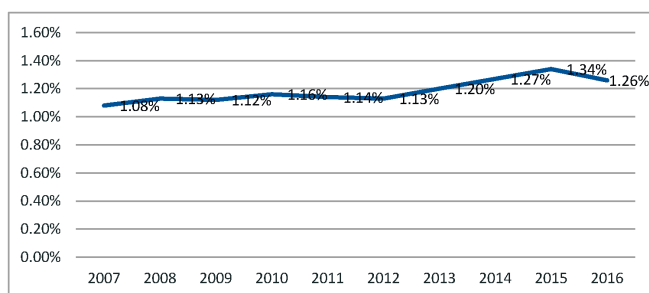


Figure 1. Gross Domestic expenditure on R&D (GERD) as a percentage of GDP

Data: Red de Indicadores de Ciencia y tecnología

Second, the efficiency of scientific researchers is relatively low, The brain drain problem is relatively serious in Brazil.(Zhang and Wang, 2019) By comparing Figures 2 and 3, in the case of similar SCI papers, the per capita amount of scientific research by Brazilian scientific researchers is nearly double that of Portugal.

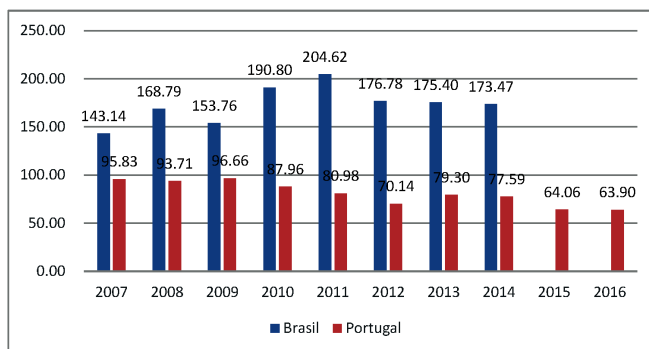


Figure 2. Gross Domestic expenditure on R&D (GERD) per researchers in thousand dollars US\$

Data: Red de Indicadores de Ciencia y tecnología

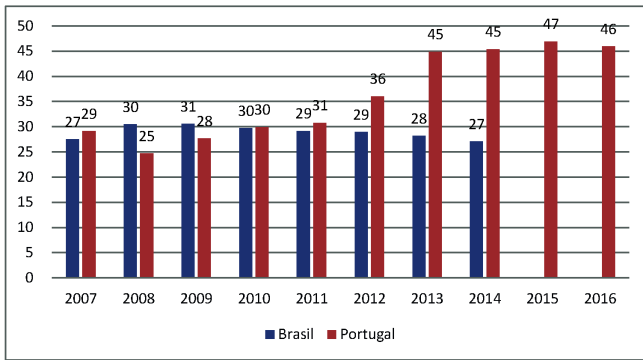


Figure 3. SCI publications per 100 researchers (EJC)

Data: Red de Indicadores de Ciencia y tecnología

The third is that the number of patents is relatively small. As can be seen from FIG. 4, although the number of patents is on the rise, as a large country with a population of 200 million, the absolute value of patents is too few.

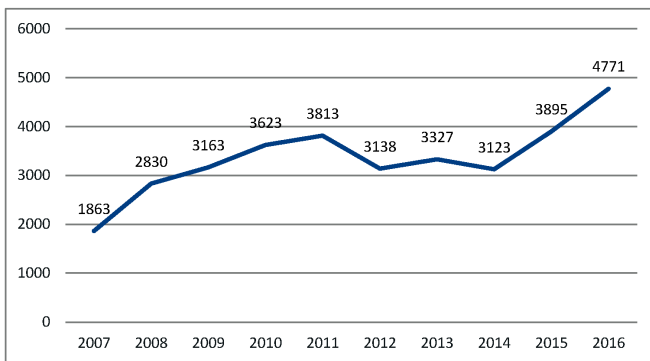


Figure 4. Issued Patent

Data: Red de Indicadores de Ciencia y tecnología

4 Opportunities brought by cooperation

BRI is attractive to more and more developing countries. The infrastructure network will allow businesses to carry out along the route, connecting to distant markets to obtain or provide goods, jobs and services. Carrying out scientific and technological cooperation between the two countries is a reasonable extension of the trade, and the technological achievements can also be provided in the market.

4.1 From the perspective of Brazil

During the construction of the BRI, with the deep integration of the development of the global innovation economy, the development of "technology and talent" highlights the importance. Therefore, it is necessary to increase R&D investment in various ways Technological cooperation with Guangdong can bring Brazil scientific research funds, talents, patents and other innovative conditions that Brazil

wants. If Brazil can rank innovation as the number one strategy for national development, deepen the industry-university-institute mechanism internally, and actively expand international industry-university-institute research cooperation to stimulate the enthusiasm of Brazilian companies for scientific and technological innovation, making improvements in innovation ability and the transformation of the innovation economic structure.

