FROM BRIDGE BUILDING TO CHIP DESIGN: BRAZIL–MALAYSIA CHIP DIPLOMACY AND THE NEED TO INNOVATE IN BILATERAL RELATIONS WITH COUNTRIES IN THE GLOBAL SOUTH

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Abstract

This article examines a case study of the efforts undertaken since 2023 to build a bilateral semiconductor agenda between Brazil and Malaysia. Known as *chip diplomacy*, the initiative leveraged a favorable political context and used innovation diplomacy as a tool to advance actions aligned with the industrial policy priorities of Brazil and Malaysia, after assessing the characteristics of their respective sectors. The experience described prompted reflection on the need for Brazil, in its bilateral relations with countries in the Global South, to seek to promote, through an exploratory and horizontal approach, innovative forms of articulation to identify concrete opportunities for collaboration.

Keywords: Global South. Bilateral relations. Semiconductors. Innovation diplomacy. Malaysia.

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DA CONSTRUÇÃO DE PONTES AO DESIGN DE CHIPS: A DIPLOMACIA DOS CHIPS BRASIL-MALÁSIA E A NECESSIDADE DE INOVAR NAS RELAÇÕES BILATERAIS COM PAÍSES DO SUL GLOBAL

Resumo

O artigo registra, como estudo de caso, os esforços empreendidos desde 2023 para desenvolver agenda bilateral em semicondutores entre Brasil e Malásia. Denominada diplomacia dos chips, a iniciativa procurou aproveitar contexto político favorável e utilizou a diplomacia da inovação como instrumento para, após analisar as características do setor nos dois países, apoiar ações alinhadas às prioridades das políticas industriais brasileira e malásia. A experiência descrita motivou reflexão sobre a necessidade de que, em suas relações bilaterais com países do Sul Global, o Brasil busque promover, por meio de abordagem exploratória e horizontal, formas inovadoras de articulação para identificar oportunidades concretas de colaboração.

Palavras-chave: Sul Global. Relações bilaterais. Semicondutores. Diplomacia da Inovação. Malásia.

DE TENDER PUENTES A DISEÑAR CHIPS: LA DIPLOMACIA DE LOS CHIPS ENTRE BRASIL Y MALASIA Y LA NECESIDAD DE INNOVAR EN LAS RELACIONES BILATERALES CON LOS PAÍSES DEL SUR GLOBAL

Resumen

El artículo recoge, a modo de estudio de caso, los esfuerzos realizados desde 2023 para desarrollar una agenda bilateral sobre semiconductores entre Brasil y Malasia. Conocida como «diplomacia de los chips», la iniciativa buscaba aprovechar un contexto político favorable y utilizaba la diplomacia de la innovación como herramienta para apoyar acciones alineadas con las prioridades de las políticas industriales de Brasil y Malasia, tras analizar las características del sector en ambos países. La experiencia descrita suscitó una reflexión sobre la necesidad de que Brasil, en sus relaciones bilaterales con los países del Sur Global, busque promover, a través de un enfoque exploratorio y horizontal, formas innovadoras de coordinación para identificar oportunidades concretas de colaboración.

Palabras clave: Sur Global. Relaciones bilaterales. Semiconductores. Diplomacia de la innovación. Malasia.

1. Introduction: From Bridge Building to Chip Design

Chips and diplomacy are not easy subjects to explain. Semiconductor manufacturing demands absolute precision, whereas diplomatic activity can be flexible and dynamic in practice. At first glance, the two fields seem far apart: engineers might take an interest in understanding the characteristics of international politics, but at least until recently it was uncommon to think of international relations professionals concerning themselves with the stages of the semiconductor production chain.

At least in public debate, it was war, rather than diplomacy, that first pushed chips into the spotlight. The phrase "chip war," popularized by American professor Chris Miller's now-classic book of the same name, has been widely adopted as it conveys the seriousness of today's challenges surrounding semiconductors.

Geopolitical tensions between the United States and China are closely tied to the concentration of an essential stage of the production chain in Taiwan. The race to dominate the sector's technological evolution, whose estimated global value for 2029 reaches US$ 1 trillion, has implications for multiple industries around the world.

The semiconductor supply disruptions triggered by the COVID-19 pandemic not only exposed the complexity of the production chain but also affected several countries, including Brazil. Yet, the "chip war" is still often portrayed mainly as an issue restricted to the game between the major powers and a handful of other developed economies. The Global South, as a rule, is cast in a supporting role, with little room to maneuver.

This article seeks to bring together two traditionally distant and difficult-to-define topics—chips and diplomacy—through a different lens: that of the Global South. It is worth noting that both terms are intentionally used in a broad, and sometimes metaphorical, sense in relation to the central arguments of the text.

Chips, semiconductors, and integrated circuits will be used interchangeably. They refer to components made from semiconductor materials, such as silicon, that can control the flow of electric current in electronic devices. They combine several parts, such as transistors, which, when interconnected in an integrated circuit on a chip, perform tasks such as storing data, processing information, or controlling signals. They are found in household appliances, TVs, cell phones, cars, and satellites, and they play a central role in the infrastructure for artificial intelligence.

Diplomacy is often described metaphorically as the art of building bridges. It is a simplified way of conveying the idea that the diplomatic profession seeks to create conditions for bringing peoples and cultures closer together and forging lasting connections between countries. This goal remains valid, and arguably more necessary than ever.

One of the most relevant trends in contemporary international politics—marked by multiple crises, including the "chip war,"—is the Global South's growing effort to strengthen coordination to assert its interests. This is most evident through coalitions operating across various international forums. A central argument of this article is that it is necessary to go beyond multilateral engagement. Effective forms of collaboration must also be pursued through bilateral relations with countries in this group.

