

## CHAPTER 4

### A BROTHERHOOD SCIENCE DIPLOMACY: INDIA-BRAZIL COOPERATION IN BIOTECHNOLOGY

*Douglas Nascimento*<sup>1</sup>

Brazil and India share structural similarities. Both countries have vast territories, multiethnic populations, and are politically organized along the lines of mass democracies – albeit in the process of solving serious social inequalities. In addition to the abundance of natural resources, the two emerging giants have a high degree of industrialization owed to import substitution policies carried out during the second half of the last century. This inward-looking orientation has created complex yet incomplete industrial bases, marked by the coexistence of production sectors with a high-level of technological development, with others whose incorporation of technology is still incipient.

This article draws attention to a sector in which India and Brazil, if considered individually, have the potential to reach high levels of technological development and productivity; and, if considered in partnership, meet all the necessary conditions

---

1 Ministry of Foreign Affairs, Brazil.

The opinions expressed in this work are solely the author's personal views and do not necessarily state or reflect those of the Brazilian government's foreign policy.

for auspicious bilateral cooperation: the biotechnology sector. Biotechnology integrates concepts of biology, chemistry, engineering, and informatics to extract from the living system's products and services to be applied in optimizing human health, animal health, agriculture, and the use of environmental resources and energy sources.

After brief comments on the general organization of the biotechnology sector in India and Brazil, this article will present how the biotechnology sector can serve as a substrate for broader adjustments in the diplomatic activity in the areas of Science, Technology, and Innovation (STI). The guidelines for forging lasting linkages between Indian and Brazilian institutions in the production microenvironment of these countries will constitute the concept of Brotherhood Science Diplomacy, whose determinants for empirical application will be addressed in the final considerations.

### **The biotechnology sector in India**

Numerous regions in India have high levels of technological development. Delhi, Maharashtra and the Southern states, notably Karnataka, Andhra Pradesh and Tamil Nadu, are home to the country's top high-tech companies. These areas concentrate old industrial poles and a large number of colleges and research centers. The geographical distribution of the main players in the Indian biotechnology sector also follows this pattern of industrial and educational concentration. The most innovative biotechnology companies are in the aforementioned regions, in hubs such as Jogindernagar, Hyderabad, Visakhapatnam, Konark, Baroda, Midnapore, and Kochi (CRESCENZI & RODRIGUEZ-POSE, 2017).

The Indian biotechnology sector has had sustained growth in the last two decades. The country is currently ranked among the

top 12 biotechnology centers in the world and has about 800 fully functioning companies.<sup>2</sup> The success of the sector is boosted by the economic prosperity of the country, the population growth, the expected elevation of health conditions, and the massive public and private investments in biotech.<sup>3</sup>

Biopharmaceuticals are the main branch of the Indian biotechnology industry, responsible for 62% of the sector's income, mainly due to the country's significant participation in the global market for generic drugs. In addition to products for human health, bio-services (18%) and bio-agricultural products (15%) make up the main potential of the Indian industry in the area of Life Sciences. As discussed below, there is a complementarity between current technical capacities and future needs of the Indian and Brazilian biotechnology sectors.

### **The biotechnology sector in Brazil**

Currently, Brazil has more than 300 biotechnology companies in full operation.<sup>4</sup> As in India, there is a massive concentration of biotechnology ventures around the areas of greater industrial and educational development: the Southeast region, the country's economic center, concentrates about 80% of companies. The main biotechnology hubs are the cities of São Paulo, Campinas, São

---

2 Data on the Indian biotechnology sector used in this article are official indicators released by the Indian Ministry of Commerce and Industry, available in documents from the India Brand Equity Foundation.

3 The Indian government plans to raise the market value of the country's biotechnology industries from US\$ 11.7 billion in 2017 to about US\$ 100 billion by 2025. Achieving this goal depends on an annual investment of US \$ 5 billion in infrastructure, human capital, and research projects. The 22 percent increase in the public budget allocated to the National Biotechnology Department for the period 2017-2018 and the authorization of 100 percent of FDI to the sector through the automatic route seems to demonstrate political commitment to this goal.

