

Cold War rivalry on Brazil's and Argentina's nuclear programs: examining military and civilian intentions

A Guerra Fria no desenvolvimento dos programas nucleares de Brasil e Argentina: analisando intenções militares e civis

DOI: <https://doi.org/10.22456/2178-8839.130433>

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Abstract

The objective of this article is to investigate whether Cold War rivalry influenced the development of nuclear programs in Brazil and Argentina. The research employs a qualitative approach and bibliographic analysis of primary sources, including articles, books, and other relevant sources. The main hypothesis is to examine whether the culture of Cold War rivalry stimulated the development of nuclear programs in these countries, analysing the military and civilian intentions behind their nuclear technologies. While it is commonly reported that Latin America was under the influence of the United States (US) and the Soviet Union (USSR) during the Cold War, the cases of Brazil and Argentina show the opposite. Both countries adopted independent nuclear policies, seeking technological transfer through diversified and autonomous partnerships. Additionally, these divergent positions included arguments and actions regarding their respective nuclear policies. However, mutual distrust between Brazil and Argentina regarding the advancement and sophistication of their nuclear programs generated a dynamic similar to the Cold War in the Southern Cone region. This dynamic originated internally based on the logic of the two countries, despite the later creation of joint non-proliferation mechanisms.

Palavras-chave: Nuclear policies; Brazilian military regime; Argentina; Cold War; Nuclearization.

Resumo

O objetivo deste artigo é investigar se a rivalidade da Guerra Fria influenciou o desenvolvimento dos programas nucleares no Brasil e na Argentina. A pesquisa utiliza uma abordagem qualitativa e análise bibliográfica de fontes primárias, incluindo artigos, livros e outras fontes relevantes. A hipótese principal é examinar se a cultura da rivalidade da Guerra Fria estimulou o desenvolvimento dos programas nucleares nesses países, analisando as intenções militares e civis por trás de suas tecnologias nucleares. Embora seja comumente relatado que a América Latina estava sob a influência dos Estados Unidos (EUA) e da União Soviética (URSS) durante a Guerra Fria, os casos do Brasil e da Argentina mostram o contrário. Ambos os países adotaram políticas nucleares independentes, buscando transferência tecnológica através de parcerias diversificadas e de forma autônoma. Além disso, essas posições divergentes incluíram argumentos e ações sobre suas respectivas políticas nucleares. No entanto, a desconfiança mútua entre o Brasil e a Argentina em relação ao avanço e à sofisticação de seus programas nucleares gerou uma dinâmica semelhante à Guerra Fria na região do Cone Sul. Essa dinâmica teve origem internamente, baseada na lógica dos dois países, apesar da posterior criação de mecanismos conjuntos de não proliferação.

Keywords: Políticas nucleares; Regime militar brasileiro; Argentina; Guerra Fria; Nuclearização.

Received: 27 February 2023

Accepted: 07 June 2023

Conflicts of interest: The authors did not report potential conflicts of interest



Introduction

The American monopoly of nuclear bombs becomes a strategic and indispensable issue for the security agendas of developed and developing states, since it raises security concerns around the world (KISSINGER, 1969; JERVIS, 2000). In 1949, the Soviet Union broke this US monopoly, also becoming a nuclear power. Following the same pace, three other powers: the United Kingdom in 1952, France in 1960, and China in 1964¹ together became the "Group of Five" countries holding nuclear arsenals before the 1970s (RICHARDS, 2003).

The Indian nuclear test, which took place on 18 May 1974, known as "Smiling Buddha", had significant repercussions for nuclear proliferation worldwide. The test led to the development of more restrictive export controls instruments, which had an impact on countries in Latin America and other regions seeking to develop their own nuclear programs. These controls were implemented to prevent the spread of sensitive nuclear technology, materials, and knowledge, and they created challenges for countries seeking to acquire these resources for peaceful purposes. As a result, many Latin American countries faced barriers to obtaining nuclear technology and were forced to rely on international partnerships to advance their nuclear programs. This situation created a complex environment of technological dependency and political negotiation, which continued to evolve throughout the Cold War and beyond (AVEY, 2015; BANDARRA, 2021; PATTI, 2021).

The development of domestic nuclear technologies in those five countries mentioned, was also accompanied by the creation of rules, written by them, to limit their monopoly of such power (GADDIS, 2006; SIRACUSA; WARREN, 2018). Known as Nuclear Weapon States (NWS), in a period like the Cold War, those states created several control mechanisms to maintain the balance of power at the international stage. Some nations outside this select group, known as Non-Nuclear Weapon States (NNWS), which sought to advance the nuclear agenda, found, to some extent, obstacles to developing their nuclear projects and to advance in fissile material research², whether for military (non-peaceful) or civilian (peaceful) purposes. After all, due to the dual nature of nuclear development research³, the debate over what constitutes peaceful or non-peaceful use⁴ of atomic energy has always been present.

To understand the context of the rules created within the non-proliferation regimes, it is necessary to highlight their main historical milestones. In December 1953, US President Eisenhower delivered a speech to the United Nations General Assembly (UNGA) in which he outlined the "Atoms for Peace" program, establishing guidelines for the peaceful use of nuclear energy. Years later, in 1957, the International Atomic Energy Agency (IAEA) was created, which main objectives were to promote and control the use of the atom capabilities (IAEA, 2016)⁵. Following the creation of the IAEA in 1957, the Nuclear Non-Proliferation Treaty (NPT) was established in 1968 and opened for signature in 1970.

Among the initiatives mentioned, Brazil and Argentina joined two, and rejected one. The first one was the adherence to partnerships through the rules of the US policy of "Atoms for Peace", highlighting here that they first acquired

¹ After the Chinese, India is the second Asian country to carry out its first nuclear test, and became known as "Smiling Buddha". The country claimed that the test was part of the Peaceful Nuclear Explosions (PNE), which will be discussed later in this article. The Asian country was not part of the Group of Five, and carried out its test after the opening of the Nuclear Non-Proliferation Treaty (NPT). At the time, the test provoked profound changes in global nuclear technology supply guidelines, and had a significant impact on third world countries.