In this context, it may be appropriate to update the traditional metaphor of diplomacy for the 21st century: in addition to building bridges, it is essential to promote chip design. In the case of semiconductors, chip design requires creating the integrated circuit that will coordinate the millions of interrelationships among its various electronic components. Diplomacy that promotes chip design must be able to proactively articulate innovative relationships with multiple public and private actors.

Innovation diplomacy can serve as a tool for Brazil's Foreign Ministry not only to continue building bridges, but also to foster more sophisticated infrastructures of cooperation, particularly in bilateral relations with countries in the Global South. Naturally, this does not imply pursuing a bilateral semiconductor agenda with every country, which would be neither practical nor desirable.

Chip design, due to its technological complexity and relevance in terms of sovereignty, sustainability, and industrial development, serves as a symbol. It underscores the need for diplomatic action to prioritize the shaping of innovative dynamics aligned with national strategic objectives, despite (or precisely because of) unfavorable geopolitical and economic conditions.

Chip diplomacy between Brazil and Malaysia is presented as a case study. Since 2023, efforts to develop a semiconductor agenda have contributed to adding value to the bilateral relationship. Alongside traditional topics such as trade, agriculture, and investment, the two countries are now discussing concrete initiatives that align with their respective industrial policies. While determined by a specific context, the Brazil–Malaysia experience offers insights that may inform future partnerships with other countries in the Global South.

From a structural point of view, after the introduction, we will address the context that favored the launch of the bilateral semiconductor agenda;

the role of innovation diplomacy in advancing the issue; the characteristics of the semiconductors sectors in Malaysia and Brazil; and the parameters for bilateral collaboration. The final sections contain a partial assessment of chip diplomacy between Brazil and Malaysia and offer reflections on Brazil's bilateral relations with Global South countries.

2. Diplomatic Discourse to Summarize the Context

To understand the rapprochement between Brazil and Malaysia in the semiconductor sector, it is useful first to consider the broader context of their bilateral relationship within Brazilian foreign policy, as well as the circumstances that enabled and favored the development of this agenda.

With the exception of the recent time frame, bilateral relations, established in 1959, two years after Malaysia's independence, gained momentum in the second half of 2022, when Brazil became a Sectoral Dialogue Partner of the Association of Southeast Asian Nations, ASEAN. From a political signaling perspective, this new status represented Brazil's recognition of the economic dynamism of the region and its interest in strengthening ties with Southeast Asian countries.

During that same period, for reasons not necessarily related, there was political pressure for Brazil to expand its diplomatic presence in Southeast Asia. The National Congress was the most emphatic advocate of the need for a "strategic foreign policy reassessment" of embassy staffing, so that "trade balance data would be taken into account" (Abreu, 2021).[2] From a quantitative and strategic point of view, the growing relevance of the Asian market for Brazilian foreign trade, particularly in the agro-export sector, was becoming evident.

Political pressure can be identified as one of the main factors that motivated the decision, in 2022, to increase the number of diplomats in Brazilian embassies in Southeast Asia. In the case of Kuala Lumpur, from one ambassador and two secretaries at the beginning of 2021, the Embassy

2 At a public hearing of the Federal Senate's Foreign Relations and National Defense Committee on May 20, 2025, Foreign Minister Mauro Vieira noted that, between 2004 and 2024, trade volume between Brazil and ASEAN grew more than tenfold. In 2024, it reached US$ 37 billion, with a surplus for Brazil of US$ 15 billion. ASEAN is already the fourth-largest destination for Brazilian exports (after China, the United States, and the European Union).

now has, on paper, in 2022, and in practice from the first half of 2023, one ambassador, one minister-counselor, and four secretaries.[3]

The increase in staffing allows, at least in theory, for the expansion of the Post's areas of activity, while also facilitating efforts to deepen political and diplomatic ties and to strengthen and diversify trade flows. Having adequate human resources alone is not necessarily enough, in diplomatic jargon, to "raise the profile of the relationship." In the case of Brazil–Malaysia relations, fortunately, there was a convergence, often rare to observe, between good material conditions and an extremely favorable environment for deepening the relationship.

Two new governments took office at almost the same time, in November 2022 in Malaysia and in January 2023 in Brazil. In general terms, both administrations share similar domestic political priorities and demonstrate alignment on various issues on the international agenda, such as global governance, climate change, peace and security, and the relevance of the Global South.

As a factor of attraction, the terms of Anwar Ibrahim and Luiz Inácio Lula da Silva coincide with significant events on the foreign agenda: in 2025, while Malaysia holds the rotating presidency of ASEAN, Brazil will host COP30 in Belém do Pará and assume the rotating presidency of BRICS, precisely in the year that Malaysia officially became a partner country of the mechanism.

Personal factors also helped facilitate the rapprochement. As an element of Brazil's soft power—and not to be overlooked, especially in countries where knowledge of Brazil remains limited—President Lula enjoys great prestige in Malaysia, particularly with Prime Minister Anwar Ibrahim. Leveraging his network of contacts and his access to local authorities, the then Brazilian ambassador to Malaysia, Ary Norton de Murat Quintella, worked to raise awareness in Kuala Lumpur about the opportunity that presented itself for closer bilateral ties.