4 The latest data compiled on the Brazilian biotechnology sector are available in the Brazil Biotech Map, 2011, published by the Brazilian Center for Research and Planning (CEBRAP) and the Brazilian Biotechnology Association (BRBIOTEC). In 2014, CEBRAP updated the number by pointing out the existence of 314 companies in full operation.

José dos Campos, Rio de Janeiro, and Belo Horizonte (BRAZIL BIOTECH MAP, 2011).

The potential for enhancing Brazilian productive capacity in biotechnology is significant. The country has one of the largest economies in the world; a population of more than 200 million inhabitants intensely demanding biological inputs in its universal public health system; the world's largest biodiversity reserve; and an internationally recognized system of research and education in High Sciences.

The Brazilian government has fostered the biotechnology sector, mainly through investments to consolidate a national industrial complex.<sup>5</sup> The main niche of products in the Brazilian biotechnology market is in the human health sector, which accounts for 39.7% of companies, followed by environment and bioenergy (14.8%), animal health (14.3%) and agriculture (9.7%). Brazil is also a world leader in the production of bioplastics and biofuels from ethanol.

### **Brotherhood science diplomacy: in search of an innovative bilateral cooperation**

The restrictions imposed by major powers on the transfer of technology to developing countries have compelled regional powers such as India and Brazil to forge alternative alliances with other emerging nations under the orientation of reciprocal gains instead of a logic of competition in a zero-sum game.

In the particular case of the Brazil-India cooperation in biotechnology, the partnership is even more feasible, since, as

---

5 An example of this is that in 2017, through the National Policy on Technological Innovation in Health, the historical practice of spending non-reimbursable resources on biotechnology projects was replaced by the offer of financing to partnerships between private and public entities, subject to the transfer of technology from the former to the latter.

previously seen, the starting point for interaction is a situation in which there is already a similarity of objectives and strategies to support the sector. Additionally, the biotechnology sector could serve as a substrate for the implementation of broader adjustments in the methods of conducting the general STI cooperation between India and Brazil. The proposed adjustments follow guidelines that bind them to an organic whole, here called Brotherhood Science Diplomacy.

The cornerstone of the concept of Brotherhood Science Diplomacy is that cooperation in biotechnology, in particular, and in Science, Technology and Innovation, in general, could go beyond the formal legal linkage between governments, to achieve direct and continuous contact between managers, professionals, and researchers in the production microenvironment of high technology. To this end, the primary role of science diplomacy agents is to gather two institutions (research institutes, companies, technological parks, funding agencies, among others), one Indian and one Brazilian, and make their communication so fluid and the level of mutual trust so high that these institutions could be considered sister institutions.

Hereafter, we present pairs of institutions in the biotechnology sector of India and Brazil that could be the focus of this diplomatic action of twinning. This list of possible partnerships is not exhaustive – and could be complemented or even replaced by options based on a better judgment of experts from both countries. The nature of this work is not informative but rather methodological. Its main objective is to spark reflection, through empirical examples, on ways to optimize the scientific cooperation between India and Brazil.

The first structural aspect of an approach for twinning Indian and Brazilian biotechnology institutions is the fact that any

initiatives, from the outset, must be designed under the umbrella of a broader concept of diplomacy. It is indubitable that actions aimed at strengthening India-Brazil relations, even at the micro-institutional level, are diplomatic initiatives. In qualifying them as diplomatic, however, does not mean that their implementation should be restricted to the exclusive action of the Indian and Brazilian Ministries of Foreign Affairs. Given the extent of the economic and social impacts of biotechnology discoveries, the participation of bureaucrats from government sectors other than foreign affairs, such as science and technology, industry, foreign trade, education, health, agriculture, among others, in the work of gathering institutions is as necessary as desirable.