² Fissile materials are all those capable of sustaining a nuclear fission chain reaction. As a consequence, they can produce energy through the heat they radiate. If properly controlled, they are used in reactors to produce electricity. However, they can also be used for military purposes, as nuclear fission can turn fissile material into an explosive, like those used in Hiroshima and Nagasaki.

³ As discussed in footnote 2, fissile material can be used for both peaceful and military purposes. What differentiates one from the other is the amount of enrichment of uranium, the main mineral used in this process. The enrichment of uranium-233 and uranium-235 needs to reach 90% if the goal is to produce a critical mass for a nuclear explosion. If it is used to generate electricity, this same percentage is reduced to a maximum of 10%, making it ineligible for the production of nuclear artifacts. Moreover, to achieve 90% enrichment of uranium-233 and 235 requires a considerable amount of resources. For this reason, the NWS mostly manage to prevent NNWS from having access to this type of technology, as we shall see briefly in the Brazilian and Argentinean cases.

⁴ Peaceful nuclear use is a controversial issue. This is because the NNWS argue that underground nuclear testing is a form of peaceful use of this type of technology, ignoring the fact that they use nuclear bombs for their defence. After all, the narrative runs into the question that if the NWS can test nuclear artifacts, why not them? That is the issue of Peaceful Nuclear Explosions (PNE) or Peaceful Nuclear Explosions (PNE), which can also be understood as peaceful use of nuclear energy, in this critical perspective of the NNWS. However, it is important to note that this concept was widely abandoned in the 1990s and is no longer considered a valid option. This is enshrined in the Quadripartite Agreement and in the Guadalajara Treaty, of which Brazil and Argentina were a part. Warnke (2016) addresses the problematic issues surrounding PNEs throughout the 20th century and how PNEs can (or cannot) be understood as peaceful use of nuclear energy.

⁵ The Agency was, and still is, linked to the United Nations (UN).

their nuclear technologies as a result of this policy, followed by the adoption of IAEA terms at the 1950s (MALLEA, 2012; PATTI, 2013). Lastly, on the NPT discussion terms, like some other NNWS countries, Brazil and Argentina did not sign and ratify the NPT⁶ immediately. When NPT was opened to signatures, Brazil and Argentina held critical positions about it, the posture that would remain until the 1990s⁷. João Augusto de Araújo Castro, Brazilian ambassador to the UN in 1968, summarizes the idea taken by Brazil, which was also followed by the Argentines, in the following passage taken from the work of Camargo (2006):

Disarmament should be more than a methodology of power. Disarmament should aim at something nobler and more inspiring than the mere stabilisation and freezing of power. Power should not remain forever, as it, unfortunately, is today, the only standard measure used to measure the acts of men and the actions of states. That is why we must return to our debate on international security and direct our efforts towards revising the United Nations Charter so that it can become an expression of justice and cease to be a by-product of power. We cannot live forever in the year 1945. Time and history have not stopped: we have not been frozen either in 1945 or in 1967.

Even though Brazil and Argentina aligned themselves on the NPT issue, demonstrating political proximity, the dispute for obtaining nuclear technologies strained their relationship. After all, nuclear development drags states in a certain logic of dispute and race between them, triggering a behaviour of rivalry, very present between middle powers, given the power that this type of technological development gives to a particular state.

Mallea (2012) in his work *La cuestión nuclear en la relación argentino-brasileña (1968-1984)* makes significant contributions to the scope of the discussion, by highlighting how Brazil and Argentina perceived themselves as potential threats due to their respective nuclear advances, during the second half of the twentieth century. Added to Mallea's work (2012) are various documents and narratives from the period, to name a few: Mendonza (2009); Patti (2012, 2014) and Wrobel (2017). In this sense, research in the field of the development of nuclear programs in Argentina and Brazil during the Cold War is important as it provides insights into the dynamics of Cold War rivalries in the Southern Cone, sheds light on the motivations and intentions of both countries in pursuing nuclear technologies, offers lessons for contemporary discussions on nuclear non-proliferation and disarmament, and has implications for regional stability and security.

The nuclear issue involving Argentina and Brazil thus gains remarkable significance for understanding the case in the context of rivalry between middle powers (GOLDEMBERG; FEIVERSON, 1994). Considering the relevant number of papers dedicated to studying this theme, we focus our study on the time frame in which both countries went through military regimes. One of the constant Cold War agendas was the nuclear issue, which was no different between middle powers such as Brazil and Argentina. Therefore, the main objective of the present work is to trace a historical parallel between the development of the nuclear programs in Argentina and Brazil in the context of the Cold War, restricting the period of analysis to their respective military regimes and proposing to verify if the nuclear issue was influenced by the Cold War logic and by the rise of the military in power in both countries. The main hypothesis of the article is to determine whether the logic of Cold War rivalry was a contributing factor to the development of Argentina's and Brazil's nuclear programs, specifically examining the military and civilian intentions in the development of nuclear technologies. To test this hypothesis, the study will focus on the period during which both countries were under military regimes and will investigate whether the nuclear issue was influenced by Cold War logic and the military's rise to power. The analysis will be limited to the time frame of the Brazilian Military Regime from 1964 to 1985, as Argentina experienced successive military coups and a permanent crisis of democracy during the same period. The study will rely on historical documents, seeking to draw a parallel between the nuclear programs of Brazil and Argentina (BETHELL; ROXBOROUGH, 2005).

⁶ It is worth noting that Argentina and Brazil joined the IAEA safeguards system, even if they did not ratify and sign the NPT in the year of its foundation, 1957 (MENDOZA, 2005, p. 4).

⁷ Created by the NWS, the treaty foresaw that, upon accession, the NNWS committed themselves to abandoning the possibility of developing research with the aim of obtaining explosive artifacts, in addition to renouncing the right to use Peaceful Nuclear Explosions. The treaty divided the world into the haves (the Group of Five) and the have-nots, exemplifying a practice of freezing power (through monopoly) in the hands of the NWS.