From a diplomatic perspective, the rapprochement between two countries can be gauged by the frequency of high-level visits. The mere fact of holding meetings does not necessarily indicate a busy agenda, but it serve as a good indicator. In the case of Brazil and Malaysia, there has been an unprecedented number of interactions between authorities from both countries, notably Prime Minister Anwar Ibrahim's visit to Rio de Janeiro to attend the G20 Summit in November 2024, when he held a bilateral meeting with President

3 The current configuration of the Embassy is as follows: one ambassador, four secretaries, and one agricultural attaché—the latter was created in December 2024 and is held by a career civil servant from the Ministry of Agriculture, Fisheries, and Supply (Brazil, MRE. Ordinances, 2022-2024).

Lula; and President Lula's planned participation in the ASEAN Summit in October 2025, which will break a 30-year hiatus without presidential visits to Malaysia.[4]

The facts briefly described above do not follow each other spontaneously. Diplomatic discourse plays a crucial role in providing cohesion and political meaning to events, whether constructed concurrently with the unfolding of events or *a posteriori*.

Diplomatic discourse has highlighted the potential identified in Brazil–Malaysia relations as follows: circumstantial factors (such as Brazil's presidency of the G20, BRICS, and COP30, and Malaysia's presidency of ASEAN) combined with structural factors (such as both countries being mega-diverse, developing nations, and part of the Global South) generate convergence of priorities and positions. Together, these factors offer an unprecedented opportunity for Brazil and Malaysia to explore new areas of cooperation, such as climate change, health, energy, defense, and science, technology, and innovation—and, within the latter, semiconductors.

On the one hand, chip diplomacy between Brazil and Malaysia benefits from the favorable context, articulated by diplomatic discourse, for its launch. On the other hand, it serves as a concrete example of what the discourse highlighted, contributing to reinforce the perception of an opportunity to deepen bilateral relations.

3. Innovation Diplomacy as an Instrument

Innovation diplomacy provided both the conceptual framework and the practical guidelines—a "roadmap"—for exploring the possibilities of a semiconductor agenda between Brazil and Malaysia, taking advantage of the material conditions and favorable political context.

There are academic works that detail the use of this concept in Brazilian diplomatic practice (Machado 2023; 2024; Pinto 2020). Drawing on these studies, as well as publications by the Ministry of Foreign Affairs (MRE), innovation diplomacy at Itamaraty, by recognizing technological innovation as a strategic national interest of the Brazilian State, can be understood as the use of diplomatic tools to promote Brazil's qualified integration into the global science, technology, and innovation landscape.

4 Before the ASEAN Summit, the Malaysian Prime Minister is expected to return to Rio de Janeiro in July 2025 to attend the BRICS Summit.

A central element for the implementation of this concept was the creation, in 2017, of the Innovation Diplomacy Program (PDI). The Program encompasses technological promotion activities carried out by the science, technology, and innovation (Sectec) sectors of Brazilian embassies abroad, which are guided by three institutional missions: to promote Brazil's image as an innovative nation; to foster connections between Brazilian and foreign partners; and to engage agents from Brazilian innovation ecosystems in internationalization processes.

When an embassy gains the human resources that allow it to explore science, technology, and innovation as a potential area of bilateral relations, as was the case with the representation in Kuala Lumpur in early 2023, the process for establishing a Sectec follows a step-by-step approach. This includes a "Manual" with explanations of concepts, suggestions for activities, and a list of potential interlocutors.

3.1. Networking with Autonomy

For the purposes of this text, the most relevant aspect of innovation diplomacy's conceptual-practical framework is that, without renouncing traditional organizational principles of Itamaraty, such as functional hierarchy and the subordination of overseas posts to the Secretariat of State, it encourages, by the ministry's standards, an innovative model of action.

By relying on networking, both among Sectecs themselves and between embassy sectors and the many actors in the Brazilian innovation system, innovation diplomacy fosters more agile, objective, and collaborative relationships. The Manual states that, "given the complexity of innovation processes, it is necessary for the innovation diplomacy agent to engage in intense networking in order to constructively dialogue, integrate, and connect various actors" within the so-called "quadruple helix of innovation" (Machado 2024), formed by government, academia, the private sector, and civil society.

Another relevant feature of this approach is autonomy of action. Autonomy enables the embassy and the diplomat responsible for Sectec to formulate and execute foreign policy actions in practice. It is worth noting that, always with the knowledge of the relevant area of Itamaraty, actions must also be linked to Brazilian public policy objectives, such as Nova Indústria Brasil, which is particularly relevant to this text.

Operating through networks and with greater autonomy, the diplomat responsible for innovation issues functions as a kind of "street-level bureaucrat" (Pinto 2020). Beyond shaping projects from conception to implementation,

in many cases they are also able to witness the outcomes of the measures adopted, which is often difficult in diplomacy, a field where initiatives typically require long timeframes before bearing fruit.

3.2. Mapping Opportunities

In the Brazil–Malaysia case, innovation diplomacy tools proved essential for developing a bilateral semiconductor agenda. For the acquisition and dissemination of knowledge about the sector, the first step was to develop the Mapping of Innovation-Promoting Environments in Kuala Lumpur.

A requirement for the formal creation of a sector dedicated to science, technology, and innovation in an embassy, the Mapping is a study of the foreign ecosystem. Prepared by the embassies themselves, it is based on research and engagement with local interlocutors. Intended for the Brazilian innovation system and made publicly available, the document serves both as an initial milestone in establishing contact networks and as a means of reporting to society on the work performed by Brazilian representations abroad.

Of particular relevance to this article is the fact that each Mapping includes a dedicated section identifying potential areas of synergy between Brazilian and foreign environments. First published in May 2023 and updated in December 2024, the Kuala Lumpur Mapping indicated semiconductors as a promising area of shared interest between Brazil and Malaysia.