The possibility of a partnership between the Brazilian Agricultural Research Corporation (EMBRAPA) and the Indian Agricultural Research Center (ICAR) can illustrate the need for a multidisciplinary approach to science diplomacy. EMBRAPA's agricultural biotechnology is largely responsible for the advancements that have made Brazil one of the world's most productive exporters of primary products. Despite the differences between Brazilian and Indian agriculture,<sup>6</sup> the niche of hybrid seed, mainly the Genetically Modified Seeds (GMS), represents a point of contact between the two production systems. Through ICAR, the genetic engineering knowledge available to EMBRAPA could help India become one of the world's largest producers of transgenic rice and genetically modified vegetables, with a minimum of social impact in the Indian countryside.

The EMBRAPA-ICAR brotherhood must not emerge, as usual, from a decision of the top Brazilian and Indian governmental authorities, who, in a top-down manner, decide on the political

---

<sup>6</sup> Brazilian agriculture is predominantly commercial, technology-intensive, and based on large properties. Indian agriculture, in its turn, is mainly focused on the domestic market, labor-intensive, and based on small familiar properties.

necessity of formalizing the partnership through cooperation agreements. Instead, it would be appropriate to designate, in each country, a technical group headed by a diplomat, but composed of civil servants from various areas of the government bureaucracy, for on-site visits to facilities and for meeting the main leaders and researchers of the respective institutions.

The opinions of these groups, on the Brazilian side and on the Indian side, would support the decision on the viability of the EMBRAPA-INCAR brotherhood. If the conclusions of the evaluations favor the partnership, it would be up to the chancelleries of both countries to approach, first, the bureaucrats of the technical evaluation groups and, then, the leaders of the institutions. If the conclusions of the evaluations proscribe the partnership, efforts would not be lost. Given the willingness for twinning and the information collected about the profile of potential partners, it would be up to the contralateral technical group to seek more suitable options for partnership.

This bottom-up approach may be slow, possibly requiring more time than desired by government leaders with temporary mandates. The allocation of people specifically to the task may also fluctuate in contexts of shortages of human resources. These shortcomings, nevertheless, could be minimized by prioritizing the technical evaluation of the most relevant entities for the country's economy and STI system, as well as by ensuring permanent civil servants as the members of the technical groups.

This domestic evaluation process is fundamental in ensuring mutual trust between representatives of biotechnology institutions, such as EMBRAPA and INCAR, and the members of national technical groups so that in the future trust could be transferred to the foreign technical group and institution. After approximating the interlocutors of both institutions, formalizing

the partnership via a Memorandum of Understanding (MoU) or any other legal instrument becomes a merely symbolic act.

After consolidating the brotherhood, representatives from sister institutions can engage in a direct, continuous, and dynamic dialogue. The exchange of visits by professionals, the participation of researchers in counterpart projects, the exchange of prototypes to be tested, the provision of technical and consulting services to the counterpart, among other forms of STI cooperation can, from that moment on, take place without the intermediation of the chancelleries, allowing technical groups to restrict their function to safeguarding the partnership in case of possible problems.

Twinning Indian and Brazilian institutions in the niche of biotechnology products focused on human health is also possible. India accounts for relevant part (8%, by volume) of the global generic drugs market. However, there is room for progress in vaccine fabrication and recombinant gene therapy, and the country has only marginal participation in the global market for industrial enzymes (useful in converting polluting chemical methods into sustainable production processes).

Brazil, for its turn, is at the frontier of knowledge in technologies for producing vaccines, industrial enzymes, biomarkers, and in the use of genetic engineering, mainly focused on meeting the demand of the national health system. Brazil is also one of the largest consumers of generic medicines in the world.