The study is based on a qualitative survey of data on the nuclear program of both countries⁸. To address the main question of this article, a bibliographical review will be conducted on studies that have already explored the topic at hand, highlighting the verification of primary documental sources, digitally available in the databases of the Wilson Center Archive, the Center for Historical Research and Documentation of the Getúlio Vargas Foundation (CPDOC-FGV), the collection of *Folha de São Paulo* and the collection of the newspaper *O Estado de São Paulo*, both Brazilian newspapers (ANCKAR, 2020).

In this way, the work was divided as follows: (i) a bibliographical review to understand the contextual variables that allowed the hypothesis to be raised; (ii) The deep analysis through case study approach, providing a comprehensive understanding about Argentine-Brazilian nuclear cooperation at the rule of both military regimes, discussing the documentary and bibliographical analyses raised; (iii) a conclusion that points out the theoretical interpretation of the period and the mentioned object, producing a literary contribution to Cold War and Nuclear Proliferation Studies in Latin America, from the perspective of new literature and sources, using the documents and all qualitative resources to comprehend the period.

The Argentinian and Brazilian nuclear programs

The development of Argentina and Brazil's nuclear programs took place under similar conditions and around the same time, but with specific differences regarding the nuclear issue, as previously mentioned. In this research, the beginning of both programs will be presented, highlighting their main challenges and constraints. Here, the objective is to contextualize the development of Argentina and Brazil's nuclear programs, through a bibliographical review, the introduction of the arguments that will be presented in the subsequent analyses. At first, the reader will be introduced to general and contextual aspects of nuclear development during the second half of the 20th century, also briefly mentioning the political situation in the countries and the crises generated by alternating military regimes. Afterwards, a detailed analysis of how the advance of nuclear development occurred in the pre-military regime period will be made to then correlate this specifically to the military regimes in Argentina and Brazil.

The beginning and the mills

Argentina created its *Comisión Nacional de Energía Atómica* (CNEA) in 1950, under the aegis of the Argentine Nuclear Plan (PLAN), establishing the first national guidelines in the context of the national development of nuclear energy (OLIVEIRA, 1998; MENDOZA, 2005; ORNSTEIN, 2010; MALLEA; SPEKTOR; WHEELER, 2015). Its first reactor, named RA-1, was inaugurated on January 17, 1958, and fulfilled the initial steps of the Argentine long-term plan to master the nuclear fuel cycle, from its initial phase, mineral extraction of uranium, to the production of the encapsulated pellets with enriched uranium, a development that would only materialize three decades later (OLIVEIRA, 1998; MENDOZA, 2005; ORNSTEIN, 2010). On June 10, 1960, Argentine President Arturo Frondizi declared through Decree n. 7006/60 the "high national interest the activities developed by the CNEA and ratifying its dependence to the Presidency of the Nation" (ARGENTINA, 2018) making the agency a subordinate expression of nuclear technological development strategies.

The first Argentinian nuclear power plant, Atucha I, result from an agreement with West Germany, operated a 367 MW Pressurized Heavy Water Reactor (PHWR) and was inaugurated operating at full load on November 16, 1974 (OLIVEIRA, 1998; WORLD NUCLEAR ASSOCIATION, 2021). Atucha I, was followed later by the creation of Embalse Rio Tercero plant, acquired by the Argentina-Canada agreement in 1974, which had a PWR reactor named CANDU 6, opened

⁸ Although the objective is to analyse which nuclear program has demonstrated more efforts towards the military use of nuclear technology, it is very important to highlight that due to the dual use of this technology one should also consider efforts for its peaceful purposes (electric power, medicine and rural) which, by intentional or unintentional consequence, lead countries to better develop their capabilities for both purposes (military or civilian). To better understand this process, which would require significant explanation in the main text, readers are encouraged to refer to footnotes 2, 3 and 4 for more details.

for commercial operation on January 19, 1984 (OLIVEIRA, 1998; WORLD NUCLEAR ASSOCIATION, 2021). The achievement of the second operable plant in Argentina places it as the second largest third-world nuclear power, behind only India (ORNSTEIN, 2010; MALLEA, 2012; WORLD NUCLEAR ASSOCIATION, 2021). Its latest plant, Atucha II, with 745 MW of power, was developed through an agreement with the West German company Kraftwerk Union (KWU), under international safeguards, its construction started in July 1981, but only finalised for commercial operation in May 2016 (WORLD NUCLEAR ASSOCIATION, 2021).

In this period, Argentina was undergoing numerous political turbulences. Juan Perón took office as president in May 1973, seven years after the military coup of 1966, the first to establish a permanent system of government (LEFFLER; WESTAD, 2012). This democratic transition amidst the military coup of 1966 was mainly due to an organised and widespread popular uprising, which advocated the return of the democratic system of government and the establishment of new elections, which had Hector J. Cámpora as the victorious, although his resignation led to new elections, which gave electoral victory to Juan Perón and his wife Isabel Perón, representatives of progressive sectors and important politicians in previous periods in the Argentine government. Perón, however, died in 1974, giving the position to his wife until 1976, when an Argentine military *junta* managed to oust her from the government, remaining in the country's highest power until 1983, with an agenda of repression of popular groups and a series of anti-constitutional reforms (LEFFLER; WESTAD, 2012).

On the other hand, the initial milestone of the Brazilian Nuclear Programme dates mainly from the 1930s, when the first research on the atom and its capabilities was carried out. The US has always been very interested in Brazil due to the large quantities of uranium available as raw material. Thus, they established a secret agreement in 1945 that provided the sale of 5000 tons of Brazilian monazite sand, a material with high uranium concentration, to the north-Americans, starting what would be the first commercial initiative in the nuclear field (PATTI, 2012). The purpose of the sand was to be used on the Manhattan Project (PATTI, 2014). One of the autarchies responsible, years later, for the continuation of the Brazilian nuclear program was the National Research Council from Brazil, *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (CNPq), which had a navy officer, Admiral Álvaro Alberto, as its chief (SATO, 2013). The admiral's mission became to seek partnership alternatives in the world that could provide the program its greatest ambition: to master the nuclear cycle, obtaining capabilities to extract raw material to produce nuclear fuel (PATTI, 2013; MALLEA; SPEKTOR; WHEELER, 2015; SPEKTOR, 2017).