To mobilize actors on both sides to explore possibilities for greater interaction, there were two key events: a webinar on semiconductors in October 2023 and, as a result of this event, the participation of a Brazilian delegation in the most important trade fair in the sector in Southeast Asia in May 2024.

The *Brazil–ASEAN Innovation Sessions* were a series of webinars that, within the framework of Brazil's Sectoral Dialogue Partnership with the Association, sought to reinforce the Brazilian view that relations with the region should go beyond the already important trade flows (Vieira 2023). The webinar *Brazil–ASEAN and Semiconductors: Unveiling Global South Synergies*, organized by the Embassy in Kuala Lumpur, was the starting point for contact between actors in the Brazilian and Malaysian semiconductor ecosystems. With the participation of governments, the private sector, and research and development institutions from both countries, the event promoted knowledge about the main features of the sector in Brazil and Malaysia and proved

instrumental in launching the strategic vision that there was potential for mutually beneficial collaboration.[5]

The webinar motivated subsequent contacts between participants, which helped to generate a critical mass around the topic. Building on this momentum, Brazil participated, with its own stand financed with budgetary resources from Itamaraty and approved within the framework of the PDI, in the *Semicon Southeast Asia (Sea)* fair in May 2024.[6] As the leading event in the Southeast Asian electronics supply chain, the fair provided an opportunity for most of the event's panelists to meet in person in Kuala Lumpur, seven months after the webinar on semiconductors, for a bilateral roundtable on the semiconductor industry.

4. Semiconductors in Malaysia and Brazil

The initiatives undertaken provided a better understanding of the semiconductor sector in both Malaysia and Brazil,[7] helping to identify the parameters under which bilateral collaboration could be pursued.

4.1. The Semiconductor Sector in Malaysia

The development of the sector in Malaysia began in the 1960s and 1970s. It was marked by the establishment in Penang, in the northwest of the country, of pioneering multinational firms, known as the "Eight Samurais," and was influenced by two processes. The first, domestic in nature, was the decision to orient Malaysian industrial policy toward export-led industrialization, based primarily on attracting foreign direct investment. This aspect, as will be seen, proved central to the sector's evolution in the country and, to this day, continues to influence debates on the prospects for the area.

The second, external process was a consequence of the evolution of the sector in the late 1960s and early 1970s, mainly in the United States. Malaysia, which sought to become an export platform, was identified as a potential destination for the relocation of less complex stages of electronic

5 As a follow-up to the discussions that took place in the webinar, it is worth noting the visit in March 2024 by representatives of the Eldorado Institute, a Brazilian research, development, and innovation center, to Mimos, Malaysia's leading microelectronics research agency.

6 With the support of the MCTI, the Brazilian delegation included representatives from the government (MCTI and Softex), the private sector (Abisemi and Adata), and research, development, and innovation institutions (Eldorado Institute, Renato Archer Information Technology Center, and Wernher von Braun Advanced Research Center).

7 The contacts maintained with Malaysian and Brazilian interlocutors at events such as the October 2023 webinar were instrumental in outlining the sector's landscape in both countries, as described in this section.

components production. Attractive features at the time (and also over the following decades) included tax incentives, geographical location (Penang is located on the Strait of Malacca), and comparatively lower production costs, including labor. With regard to labor, the widespread use of English among the workforce has remained an important comparative advantage for Malaysia to this day.

The geopolitical context of the period must also be taken into account: amid the tensions of the Cold War, particularly in Southeast Asia, which witnessed the Vietnam War at that time, the establishment of US multinationals in Penang, near the Thai border, may also be interpreted as a deterrent to fears of communist advances on the Malay Peninsula.

Between 1970 and 1990, the electronics sector was fundamental to Malaysia's economic development. Predominantly based on the export of raw materials such as rubber and tin, the economy diversified and became more industrialized. Through chips, it became connected, in terms of investments and trade flows, to the US and other integrated circuit production centers. From that period onward, the country established itself as a key link in the semiconductor production process, which by the 21st century had evolved into one of the most complex global production chains.

The model centered on attracting multinationals began to show signs of limitations, especially in the 1990s and 2000s. Critics argue that Malaysia risked being reduced to an "assembly and production center for multinational corporations, with local actors facing difficulties in accessing markets, securing intellectual property, and competing globally." (Embong 2025). Statistical evidence reinforces this thesis: while the sector accounts for only 6% of Malaysia's GDP, it represents in exports 40% of the country's exports.

The feeling is that the advantage of having "started ahead" in the 1960s was not properly exploited by Malaysia,[8] especially when the evolution of the sector in the country is compared with that in Asia between the late 1980s and early 2000s. This period was characterized by rapid technological evolution, greater competitiveness, and industrial development in centers other than the US, such as Japan, Taiwan, South Korea, and, more recently, China, with public investment playing a key role in expanding production and research capacities.

8 Several theoretical references provide relevant context on this issue. Keun Lee (2021) examines how foreign direct investment can be leveraged to strengthen local capabilities, presenting Penang as a case study; Hartmann et al. (2021) address the importance of productive sophistication beyond simply attracting labor-cost-driven investment; and Liew Chin Tong (2024) reflects on the need for Malaysia to move beyond this investment-attraction model.

Despite this, Malaysia has remained relevant to the global semiconductor supply chain: it ranks among the world's top 10 chip hubs, holds 13% of the global market for chip packaging, assembly, and testing, and is recognized as the sixth-largest semiconductor exporter. One of the country's current comparative advantages is its consolidated ecosystem, already well integrated into the global value chain, especially when compared to other Southeast Asian countries that have only more recently been developing their semiconductor sectors.