Therefore, India's need for innovation to expand exports perfectly matches Brazil's imperative of technological incorporation to meet growing domestic demand. A close contact between the Indian company Glenmark Pharmaceuticals, one of the world leaders in the production of generic medicines for emerging countries, and the Oswaldo Cruz Foundation (FIOCRUZ), a reference center in manufacturing biopharmaceuticals in Brazil,



could improve productive capacities of both institutions and help overcome shortages of the STI system of both countries. The same effect could be expected from a partnership between BIOCON, an innovative Indian company which fabricates medicines for the treatment of chronic diseases, such as diabetes, cancer and autoimmune diseases, and the Butantan Institute, a Brazilian nonprofit foundation focused on the manufacturing of immunobiological medicines for public health.

A closer relation between actors directly involved in the scientific and production microenvironment of biotechnology is also crucial for accelerating innovation in India and Brazil. A partnership between India's Biotechnology Park, in Lucknow (Uttar Pradesh), and the Brazilian Bio Park, in Toledo (Paraná), could replicate successful innovative solutions among them, and help startups scale their business models towards internationalization. Diplomatic efforts to mediate the twinning between the Bangalore Biotechnology Park, in Karnataka, and the Bio-Rio Park, in Rio de Janeiro, may achieve the same goal.

Productive innovation can also be driven by entities of different, yet complementary, natures. A partnership between the Brazilian-Argentinian Center for Biotechnology (CBAB), the most renowned teaching and research biotechnology institution in South America, and the Biotechnology Incubation Center of Hyderabad (Andhra Pradesh), an Indian incubator of innovative companies, can help convert scientific knowledge in Life Sciences into products and services for the biotechnology market of both sides. Likewise, transforming into sister institutions the Center for Cellular and Molecular Platforms (C-CAMP) of India, responsible for R&D in advanced technological platforms, and the Brazilian Industrial Research and Innovation Company (EMBRAPII), which shares financial risks with Brazilian startups, can foster

entrepreneurship in biological sciences and mutual exploration of markets.

### **Final considerations**

In India and Brazil, bilateral cooperation with emerging countries for the endogenous development of productive capacity in high-technology sectors has proved to be a safer alternative, in the long-term, than waiting for a transfer of technology from developed countries. The proposed project of Brotherhood Science Diplomacy has attempted to present some possible adjustments in the diplomatic work so that the interest of India and Brazil in cooperating could be converted into concrete actions in the production microenvironment of high-technologies.

Framework agreements<sup>7</sup> constitute only one first step towards the STI cooperation between two countries. The traditional approach to science diplomacy, characterized by colossal fairs, congresses, and joint commissions, and for abstract goals, should open space for a diplomacy that works in the institutional microenvironment, that binds people, and that celebrate success when the modest, but concrete, objective of joining a single double of Indian and Brazilian institutions is achieved. Brotherhood Science Diplomacy does not go without professional diplomats. Nevertheless, they should be focused on leading the process of developing mutual trust and commitment of individuals belonging to sister institutions rather than on preparing empty documents of cooperation.

Although it is possible to criticize the idealist component of a proposal focused on individuals and microstructures, it is argued

---

7 In 2006, India and Brazil signed the Agreement on Scientific and Technological Cooperation, in force since 2010. In 2012, the two countries expanded their net of cooperation in S&T through the Memorandum of Understanding between India and Brazil in Cooperation in Biotechnology. The MoU expired in 2017.

that the history of science itself demonstrates that the peer-review system and its implication on personal reputations constitute one of the most effective methods of social coercion and efficiency promotion, especially in personalistic societies such as India and Brazil. We hope that this success could spillover from science to science diplomacy.

### **References**

CEBRAP & BRBIOTEC, 2011, Centro Brasileiro de Análise e Planejamento (CEBRAP). Associação Brasileira de Biotecnologia (BRBIOTEC). Brazil Biotech Map.

CRESCENZI, R & RODRÍGUEZ AP 2017, 'The geography of innovation in China and India', *International Journal of Urban and Regional Research*, vol. 41, no. 6, p. 1010-1027.

INDIAN BRAND EQUITY FOUNDATION 2018, *Indian Pharmaceutical Industry*, Sectoral Report, March, available at <<https://ibef.org/industry/biotechnology-india.aspx>>.