Monazite sand was discovered in Brazil, in greater concentration in the state of Espírito Santo, thanks to geological analyses carried out by North American specialists. The export of monazite sand to the US lasted until the mid-1950s when the Brazilian government began to seek reciprocity through technological transfer, which would allow advancements in a national nuclear program. Alberto was a great exponent in the pursuit of reciprocity in relations with Washington in the nuclear realm. He represented Brazil since 1946 at the United Nations Atomic Energy Commission (UNAEC), and was responsible for presenting the first proposal for nuclear development at the National Security Council of Brazil. The CNPq was created in 1951 in this context, and although it is a broad-based research support institution, one of its primary functions was nuclear development (SATO, 2013; PATTI, 2014).

The nuclear plan prepared by Admiral Alberto was approved in 1951 by Brazil's president, Getúlio Vargas. The strategy was based on the pursuit of international partnerships and had been built after the visit of Brazilian officials to civilian nuclear research centres in Western Europe and North America. Alberto believed that the US would be the most relevant partner regarding Brazil's nuclear development, but nevertheless, he remained in touch through letters with nuclear scientists from the Soviet Union, because he was seeking advantages and technology on more than one negotiation front. 1951 was a key year for the US-Brazil relations concerning nuclear energy, as the Capitol amended the US Atomic Energy Act, authorising the sharing of restricted information as long as the US would get tangible benefits in return from its partners (PATTI, 2014).

Considering that Brazil was one of the main suppliers of atomic materials to the US, the expectation was for the intensification of cooperation with Washington, however, this did not happen. In the same period, uranium was discovered in the American states of California and New Mexico which, in a certain sense, weakened Brazil bargaining power. Thus, the US opted for a positioning of cooperation through training of Brazilian scientists at its universities and to enable the purchase of laboratory equipment for uranium research, however, strategic technologies that could speed up the nuclear program were not provided (PATTI, 2014).

In 1955, an agreement was signed for the provision of a synchrocyclotron particle accelerator from the US to Brazil. This equipment can be used for uranium enrichment through electromagnetism, however, despite the Americans considering it only as a research tool, the Brazilian military saw applications for other purposes. Even nowadays, it is not clear if the intentions were peaceful or about the development of a nuclear artifact. When it became evident that the US would not provide the technologies or materials that would make Brazil turn nuclear fission feasible, Alberto began to seek cooperation directly with German research centres. At the same time, Brazil established a partnership with France, seeking to mine and refine uranium. Between 1952 and 1953 CNPq tried to bring a heavy water reactor from Norway, which used plutonium as fuel, nevertheless the high installation costs and technical advices from one of the creators of the atomic bomb, Robert Oppenheimer, led Alberto to opt for the reactor's technology from Germany (SATO, 2013). Both President Vargas and the CNPq board of directors had the common understanding that the diversification of partnerships would be a crucial element for the development of the Brazilian nuclear program. Thus, they could not become dependent on a single country, not even a friendly nation in diplomatic terms (PATTI, 2014).

As a result of the efforts and resources of that time, Brazil reached its first major agreement for purchasing nuclear facilities with the Federal Republic of Germany (FRG) in the late 1950s. The forecast was to receive uranium enrichment ultracentrifuges⁹, to be delivered in 1957, and a uranium hexafluoride plant (PATTI, 2013). However, due to political changes, they do not actually get to be installed in Brazil¹⁰ (CAMARGO, 2006; PATTI, 2013). Brazil will have its first reactor in fact only years later, in 1958, when the IEA-R1 research reactor is inaugurated, due to the "Atoms for Peace" agreement (PATTI, 2013).

On November 25, 1953, President Vargas approved a national project for the acquisition of all phases of nuclear energy production, including the construction of power plants and the training of nuclear scientists abroad. This meant the official opening for negotiation on different fronts, but again it would be frustrated attempts, because in July 1954 the acquisition of the German ultracentrifuges was blocked by the US. Since the beginning of negotiations with FRG, Alberto had been cautious, for example, he excluded the Ministry of Foreign Affairs and included only the CNPq to avoid information leaks. However, in June 1954 a member of the CNPq shared with the US Embassy in Rio de Janeiro that there were four young Brazilian scientists participating in a research project in West Germany on methods of separating uranium-235 by centrifuges. This led to a strict approach by the State Department towards Brazil on the nuclear issue. In the same year, through the aforementioned "Atoms for Peace" program, American legislation began to allow greater cooperation with other countries, but Washington kept the policy that the CNPq's cooperation with the FRG resulted in a diplomatic deadlock, and even threatened to ban Brazil completely from nuclear cooperation, as the enrichment of U-235 would jeopardise hemispheric security. In addition to preventing the sale of centrifuges, the American political pressure led to the end of atomic cooperation with France and the removal of Alberto from the presidency of the CNPq, which had repercussions on the entire nuclear program (PATTI, 2014).

The first nuclear power plant created in Brazil is called *Angra I* and was installed in the city of Angra dos Reis, Rio de Janeiro. It was the result of an agreement with the American company Westinghouse, and started its construction in

⁹ Here we highlight a difference for the Argentines. This equipment, unlike a reactor, is used to manufacture nuclear fuel. The reactor, on the other hand, requires nuclear fuel.

¹⁰ The first reactor acquired by the country would be the result of the US policy "Atoms for Peace", in 1955, the IEA-R1. From this, the country was able to create another, nationally produced, known as "Argonaut", operational only in 1965. Both were, and still are, used for scientific research (PATTI, 2013). The Argonaut is located at UFRJ, and the IEA-R1 in São Paulo.

March 1972, being commercially activated in December 1984, with power generation capacity of 609 MW (PATTI, 2013; WORLD NUCLEAR ASSOCIATION, 2021). It went through several difficulties, the main one being the fuel supply, in the 1970s. In 1974, after the "Smiling Buddha" nuclear test in India, the US Atomic Energy Commission (USAEC) suspended the contracts established with *Furnas*¹¹ and the Westinghouse, making the PWR model reactors installed in *Angra* temporarily inoperative (PATTI, 2013). That moment was decisive for rescuing previous contacts with the FRG, which seemed to be a good alternative, since the US proved to be an unreliable partner. The second Brazilian nuclear power plant is named *Angra II*¹², which has an operational capacity of 1275 MW, and is installed in the same region as *Angra I*. It arises from the Brazil-West Germany agreement, from a contract with the Siemens company (PATTI, 2013). It also has PWR-type reactors that came into operation in 2002 (SPEKTOR, 2017; WORLD NUCLEAR ASSOCIATION, 2021).