Malaysia's share of the global market, however, remains heavily concentrated in the back end of the industry: packaging, assembly, and testing activities. Essential to the production process, these stages are comparatively less capital– and R&D-intensive, and less technologically complex. They still generate economic impact, given the overall scale of the semiconductor industry, but they add less value and technological intensity than the so-called *front end*, which includes activities such as integrated circuit design and wafer manufacturing (semiconductor substrates, such as silicon, on which chips are "built").

Improving the country's position in the global semiconductor chain is one of the priorities of Prime Minister Anwar Ibrahim's government. The *New Industrial Master Plan* (NIMP) of 2023 and the *National Semiconductor Strategy* (NSS) of 2024 seek not only to increase the country's participation in back-end activities but also to develop front-end capabilities. Ambitious plans have recently been launched for chip design, notably the creation in 2024 of the *Malaysia IC Design Park* in the Kuala Lumpur metropolitan area, as well as a US$ 250 million agreement with the British multinational ARM in 2025 to provide local companies with access to the company's design architecture, currently used in most advanced electronic products.

4.2. The Semiconductor Sector in Brazil

Unlike Malaysia, Brazil never sought to position itself as an export, but it did develop a relatively complete chip ecosystem until the 1980s, anchored in state-owned enterprises and science and technology institutes. However, the different political and economic cycles from the 1990s to the early 2000s, combined with a process of deindustrialization, weakened the trajectory of the country's semiconductor sector. The emergence in 2007 of PADIS (Program to Support the Technological Development of the Semiconductor Industry) represented an attempt at recovery. Designed as a legal framework for the industry, PADIS aimed to promote the establishment and maintenance

of companies engaged in the design, development, and manufacture of semiconductor devices within Brazil.

Although the Brazilian ecosystem currently includes back-end (assembly and testing) and front-end (design and manufacturing) companies, as well as universities and research, development, and innovation centers, there is a certain mismatch between Brazil's economic weight and the degree of participation and integration of its electronics sector into global markets.

Current sectoral policies seek to ensure that Brazil's scientific and technological potential translates into greater economic complexity for the chip sector. This could be achieved by diversifying and intensifying back-end production, currently concentrated in the mobile phone and computer memory segment, and encouraging front-end activities. The Brazil Semiconductors Program—Brasil Semicon (Law No. 14,968, of September 11, 2024), which improves the legal framework established by PADIS, is designed to revialize all stages of production, stimulate domestic production, and increase the country's integration into global value chains.

Brasil Semicon is related to Nova Indústria Brasil (NIB), the country's new industrial policy launched in 2024. Under Mission No. 4 (Digital Transformation of Industry to Increase Productivity) NIB recognizes semiconductors as a strategic priority, seeks to reduce productive and technological dependence on nano– and microelectronic products, and aims to strengthen the global positioning of the domestic industry.

The priority given to semiconductors in industrial policy is justified by their role in safeguarding national technological sovereignty and serving as a productive foundation for innovative and sustainable reindustrialization. They are also a critical enabler for artificial intelligence infrastructure, such as data centers, and technological progress in strategic areas such as energy, health, defense, and mobility.

5. From Competition to Collaboration

5.1. Dialogue to Build Trust

The exchange of knowledge and the promotion of interactions between actors in the Brazilian and Malaysian ecosystems gradually helped define the parameters that would guide chip diplomacy.

As noted, Brazil's semiconductor sector has traditionally focused on the domestic market and remains not properly integrated into global value

chains. In Malaysia, the evolution of the chip industry was stimulated by foreign direct investment, which did not necessarily favor the emergence of national companies that would occupy a central position in the local ecosystem or the international stage.

Before the contacts, the first impression was unfavorable to bilateral rapprochement. There were fears that the two countries might end up as competitors, with advantages for Malaysia, which is more integrated into the global chain. Since both countries had specialized in chip packaging and testing, there were legitimate concerns in Brazil regarding the production of memory chips, the country's main industry segment, which has managed to remain relevant despite the process of deindustrialization observed in recent decades.

Shifting from a competitive to a collaborative mindset was only possible thanks to a process of building trust through sustained dialogue between actors from both countries. Both sides gradually opened up to exploring alternatives to their established models: Brazil's historically inward-looking approach, and Malaysia's dependency on foreign financial and technological inputs.

In its contacts with the Malaysian side, Brazil did not position itself as a mere potential market for semiconductors produced in Southeast Asia. Instead, it emphasized its interest in exploring opportunities with strategic significance in areas such as professional training and technological partnerships, in a joint effort resulting from an alliance between the government, the private sector, and research and development institutions.

From this strategic perspective, the size of the Brazilian market could certainly be presented as an attractive factor, but in a qualified way. The country's industrial base would no longer be threatened, but could benefit from the contact and new dynamics created through horizontal partnership between countries with similar interests. In the same vein, the large Brazilian market could offer the necessary scale to support devices or technologies created jointly, in collaboration between research institutes, for example.

For Brazilian stakeholders, exposure to the external environment ended up favoring a process of self-knowledge, helping to better identify and formulate the sector's interests in Brazil. One of the most significant consequences of the rapprochement with Malaysia may have been the shift in attitude: rather than viewing dialogue with apprehension, it came to be seen as a tool for building trust and the process of identifying synergies as an opportunity to enhance industrial capacity and national talent.

5.2. Shortcuts to Strategic Objectives

Actors from both countries began to value the advantages of an exploratory and horizontal approach. There was a clear understanding of the limits of the proposed collaboration: it was not a definitive solution, but rather a complementary alternative to national strategies, which could offer opportunities in specific priority areas of their respective industrial policies.