4.2 From the perspective of Guangdong

The bilateral cooperation between China and Brazil is the cooperation of the two largest developing countries, and there are also mechanisms of the BRICS countries. Therefore, the Macao Forum as a multilateral cooperation mechanism has not played a very large role in the cooperation between the two countries. The author believes that with the deepening of the cooperation between Guangdong and Brazil, it will help Macao improve its position in bilateral relations and further strengthen the role of the Macao Forum. At the same time, at present, the country hopes to build Macao into a Portuguese speaking countries currency clearing center, to explore the path of RMB internationalization, and the settlement of RMB and reals in Macao can provide convenience for the two countries. At the same time, Brazil's unique technologies in clean energy and agriculture are attractive to Guangdong.

5 Possible threats

In recent years, the development direction of Chinese politics has greatly disappointed policy makers and policy analysts in Western countries. The socialist market economic rules adhered to by China are regarded as "state capitalism". While the pandemic caused a substantial blow to the global economy, it also caused a blow to public opinion on China.

5.1 Impact of the relationship between China and the U.S.

Even before the very beginning of the trade war, the U.S. positioning of China has changed from a defective partner to a strategic competitor. During this process, Brazil's attitude toward China has also undergone certain changes. During his visit to China in October 2019, Brazilian President Bolsonaro proposed that Brazil's development and investment policies and "possibly achieve a connection" to the

BRI. But at the end of December, a memorandum of understanding was signed to sign the development plan for the Americas, a strategic investment plan initiative initiated by the United States in Latin America to compete with the BRI.

Weighing all potential gains in China-Brazil relations and the possible negative effects of U.S. pressure may be two sides of a coin for Brazil. Although Brazil is the largest country in Latin America, the radiation of American political and military power in the region makes it impossible for Brazil to be interested in confrontation with the United States. Instead, it must pursue mature diplomacy in order to maximize its national interests. The author believes that at this time, Guangdong should insist on developing multilateral cooperation with countries in the world including the United States in the fields of economy, trade and technology; if the U.S. wants to sanction Huawei, Huawei should insist on cooperating with U.S. companies and continue to hire scientists from various countries, and there is no need to block Apple in China; if the U.S. officials show off the "China threat" in Brazil, and China should increase contact with Brazil to eliminate doubts.

5.2 Impact of global economical declining caused by COVID-19

The pandemic has caused countries to realize that their own manufactures are not in the country, such as the United States and Japan. Therefore, the governments of these countries advocate the withdrawal of manufactures in China. Based on labor cost factors, the author believes that the possibility of withdrawing manufactures to their own countries is unlikely to happen. Japan may target Southeast Asia Countries, while the United States target Mexico and Brazil. However, Brazil has already experienced a "middle income trap" in foreign investment. As the southern hemisphere gradually enters winter, the epidemic in Brazil might slowly become serious, and the economic recession is inevitable. Although there are some views that the "suspicious investment" of the BRI is essentially a "diplomacy debt trap", on the issue of debt, both the creditor and the debtor face certain risks. Since infrastructure is a very important part to growth of economy, the debtor will be more able to repay the debt and develop himself. China is nothing more than transplanting the experience

of developed countries to developing countries and promoting economic growth in emerging economies.

In the past, Brazil's attitude towards BRI was to find the right time, negotiate more favorable conditions, share the historical opportunities of China's development, and strive to attract more Chinese investment while Brazil can dominate its own infrastructure projects. With the comprehensive national strength, if the Brazilian government can concentrate public resources, it is actually capable of constructing such projects, but it has been unable to start construction due to various reasons such as political differences, financial budgets, or cost reductions expected from technological development, and now China's offer is already the door, instead of waiting for the most appropriate time, it is better to harvest the benefits of the projects as soon as possible to deal with the recession caused by the pandemic. If there are economic difficulties in the near future, the author believes that it can even refer to the Angola model for reasonable debt.

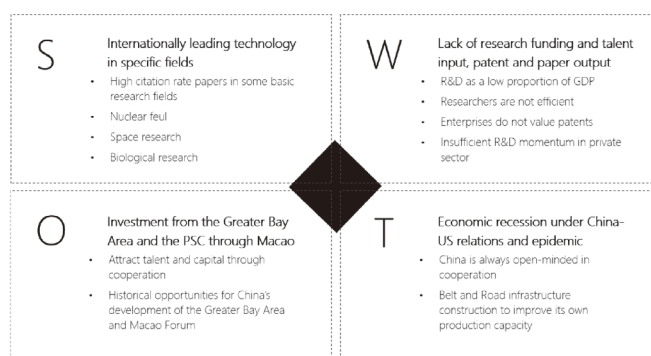


Figure 5. SWOT analysis of cooperation

As can be seen from Figure 5, the SWOT analysis of scientific and technological cooperation between Brazil and Guangdong, the author believes that it will bring historic opportunities for both sides to exert their respective advantages, participate in international division of labor and cooperation, and promote economic and social development.