The four South American pearls: *Atucha I*, *II*, *Embalse*, *Angra I* and *II*, are the most expressive results of the political efforts of both countries' democratic and military regimes, aiming to achieve, primarily: (i) energy self-sufficiency; (ii) master nuclear technology (even if not entirely); (iii) use of nuclear technology for peaceful purposes; and (iv) access to nuclear fuel production facilities and stages. However, as will be observed, the efforts for the construction of nuclear power plants that Argentina and Brazil have invested numerous resources, along with valuable political capital, to obtain the necessary conditions for the development of their respective nuclear programmes, have promoted rivalry between them in this context.

A brief analysis of pre-military coup d'état: Argentine-Brazilian peaceful nuclear situation during 1960-1966

The nuclear proliferation motivations usually develop from two different levels: the first are motivations based on a regional context, i.e., nuclear weapons play a supreme role in the policy of mutual deterrence among neighbour states; while the second level is constituted of global motivations, which presume the ability to project power on a global scale. As an example of the first case, there is India and Pakistan, or the North Korean situation. For these countries, nuclearization was motivated by regional circumstances as a means of ensuring their survival. For the second case, the nuclearization of the US and the Soviet Union, in the context of the Cold War, are examples of superpowers with global pretensions. In research carried out in 2018, among the 10 largest economies in the world, Brazil was the only country which mastered the nuclear fuel cycle that lacked nuclear weapons for self-protection. Argentina, which consolidated itself as the second power in the Southern Cone, likewise, despite having nuclear technology, having installed its first nuclear power plants even before Brazil, also did not build atomic bombs. Achieving their current level of nuclear development required massive investments in research and technology, as well as efforts in international cooperation. The Brazilian and Argentine nuclear capabilities thus extend beyond conventional explanations at the global and regional levels, but consist of a unique historical experience (GOLDEMBERG; FEIVERSON, 1994).

Mallea (2012, p. 39) and Mallea *et al.* (2015) state that during the 1960s: "the Argentine-Brazilian nuclear relationship was characterized by a climate of cordiality in the diplomatic sphere, and they began to rehearse unified postures expressed in joint statements, in respect of the international order (...)". The need to join forces, at this first moment, was mainly due to the need to overcome the difficulties imposed by the NWS in the trade of nuclear materials. An example of this rapprochement between Brazil and Argentina can be seen in the creation of the IAEA, where they decided to alternate between them for the position of South American representative in the organization (MALLEA, 2012, p. 42).

In 1962 the Cuban missile crisis was the first episode in which a nuclear weapon reached Latin American soil. The event brought the US and USSR to the height of their political tensions and had a unifying effect on Latin American countries about the non-proliferation agenda and led to the establishment of a nuclear weapon-free zone in the region

¹¹ The public enterprise responsible to manage the contract between Brazil and US.

¹² It is necessary to highlight that *Angra II* was concluded after the analysed period of this article.

(WROBEL, 2017, p. 59). In 1967, Argentina and Brazil and 19 other countries signed¹³ the Treaty for the Proscription of nuclear weapons in Latin America, known as Treaty of Tlatelolco¹⁴, after institutionalized by the Organism for the Proscription of nuclear weapons in Latin America and the Caribbean (OPANAL) created in 1969, as a necessary mechanism in ensuring compliance with the treaty (MENDOZA, 2005).

The movement to create Treaty of Tlatelolco and to OPANAL demonstrate the Argentine-Brazilian efforts towards the construction of the Latin American non-proliferation agenda, pre-military dictatorship. However, Mallea (2012) highlights that the Argentine delegation, at the beginning of the negotiations for the treaty, even though it existed, did not conclude that the Argentines wanted restricted cooperation (MALLEA, 2012).

This Argentine position of supporting OPANAL but remaining independent regarding the implementation of obligations that would prevent or hinder its nuclear development, is seen in the defence of PNEs (Peaceful Nuclear Explosions)¹⁵. Brazil, on the other hand, at least under João Goulart's leadership, was opposed to any nuclear explosion, whether PNEs or even military ones¹⁶ (MALLEA, 2012, p. 42).

It is interesting to note that this scenario underwent a radical change after the military coup in Brazil on April 1st, 1964. The Brazilian military started to defend the use of the PNEs as an indispensable right for Brazil's political autonomy, which opens the discussion that: both defending the use of peaceful explosions, they rushed to obtain the bomb as soon as possible in order to be the first in South America to carry out nuclear tests. In this way, they do not sign the Treaty of Tlatelolco because they do not rule out the possibility that they could, if they wanted to, use nuclear weapons in the future (MALLEA, 2012; PATTI, 2012; MALLEA; SPEKTOR; WHEELER, 2015).

In December 1967, the Costa e Silva administration, the president who succeeded Castelo Branco, proposed, through a visit by CNEN president Uriel da Costa Ribeiro and CNEA director Oscar A. Quihillalt, the beginning of negotiations to create a nuclear agreement with Argentina (RIBEIRO, 1967). After all, by simultaneously defending the use of PNEs, both Argentina and Brazil did not rule out the possibility of manufacturing a nuclear explosive, whether for "peaceful" or military purposes¹⁷. In the same year in which the agreement between both countries was conceived, two military dictators met for the first time to discuss the issue of nuclear cooperation at a time when the Cold War logic predominated in international relations.