Both sides acknowledged the growing competitiveness and complexity of the sector and recognized that, as developing countries in the Global South, Brazil and Malaysia face difficulties in competing directly at the most advanced fronts of the sector and moving up in the global value chain.

They also face challenges in achieving industrial catch-up. Due to the rapid evolution of the chip production chain, today's state-of-the-art technology quickly becomes outdated, and the cutting-edge technology of tomorrow will have received substantial investments before it prospers commercially and becomes dominant in the market.

Despite the challenging environment, there are opportunities in both countries that can be exploited to enhance their established industrial and research capabilities. If there is interest in seeking a more qualified and competitive insertion in the global production chain, this goal can be pursued jointly.

As part of the process of changing mindsets, it was identified that: i) collaboration can help reveal concrete shortcuts that are mutually beneficial for achieving national strategic objectives; and ii) bilateral rapprochement should prioritize the promotion of shared development structures, such as joint ventures, that leverage Brazilian and Malaysian capabilities—to the detriment of the traditional focus on attracting foreign direct investment, which has typically characterized relations with developed countries.

6. Brazil–Malaysia Chip Diplomacy: Partial Assessment

Moore's Law is always cited in texts on semiconductors. The "law" refers to a prediction made in the 1960s by Intel co-founder Gordon Moore, which held true for decades, that the number of transistors on a chip would double every two years at the same cost, resulting in increased computing power.

The sector's progress has been so impressive that the continued chip miniaturization has imposed physical and chemical barriers to the continuity of Moore's Law. If, in 1965, transistors measured about 10 micrometers—roughly 10 times thinner than a human hair—today, state-of-the-art transistors are

being designed at about 2 nanometers, which is 50,000 thinner than a hair and even smaller than a DNA molecule. The industry then began to discuss "more than Moore" innovations, which would allow the capabilities of chips to be expanded beyond miniaturization.

The digression with the mention of Moore's Law is to emphasize that no one could foresee the outcomes of the Brazil and Malaysia's bilateral agenda on semiconductors when the sector was first identified as a potential area of bilateral synergy in science, technology, and innovation, which was then beginning to be explored.

After two years, however, rapid progress has been noted. Semiconductors are one of the pillars of the current bilateral relationship between Brazil and Malaysia, and projects that could benefit both countries are under discussion.

Although not meticulously planned at the beginning of the rapprochement process, concrete actions have always been within the realm of possibility and aspiration. This characteristic of dealing with possible horizons may have been essential to the developments that have taken place. By framing initiatives as possibilities, actors avoid frustration when goals are not met and, more importantly, ensured rapid adaptation to redirect limited resources toward initiatives that show greater promise at a given moment (Rodrik 2004).

Chip diplomacy between Brazil and Malaysia currently covers several segments of the semiconductor production chain. In addition to industrial and technology-promotion projects in the back end and front end, there are efforts to institutionally consolidate interactions between stakeholders in both countries, cooperation among research, development, and innovation centers, and discussions on partnerships between Brazilian and Malaysian universities for professional training. Aligned with each country's national strategies for strengthening the sector, the agenda has political support at the highest level.

6.1. Industrial Collaboration Initiatives

The objective of diplomatic action should be to pave the way for concrete initiatives that contribute to social inclusion, to reduce inequalities, and to promote the sustainable and sovereign development of the country. Chip diplomacy, in addition to projecting Brazil's image as an innovative nation, should therefore also seek to generate quality jobs and facilitate the country's access to strategic technologies.

In practice, supporting concrete initiatives requires deepening contacts with private sector actors and research centers. A better understanding of

existing interests and possibilities is a prerequisite for developing strategies that can benefit the country and all stakeholders involved. Maintaining this dialogue in an institutional, transparent, and coordinated manner lends legitimacy to the work of innovation diplomacy agents.

As noted in the *Sectec Manual*, diplomats' greater access to governments and key players in foreign innovation ecosystems allows them to act as facilitators between institutions, researchers, and companies, as well as promoters and defenders of national technology sectors. The traditional recording of activities by embassies to the Secretary of State, with analyses and reports on actions and their developments, serves as a basis for more agile, modern, and sophisticated action, one that actively identifies opportunities that can benefit Brazil.

Networking between the Brazilian and Malaysian semiconductor ecosystems led to the creation of unique dynamics among the players. The prospect of chip diplomacy quickly expanded. With the consolidated idea that bilateral rapprochement could be beneficial to both parties and with mutual confidence to explore possibilities, interlocutors began to get to know each other better and establish new relationships. In a relatively short period of time, it became possible to glimpse concrete results for the proposed cooperation in areas initially considered more complex, such as in the examples of industrial collaboration described below.

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One of the concrete initiatives resulting from chip diplomacy was the Brazilian group Tellescom's project to seek a technology partner in Malaysia.[9] The goal is to establish a joint venture to build factories in Brazil dedicated to chip encapsulation and testing, which will be used mainly by the Brazilian automotive industry. If negotiations currently underway between the Brazilian group and its Malaysian counterpart are concluded successfully, the initiative will be an example of industrial cooperation that, in line with the objectives of Nova Indústria Brasil and the Brasil Semicon Program, could contribute to increasing the country's participation in the global semiconductor chain.

9 The Malaysia Digital Corporation (MDEC) has been a key partner of the Embassy and played an essential role in identifying local partners. Due to the bilateral agenda on semiconductors, Brazil was included as a new potential market to be explored by the agency. In a six-month period between 2024 and 2025, MDEC organized two missions to the country, which were essential for generating interactions between actors and including other agencies in the network that formed around the topic. The interest of the InvestRS agency and the Rio Grande do Sul State Secretariat for Innovation, Science, and Technology in projects with Malaysia is an example of this process.