6 Possible fields of cooperation in the future

The overwhelming majority of the infrastructure construction carried out by Chinese companies in Latin America is originally in the development plans of these countries. Some large projects are the dreams of Latin American countries for decades. The BRI platform has played a role in speeding up and boosting, and brought benefits

to a wider range of commerce and public services in the host country earlier. Although Brazil and Guangdong have some internationally advanced technological innovation areas, such as Brazil's civil aviation and deep-sea oil extraction industries, and Guangdong's artificial intelligence industry, due to differences in foundations, they are only suitable for unilateral technological output. Therefore, after a comprehensive comparison, the author believes that energy technology, ecological agriculture and information technology are suitable as pilot areas for in-depth cooperation.

6.1 Energy technology

Both China and Brazil are emerging countries in the field of science and technology. Strengthening cooperation in large scientific installations will greatly contribute to the joint improvement of the scientific and technological strength of the two countries. The energy industry with the core of electronic infrastructure construction also played an important role in promoting the development of international infrastructure. The increase in Brazil's industrial, commercial and residential electricity consumption and the upgrade of the level of electrification construction have effectively stimulated the demand for energy construction in the BRI. At the same time, with the implementation of the concept of sustainable development in the field of infrastructure construction, the concepts of green development and green infrastructure have been widely recognized by the international community, and the attention of clean energy such as wind energy, solar energy, nuclear energy, etc. has continuously increased.(Xu, 2019) There is a hydrogen energy high-tech industrial park, which has good prospects for cooperation with Brazil's specialty biofuel energy research.

Because China and Brazil have different comparative advantages in renewable energy, there is actually no competition. The cause of the trade dispute is the duplication of imported and domestic commodities caused by information asymmetry, and the lower prices of imported commodities have impacted domestic related industries. If the transparency of information on renewable energy is increased, Chinese and Brazilian companies can fully understand each other's industry development status, which can effectively avoid disputes caused by product similarities.

6.2 Ecological agriculture

In 2015, President Xi Jinping announced that China would provide 3 billion 100 million U.S. dollars to establish a South China Climate Cooperation Fund to help developing countries cope with climate change. In recent years, the International Cooperation Bureau of the Chinese Academy of Sciences has supported the South China Botanical Garden in Guangdong to carry out scientific research cooperation in biodiversity related fields in the upstream countries of the Amazon River in the form of projects.(Yu et al., 2018)

Due to the impact of the epidemic on the supply capacity of American agricultural products, Brazil has become the largest agricultural product import country in China. Affected by the instability of China-U.S. relations, the demand for agricultural products import may be more transferred to Brazil. The climate of Guangdong is very similar to that of Brazil, both of which belong to the humid climate of tropics and subtropics. The technologies of Guangdong Academy of Agricultural Sciences in crop improvement can be used in Brazil's agriculture. At the same time, an evolution laboratory can be built for researching, developing, exploring and screening useful plant resources in the natural conditions of Amazon River, which may collect and introduce a number of valuable species.

6.3 Information technology

At present, 5G auction in Brazil has been postponed to 2021 or 2022, which the author thinks there will still have the opportunity to carry out scientific and technological cooperation for Huawei. As a global 5G technology leader, Huawei has carried out cloud computing cooperation with MCTIC. At the same time, Huawei and ZTE have also carried out smart city cooperation with some state government of Brazil. The information technology can be combined in many fields, such as intelligent driving of new energy vehicles or artificial intelligence in other scenarios.

7 Conclusion

Today's world is undergoing profound changes, the trend of economic globalization is in-depth development, scientific and technological progress is advancing rapidly, the optimization and reorganization

of production factors, the acceleration of industrial transfer, and the increasing interdependence among countries. However, the unfair and unreasonable factors in the international economic order still exist. Economic globalization also intensifies the worldwide economic and technological competition, the rise of trade protectionism, the increase of economic and financial risks, and the further widening gap between the north and the south. These adverse factors have brought greater risks and costs to the economic and social development for the developing countries. Some developing countries are even faced the danger of marginalization.

In the face of opportunities and challenges, the author believes that the following three points will provide reference for cooperation between Brazil and Guangdong: first, both sides open technology market to each other, Guangdong can supply researchers and funds, and Brazil's unique technology is also very attractive to Guangdong. Second, scientific and technological cooperation in the fields of new energy, agriculture and information technology has a good foundation and reciprocity. Third, under the influence of China-U.S. relations and pandemic situation, in order to counter the trend of anti globalization and avoid isolationism, China holds the vision of strengthening cooperation with the world, and promotes Guangdong to establish a good cooperative relationship with Brazil through Macao.

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