The Argentinian and Brazilian nuclear trajectories from 1966 to 1985: the rule of the militaries

Brazil took the initiative to propose a nuclear cooperation agreement to Argentina, in 1967 (LIVRETO COH, 2012). That produced a preliminary draft of the nuclear cooperation agreement between them, numbered in four articles, officially presented in March 1968 by a CNEA scientist who went to Brazil to be briefed on it (BRAZIL; ARGENTINA, 1968). At this point, the institutionalisation of scientific and political networks was growing and developing in the search for balance and peaceful nuclear development, even under the beginning of their military regimes. Despite that, during this

¹³ It is worth noting that Argentina and Brazil's commitment to the treaty was partial, since they did not ratify the treaty in their national laws (MALLEA *et al.*, 2015, p. 208).

¹⁴ The Tlatelolco Treaty, among other clauses, provides in Article 1: (i) the commitment to the peaceful use of nuclear materials and facilities; (ii) the prohibition of the use, manufacture, production or acquisition of all nuclear weapons (OPANAL, 2006; STUENKEL, 2010; WROBEL, 2017).

¹⁵ Peaceful nuclear explosions (PNEs) were nuclear detonations carried out for non-military purposes, such as excavation or mining. Some nations advocated for PNEs as a way to maintain the option of using nuclear weapons for peaceful infrastructure projects. While PNEs did not involve the testing of nuclear weapons, they nonetheless raised concerns about the potential for radioactive contamination and were largely abandoned as a concept in the 1980s.

¹⁶ The idea that Brazil, under João Goulart's leadership, was opposed to any nuclear explosions has long been accepted. However, since the study of Patti in 2021, this thesis has been contested. Patti's study presents new documents and evidence that challenges this widely accepted notion and offers a different perspective on this moment in Brazil's history. According to Patti, Brazil's stance on nuclear explosions was not as straightforward as previously believed, and there were competing interests and influences at play during this period.

¹⁷ When discussing PNEs under other circumstances, military purposes were not necessarily driving the discussion. The term peaceful nuclear explosion (PNE) refers to using nuclear explosions for peaceful purposes, such as for exploration or extraction of natural resources. Many countries invested heavily in PNEs during the 1960s and 1970s in order to achieve energy independence and boost their economic growth. The US, for instance, carried out several PNEs in the 1960s, including the Project Plowshare, which aimed to use nuclear explosives for mining, excavation, and civil engineering projects. Similarly, the Soviet Union carried out several PNEs in the 1970s for similar purposes. However, the risks associated with PNEs and the opposition of the international community led to the decline of this technology (KUROSAWA, 2018).

time, some specific movements among Argentina's political elite view from the Brazilian Nuclear Program (PNB), were to be careful with this subject. Written on October 19, 1967, an Argentinean report on nuclear development in both countries stated that Argentina was "five years ahead of Brazil" in its nuclear program, highlighting the danger of Brazil's defence of PNEs, and emphasising that in the meetings of the Preparatory Commission for the Denuclearization of Latin America (COPREDAL), Brazil had reinforced its right, even more than before, to be able to use nuclear artifacts. Mutual requests to sign the NPT also began at this period, the starting point of rivalry feeling, according to "Report, Argentinian Ministry of Foreign Relations, 'Nuclear Energy'" (1968).

Some months before the Argentine report, on July 6, 1967, the newspaper *Folha de São Paulo* also published an article with the same ideas shared by the Argentines', saying that: "Since 1960 Brazil has the conditions to manufacture the atomic bomb and now the military guarantee that: Nuclear delay will be overcome" (NUCLEAR..., 1967, p. 1). The delay was referred to the comparison of the PNB with Argentina's nuclear program, and which, according to the article, Brazil must act in face of the inevitable progress from the neighbouring country. The clear perception that Argentina was more advanced than Brazil in terms of possession of nuclear facilities, following years of intentions to approach cooperation agreements between both, which proved to be a long shot (BRAZIL, 1974c; MALLEA, 2012).

Upon taking office, Brazilian President Emílio Garrastazu Médici tried to resume the dialogue on nuclear cooperation between the countries. At the time, Brazil's Foreign Affairs Ministry, *Itamaraty*, headed by Mario Gibson Barboza, considered it favourable to resume talks with Buenos Aires, in order to "calm tempers" (BRAZIL, 1974b), something good to both countries. However, it was the Argentine Foreign Ministry that was wary of this specific rapprochement (MALLEA, 2012, p. 57). The reasons vary but, in the early 1970s, the fact that Brazilian economy was solidified as the fastest growing in Latin America, while Argentina went through moments of intense economic retraction, triggered a dispute environment in their relations (BANDEIRA, 2014; RICUPERO, 2017). The economic factor is just one, among many others, especially in the progress of the nuclear cooperation agreement, that contributed to the climate of confrontation and divergence between the countries. Even if the technical-scientific dialogue networks established a good basis for information exchange, aiming to avoid any kind of suspicions and misunderstandings in the nuclear area, it was inevitable that the successive frustrations, based mainly in direct comparisons, gave more strength to rivalry at the Argentine-Brazilian nuclear policy¹⁸ (MALLEA, 2012; MALLEA; SPEKTOR; WHEELER, 2015; SPEKTOR, 2017).

Adding to the list of political facts that affected the relationship of the two countries, the Indian test of May 1974, the "Smiling Buddha", heats up even more the debate for the defence of PNEs. India defended its right to use these explosions – as Indira Gandhi officially declared (PERKOVICH, 2002; MALLEA, 2012) and became the first "developing" country to acquire access to a nuclear detonation artifact. Soon after the tests, the chancellor appointed to office in March of the same year, now Antônio Azeredo da Silveira, made the following statement, taken from Mallea's dissertation (2012, p. 68):

In view of the above, it seems worth considering the possibility of Argentina moving towards a solution along the lines already followed by India, thus seeking its admission into the restricted group of nuclear powers, where it believes it is the only Latin American country in a position to join. To this end, we must take into account the fact that Argentina will have from this year onwards the capacity to produce 150 kilos of Pu-239, sufficient to sustain a production program of 15 artefacts of 10 kilotons. Argentina is even freer than India and Brazil, insofar as, not having ratified the Moscow Treaty, it can experiment with nuclear explosives. Not only underground, but in the atmosphere, under the waters and on the terrestrial surface.