If the joint venture is confirmed, the partnership could represent an investment in Brazil, in capital expenditures, of around US$ 170 million (Knebel 2025), which would include infrastructure costs, such as the construction of a clean room and the acquisition of production equipment. This would generate quality jobs in Brazil, provide a local alternative to supply part of the demand for semiconductors from the automotive industry in the country, and open up the possibility of exporting components produced in Brazil to other countries.

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In addition to this back-end project, chip diplomacy has also paved the way for a bilateral initiative on the front end. With support from the Embassy and Brazil's Minitry of Science, Technology and Innovation (MCTI), the Brazilian technology ChipInventor, developed by the Wernher Von Braun Advanced Research Center,[10] was promoted.

ChipInventor is an innovative platform for chip design. Compared to the main existing tools, the Brazilian technology stands out for being more accessible. It allows for web-based design and more economical chip production, characteristics that favor the use of the tool for educational and training purposes, but also for innovation, since the costs for prototyping and manufacturing new solutions are lower.

Because it is affordable and accessible, ChipInventor democratizes access to chip design, reducing barriers to entry and favoring the development of innovative solutions. The best example to illustrate its potential is the interaction between the Von Braun Center and the Malaysian hybrid drone company Alphaswift. After learning about Brazilian technology in November 2024 during a prospecting mission to Brazil organized by a Malaysian agency, Alphaswift managed to develop its own chip to for use in its drones in just three months (Lee 2025).

The promotion of ChipInventor underscored Brazil's capabilities in one of the most advanced segments of the semiconductor chain. It also strengthened chip diplomacy and projected the country's image as an innovative nation. Brazil's collaborative approach, with the possibility of sharing, transferring,

10 In April 2025, as part of the Innovation Diplomacy Program, a technology promotion mission was carried out in partnership with the Malaysia Semiconductor IC Design Park and the Advanced Semiconductor Academy of Malaysia (ASEM), with support from Amazon Web Service (AWS). As a result of engagement with Malaysian actors, Brazilian technology developers indicated plans to maintain a presence in Malaysia and expand operations in Southeast Asia, with a view to promoting ChipInventor in the country and the region in a structured manner. The action was a direct result of the entity's participation in the Brazilian delegation to the Semicon Sea fair in May 2024.

and jointly developing technology, while allowing concrete gains for both sides, stands out as a model of cooperation between countries in the Global South.

6.2. Institutional Consolidation of the Rapprochement

Due to its growing relevance in bilateral relations, the semiconductor partnership should be reflected in the legal and institutional framework of the Brazil–Malaysia relationship. Memoranda of understanding on science, technology, and innovation, negotiated between the ministries of Science, Technology, and Innovation, and on cooperation in semiconductors, between the ministries of Industry, are at an advanced stage of negotiation.

As chip diplomacy also includes the private sector and research, development, and innovation centers in both countries, instruments involving sector associations and research centers have been signed.[11] Cooperation between research centers is what potentially allows for the exploration of niches of greater technological intensity, in which Brazil and Malaysia would have the opportunity to position themselves at the forefront of the sector.

In the area of research and professional training, the Embassy has facilitated contacts between Brazilian universities (UFRGS and Unisinos) and Malaysian universities, and other agencies and institutions. Possible collaboration is under discussion within the framework of the federal microelectronics residency program CI-Inovador and a similar program in the state of Rio Grande do Sul, which would include training activities for Brazilian participants in Malaysia. A partnership in this area, if confirmed, would constitute a front of action that tends to consolidate, deepen, and provide continuity for interactions between actors in the two ecosystems.

From a political standpoint, the bilateral rapprochement in semiconductors was endorsed by the Joint Declaration issued after the meeting between President Lula and Prime Minister Anwar Ibrahim at the G20 Summit in November 2024. Paragraph 12 of the document reads as follows:

> [The two leaders] supported efforts to develop bilateral collaboration in the semiconductor sector through increased dialogue between the governments, the private sector, and research, development, and

11 In November 2024, during Prime Minister Anwar Ibrahim's visit to Brazil, two memoranda of understanding were signed: i. between industry associations—for Brazil, Abisemi (Brazilian Semiconductor Industry Association) and Abinee (Brazilian Electrical and Electronics Industry Association) and for Malaysia, MSIA (Malaysia Semiconductor Industry Association); and ii. between research, development, and innovation centers—Brazil's Instituto Eldorado and Malaysia's Mimos—at the suggestion of the MCTI, the interaction between Instituto Eldorado and Mimos, still in its infancy, also came to include the National Institute for Space Research (INPE) and the Renato Archer Information Technology Center.

innovation institutions in both countries, reaffirming the benefits of an exploratory, horizontal, and collaborative approach that is aligned with the industrial policies of both countries.

7. Conclusion: The Need to Innovate in Bilateral Relations with the Global South

7.1. Bilateral Agenda with the Global South

It would be inaccurate to say that there is a typology for Brazil's bilateral relations with different groups of countries. Reality is always more complex than any abstract classification. Still, as an approximation, one can consider that Brazil's diplomatic experience is more consolidated with certain groups of countries than with others. Compared with bilateral relations maintained with other countries in the Global South, Brazil's diplomatic experience is already much more solid in its bilateral relations with nations in South America and Latin America; developed or Global North countries; and relatively less developed countries.

In an imperfect simplification, relations with South and Latin American countries tend to be deeper, favored by geographical, cultural, and historical proximity and integration mechanisms. With developed countries, there is generally a diverse agenda, supported by established trade and investment flows (here, the US and Canada, Western European countries, and some Asian countries, such as Japan and South Korea, but also China, could be included). With relatively less developed countries, in turn, bilateral relations tend to be heavily influenced by technical cooperation projects, in which Brazil transfers or shares knowledge with entities in partner countries.

In the case of countries in the Global South, there is a tradition of formalizing coalitions in multilateral forums on various issues, which is particularly relevant in the current context (Spektor 2025). However, there is still a lack of consolidated practice in bilateral relations. This characteristic tends to be more relevant in the case of countries in the Global South that are not Latin American. Malaysia, other Southeast Asian nations, and some of the new BRICS members and partners, for example, would fit into this group.

7.2. The Role of Diplomacy in Breaking Inertia

In the absence of a consolidated practice, inertia prevails, which favors neither innovation in methods nor substance. Ongoing processes tend to be maintained or deepened.

In the Brazilian case, in addition to greater organization in the private sector, the government structure supporting the maintenance and expansion of exports in the national agricultural sector is already well established. The dynamic network formed by Itamaraty, the Ministry of Agriculture, Fisheries, and Supply (MAPA), agencies such as ApexBrasil and Embrapa, associations, and companies in the sector is an example of a coordinated circuit that functions efficiently, with multiple layers of interactions among its actors. The important role of the agro-export sector in Brazil's trade balance justifies the continuous improvement of this structure, as has recently occurred through the expansion of the network of agricultural attachés abroad.

In order to diversify and add value to Brazil's export basket, promote national technologies, and identify opportunities for collaboration in ongoing reindustrialization efforts on a sustainable basis, it is necessary to develop new "integrated circuits." Prioritizing knowledge diplomacy issues in Brazil is crucial not only for its intrinsic relevance and its impact on the global economy and societies (Lopes 2023), but also due to the current characteristics of the "national political geography" (Alencastro 2022), marked by the economic and social weight of agribusiness.

Brazilian diplomacy can play a fundamental role in the political-institutional process of recalibrating the national productive structure. The desire for the recovery of the industrial sector in Brazil is directly influenced by the external scenario, which presents possibilities and imposes constraints.

Because it has the capacity to provide input on this relationship, with a cross-cutting medium—and long-term vision, the Ministry of Foreign Affairs should seek to contribute increasingly to the process of formulating public policies and strategies on the subject. The semiconductor sector again offers a relevant example: decisions and processes initiated today will determine the relative position of countries in terms of competitiveness, as well as their resilience or vulnerability and technological dependence in the coming decades.

7.3. Innovating in Form and Content with Countries in the Global South

Relations with countries in the Global South are marked by horizontality. Typically, both partners face comparable levels of development and similar challenges to overcome. The tradition of coordination in multilateral spheres,

in addition to indicating shared views of the international landscape, tends to help foster mutual trust.

Horizontality and trust are fundamental elements for exploring the possibilities that exist in bilateral relations, including collaborative solutions based on the joint development of technologies. As explained in this text, chip diplomacy between Brazil and Malaysia was based on an exploratory, horizontal, and collaborative approach.

In developed countries, the ease of identifying cutting-edge technology sectors often comes at the cost of limited access to this type of technology. With developing countries, this relationship does not necessarily hold true. Sometimes, cutting-edge sectors—or those with the potential to become so—are not immediately recognizable, but once identified, there are better conditions for establishing relationships that allow for genuine technology sharing, transferring, or joint improvement.

Identifying opportunities in the Global South, however, is rarely among the priorities of government agencies, institutions, or the private sector. There are several reasons for this. In addition to a lack of knowledge and linguistic and cultural barriers, the generally scarce human and material resources tend to reinforce traditional inertial tendencies, such as turning to countries in the North, which are considered, despite the difficulties in sharing technology, "natural" partners for qualified insertion into more advanced production chains.

This context underscores the strategic importance of diplomatic action. In markets whose full potential is still unknown, it is even more important to equip embassies with the capacity to play a pioneering role. Innovation diplomacy has the right tools to do this—not by prescribing a rigid model, but by proposing a working approach that fosters networking and autonomy. While not exclusive to relations with countries in the Global South, this approach proves particularly useful in relations with this group of countries.

The intelligence produced by Brazilian embassies abroad can be a catalyst for the formation of new "integrated circuits": innovative structures involving governments, the private sector, research, development, and innovation institutions, as well as universities that focus on concrete initiatives in strategic areas.

In terms of cost-benefit, strengthening diplomatic action in countries of the Global South is a relatively low investment. Coordinated through the embassy network, it does not demand disproportionate expenditure of budgetary or institutional resources. This is positive both because of the potential gains that can be obtained and because it mitigates the impact if the initially expected results are not achieved.

In terms of human resource allocation, the addition of an extra diplomat to the embassy in a Global South country should be seen as a potential asset, to be used to identify and promote the strategic interests of various national productive ecosystems. For professionals abroad, the prospect of networking, with a more dynamic approach, will be stimulating, as it will allow them to explore several fronts at the same time, with the autonomy to reorient their actions towards the areas that prove most promising.

Developing new structures for collaboration in bilateral relations with countries in the Global South requires a willingness to innovate in form and content. Through its network of posts abroad, Itamaraty can, with the diplomacy of innovation, be an agent for inducing new dynamics. Using the terms of economist Mariana Mazzucato, whose concept of mission-driven economics is a reference for the industrial policies of Brazil and Malaysia, it is necessary to trust in the benefits of acting with boldness and experimentation, taking risks together and sharing rewards.

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