¹⁸ To provide further context, it is worth adding a note from the CNEA President's regarding a potential agreement with Brazil. The note summarizes the reasons behind the failure to reach a nuclear cooperation agreement with Brazil. The note mentions past diplomatic correspondence between the responsible authorities from Argentina and Brazil, which sheds light on the history of communication between the two countries regarding nuclear matters. This correspondence includes letters and other documents that reveal the positions, concerns, and proposals of each side, during the negotiations (ARGENTINA, 1972).

In July of the same year, according to a confidential file (BRAZIL, 1974d), Brazil sent a delegation from its War College, *Escola Superior de Guerra*, to visit the *Atucha I* nuclear facilities, in order to make progress at the Argentine-Brazilian nuclear agreement attempts. Also, it was a secondary objective to explore how far was Argentina's nuclear program, and if they also could master the process to manufacture explosives artifacts, producing reports that could serve as material to compare their nuclear program with Brazil's situation. On September 11 of 1974, the Secretary-General of the Brazilian National Security Council, General Hugo de Andrade Abreu, sent President Ernesto Geisel a two-page report explaining the advantages of a cooperation agreement with the Argentines (BRAZIL, 1974a). The President of Brazil did not answer (MALLEA *et al.*, 2015).

It is very important to emphasise that, during all these attempts to achieve a nuclear agreement, Brazil and Argentina were at the climax of the dispute involving the use of *Bacia do Prata*, water basins that could provide high amounts of hydroelectric energy to both countries. This dispute began in 1967, when Brazil excluded Argentina from the right to participate in the construction of *Itaipu*, the hydroelectric plant base on the Paraná River (MALLEA; SPEKTOR; WHEELER, 2015, p. 23). For Mallea *et al.* (2015, p. 31) the dispute over the hydroelectric plant represented, together with both lack of interest to achieve a nuclear agreement, the main reasons that could provoke and trigger a security dilemma with the biggest countries in South America (MALLEA; SPEKTOR; WHEELER, 2015).

From this point, the question of the construction of the *Itaipu* hydroelectric plant becomes the most important element to measure the level of tension between Brazil and Argentina during the 1970s. In September 1974, Brazil's president Geisel stated that the "conditions to any progress in nuclear negotiations with Argentina passes to a resolution of the question of *Itaipu*" (MALLEA; SPEKTOR; WHEELER, 2015, p. 210). The following years, 1975 and 1976, were marked by more political instability in Argentina, reflected in its foreign and economic policies, therefore, emphasizing energy issues even more. The format of the exploitation of the Prata basin had not been resolved, that is, whether Argentina would enter into the agreement between Brazil and Paraguay. This process strengthened Argentina's suspicion that Brazil might be trying to weaken them, and that Brazil was already advanced in the nuclear project.

The perception of delay regarding the Brazilian nuclear program compared to the Argentine one, was not overcome even with the creation of *Angra I*. This reactor that had been supplied to Brazil in the late 1960s, which came into use only in 1984, was the target of criticism from Brazilian scientists and military, for being considered a turnkey unit. On the other hand, Argentina seemed to gain greater nuclear autonomy through cooperation with the Germans, a fact that raised concerns, as neither Brasília nor Buenos Aires had joined the NPT. This concern was one of the motivations for the change in Brazilian foreign policy, which led to seeking German technology transfer, by explaining that the country was facing energy problems which resulted from the petroleum shock, which was illogical, given that Brazil at that time was already dependent from hydroelectric power rather than from burning fossil fuels. This change implied a reaction by Washington, which promoted retaliation against Brazil's nuclear program, such as the suspension of fuel supply to *Angra I* (GOLDEMBERG; FEIVERSON, 1994).

One of the actions that gave strength to the Argentine thesis for the supposed Brazilian nuclear advanced program was the unfolding of the nuclear technology transfer agreement between Brazil and Germany for the construction of the *Angra II* plant. According to reports (BRAZIL, 1975), in Argentina perceptions, Brazil was now able to advance in the domain of enrichment technology, given the nature of the agreement with the company Siemens/KWU, and thus increase the capacity to generate energy and also create an environment for producing nuclear artifacts (MALLEA *et al.*, 2015). The agreement with Siemens/KWU advanced the Brazilian nuclear program to a point that the US, during the Carter administration (1977-1981), called for meetings with the Germans seeking to limit certain types of contracted technologies.

The German-Brazilian nuclear agreement signed in the 1970s has been widely studied in the academic literature. New studies provide a general overview of the agreement, a more nuanced understanding of the negotiations and technology transfers require a deeper analysis. For example, Bandarra (2021) highlights the challenges that arose during

the negotiations, particularly regarding the transfer of sensitive technologies. According to the author, West Germany's primary interest was obtaining reliable uranium supplies for its nuclear industry, and Brazil was a natural partner for this. In addition to discussing the negotiations between the two countries, the article sheds light on Brazil's concessions, such as accepting the safeguards of the International Atomic Energy Agency. That was also defended by Cameron (2018), Gray (2012) and Hilfrich (2014) that offer different perspectives about the 1975 nuclear agreement between Germany and Brazil. As Cameron (2018) explores domestic criticism in Brazil, Gray explores the US-German dispute over Brazil, and Hilfrich examines the roots of conflict between the US and West Germany over nuclear proliferation. As a whole, these articles give an insight into the complex political and technological factors that influenced the agreement, including the studies of Patti (2021) and Spektor (2017), which are widely used in this article (GRAY, 2012; HILFRICH, 2014; SPEKTOR, 2017; CAMERON, 2018; PATTI, 2021).

In response, the Brazilian alternative to North American, and the non-confidence partnership with the FRG, was to create the Parallel Nuclear Program (PNP) in 1979, in order to secretly spend resources under indigenous nuclear program and advance in the uranium enrichment process seeking to master the nuclear fuel cycle¹⁹, limited since then by the US²⁰. It is also noted that Argentina did not develop any parallel nuclear programme initiative like its Brazilian counterpart.

However, studies and documents show²¹ that the development of the Brazilian PNP did not conclusively prove to be a relevant variable in a possible conclusion by the Argentine military regime, or even influenced any counter measures. On the other hand, following normal pace, in 1979, Argentina's president Jorge Videla (1976 to 1981), acquired one reactor from Switzerland, which seemed to triggered positive feedback from Brazilian President João Baptista Figueiredo, who sent the president of NUCLEBRAS to Argentina in order to explore, again, the agreement with that country (PAUL, 2000). At this time, Argentina was open to agreeing on a nuclear cooperation deal (ARGENTINOS..., 1979). In this context, the technical-scientific staff from both CNEA and CNEN, in April 1980, discussed the terms of a final bilateral agreement in Rio de Janeiro (MALLEA; SPEKTOR; WHEELER, 2015, p. 213). Figueiredo finally visited Argentina, for the first time, to discuss nuclear agenda, in May 1980, aiming to sign the agreement that called for bilateral technical collaboration and joint ventures for the production of reactor components and fuel elements (BRAZIL, 1983). That was the first visit of a Brazilian president in Argentina since 1935 (VIGAL, 2007). On May 17, 1980, the agreement was drafted and opened to signatures from both foreign ministers.

The good environment shared by governments in Brazil and Argentina, followed by the decline of both military regimes, in 1985, contributed to put aside the suspicions surrounding the defence of the PNE, positively impacting on the perception of threat from one to the other, strengthened the agreement from May 17. Five years later, on November 1985, a joint declaration about Nuclear Policies between both countries was also signed (BRAZIL; ARGENTINA, 1985). In 1991 Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC)²² (MALLEA; SPEKTOR; WHEELER, 2015) was created, in order to address any suspicious about both nuclear program's status, and opening a window of opportunity to apply IAEA safeguards in both nuclear programs.

The beginning of this new period for the nuclear relationship between the two countries, due to efforts amid disputes, during the 90's became a reference to the non-nuclear proliferation agenda, and it was only possible by the advance of democratic regimes in Argentina and Brazil. Marinho (2017) describes this new period in Brazil-Argentina relations as a transition from "official cordiality" to "official fraternity". The previous phase, known as "official cordiality",

¹⁹ The PNP was divided into three separate projects, one for each of the Brazilian military branches. The Army's project was known as "Ciclone", the Navy's as "Remo," and the Air Force's as "Solimões" (PATTI, 2013).

²⁰ While the Argentines faced pressures from Washington in relation to their nuclear program, these were not as significant as the pressures experienced by Brazil (MALLEA *et al.*, 2015; PATTI, 2013).

²¹ Documents analysed at the following studies: Mallea *et al.* (2015) and Mallea (2012).

²² Recent studies have sought to document the history of the creation of the ABACC. These studies reveal that as early as 1977, US Congressman Paul Findley suggested the establishment of an institution like ABACC (PATTI; MALLEA, 2018).

was characterized by rivalry between the two countries, where although there were still channels of communication allowing dialogue on nuclear programs, it was conducted in a confrontational tone. On the other hand, "official fraternity" represents a stage of greater atomic integration, overcoming rivalry and establishing a cooperative approach that resulted in the later formation of MERCOSUR.

Conclusion

During the Cold War, Brazil and Argentina both pursued the development of nuclear programs, driven by geopolitical and domestic factors. Brazil, under the military dictatorship, saw nuclear technology as a symbol of national pride and sovereignty, as well as a means of diversifying its energy sources. Argentina, on the other hand, saw nuclear technology as a way to bolster its technological capabilities and strengthen its strategic position in the region. Despite their shared motivations, the two countries pursued different paths towards nuclear development. Brazil opted for a more independent approach, seeking to develop its own nuclear technology and capabilities, such as the aspiration to obtain complete knowledge of the uranium enrichment process. Argentina, however, sought international partnerships and cooperation, particularly with the US, in its pursuit of nuclear technology, being widely open to the international community. Taking into account that the main hypothesis of the article was to determine whether the logic of Cold War rivalry was a contributing factor to the development of Argentina's and Brazil's nuclear programs, specifically examining the military and civilian intentions in the development of nuclear technologies, the findings were that Cold War rivalry and the rising of military regimes in both countries contributed considerably to the development of the intentions on both nuclear projects, even providing both countries with the option of using PNEs.

The mutual distrust between Brazil and Argentina regarding the level of development and true intentions underlying their respective nuclear programs created a dynamic similar to that of the Cold War in the Southern Cone. Overall, the findings of this research, which aimed to answer the question: did the dynamics of the Cold War impact the development of Argentina's and Brazil's nuclear programs? support the hypothesis that the logic of Cold War rivalry played a significant role in shaping the development of Argentina's and Brazil's nuclear programs. The contrasting paths taken by each country and their interactions with external actors demonstrate the complexity and multifaceted nature of nuclear development during this period.

Furthermore, the development of nuclear programs in Brazil and Argentina were not without controversy and concerns about nuclear proliferation. The international community, particularly the US, as mentioned above, was wary of the potential of these programs to contribute to the proliferation of nuclear weapons. Both countries faced pressure to comply with international safeguards and inspections, and both eventually signed the NPT, during the post-Cold War period. Overall, the nuclear programs of Brazil and Argentina during the Cold War illustrate the complex interplay between domestic politics, regional power dynamics, and international pressures. While both countries ultimately chose different paths towards nuclear development, the pursuit of nuclear technology remained an important part of their national identities and strategic aspirations.

Finally, it was observed that the different moments involving Argentina and Brazil had outcomes that depended on their respective contexts. While the periods prior to the military coup dealt with the rapprochement towards the consensus, that the Argentine-Brazilian nuclear situation would be better solved if both joined forces, the changes in both military regimes promoted an environment of distrust and doubts regarding their real chances and intentions, in obtaining and using nuclear technology. The issue involving the possibility to use peaceful nuclear explosions and the perception of mutual delay, reveal that both mirrored to a certain extent an arms/technology race logic that resembled the Soviet-American nuclear relationship. Nuclear issues during the analysed regimes had a different political significance when compared to ideological issues: for Brazil, superiority over Argentina in nuclear advancement was indispensable, while for

the Argentines, this difference boiled down to not being a threat, but rather a scientific competition. However, when it came to ideological repression, both parties agreed and found ways to cooperate.

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