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# THE NEED FOR A SYSTEMIC THINKING-BASED INTERVENTION IN THE BRAZILIAN SPACE PROGRAM IN THE NEW SPACE ERA

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**Abstract**
The Brazilian Space Program (PEB), initiated in the 1940s, enabled the development of national infrastructure, human capital, and industrial capacity. However, with the rise of the New Space paradigm—marked by increased private sector participation, venture capital investment, commercialization of space activities, and military interest—Brazil's governance structures and public policies are still adapting to this new dynamic. Despite its potential, the program's lack of systemic integration limits its strategic effectiveness and capacity to deliver societal and technological outcomes.
Systems thinking provides a suitable approach for assessing institutional asymmetries, mapping interdependencies, and analyzing how structural bottlenecks and feedback dynamics contribute to inefficiencies. This lens helps identify where targeted interventions could lead to systemic improvements. The study employs semi-structured interviews with experts from government, academia, and the private sector, combined with analytical tools from systems thinking and system dynamics. A participation vs. power matrix is used to assess the influence and engagement of key stakeholders. At the same time, causal loop diagrams illustrate the importance of sustained public funding in attracting private capital and fostering the growth of space companies.
The results highlight the growing role of FINEP – the Brazilian Funding Authority for Studies and Projects – as a key actor in the national space agenda, allocating capital in technological developments within the industry. To overcome governance challenges, the study proposes a systemic redesign of institutional arrangements, including the creation of a dedicated Ministry of Space to coordinate agendas, enhance policy coherence, and foster innovation aligned with the New Space context.

**Keywords**
New Space, Systems Thinking, Innovation Governance, Brazilian Space Program, Public Policy

## Introduction

In recent decades, the global space industry has evolved with the emergence of what is referred to in the literature as New Space—a paradigm marked by increasing private sector participation (Parrella et al., 2020), commercialization (Denis et al., 2018), and new forms of public-private collaboration and

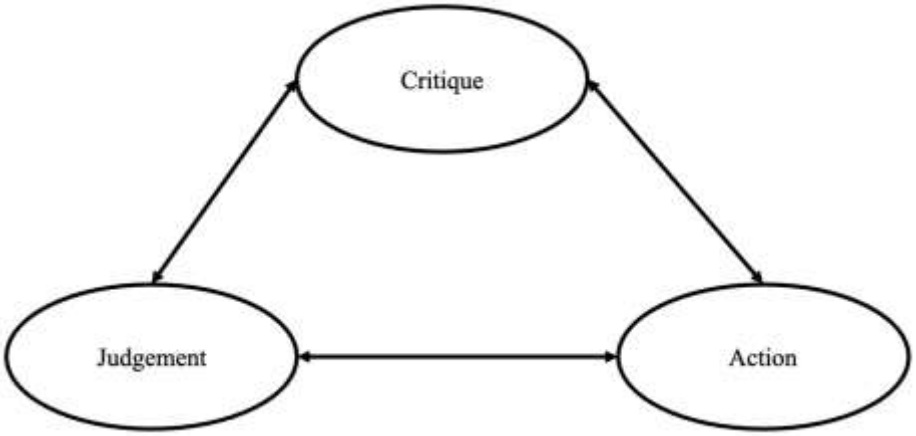
organizational hybridization (Ciccarelli & Dave, 2019; Heitor et al., 2024). In Brazil, this dynamic is gradually taking shape, creating pressure to adapt institutional arrangements to align with the structural changes reshaping the global space sector (Matos, 2024).

This article proposes a systemic intervention in the governance of the Brazilian Space Program (PEB), drawing on systems thinking as a suitable framework to identify institutional asymmetries, map interdependencies, and understand feedback dynamics. Stakeholder theory is used to analyze the interactions and roles of key actors in the Brazilian space ecosystem (Freeman et al., 2010). The methodological foundation is based on systemic intervention as developed in systems theory, which emphasizes boundary critique, methodological pluralism, and improvement-oriented action (Midgley, 2000). From this perspective, the paper outlines targeted interventions in the Brazilian space ecosystem that are aligned with the opportunities and challenges of the New Space era.

## Systemic Intervention

A systemic intervention is a "purposeful action by an agent to create change in relation to reflection on boundaries" (Midgley, 2020, p. 128). The methodology for systemic intervention comprises three components: first, the need for agents to reflect critically on their boundaries; second, the need for agents to make choices between theories and methods to guide their actions; and last, the action for improvement should be explicit (Midgley, 2020).

**Figure 1.** The three aspects of a methodology for systemic intervention. Adapted from Systemic Intervention: Philosophy, Methodology, and Practice by G. Midgley, 2020, p. 132.




In this paper, these three components will be presented in terms of improvements for the Brazilian space ecosystem in the new space era.

## The New Space

Government entities traditionally controlled the space sector, as they were the leading actors participating in this market. In recent years, substantial changes have occurred in global space activities, associated with the emergence of the New Space paradigm (Paikowsky, 2017).

The term "*New Space"* refers to the modern era of space exploration, characterized by significant private sector involvement and commercial activities, which contrasts with traditional government-dominated efforts (Old Space) (Melo et al., 2025; Heitor et al., 2024; Bousedra, 2023; Denis et al., 2017). It embodies a shift toward entrepreneurial ventures, leveraging public markets, private investments, and increasingly, public-private partnerships (PPPs) to exploit commercial opportunities in space (Heitor et al., 2024; Bousedra, 2023). Despite this commercial focus, the militarization and potential weaponization of space remain relevant concerns due to the inherently dual-use nature of space technologies, which serve both civilian and military purposes (Boztas & Turkmen, 2024). As space increasingly becomes a domain of

strategic competition, states are incorporating defense, deterrence, and sovereignty into their space strategies (Pace, 2023).

## The Brazilian Space Program

To understand the current status of new space in Brazil, a brief overview of the historical development will be presented in this section, which is divided into three phases: (i)1940–1979: establishment of institutions and formation of human capital; (ii) 1979–1994: creation and implementation of the Complete Brazilian Space Mission (MECB); (iii) 1994–nowadays: creation of the Brazilian Space Agency (AEB) and the era of National Space Activities Plans (PNAE).

The first Brazilian initiatives aimed at organizing the development of aerospace activities occurred in 1941 with the creation of the Ministry of Aeronautics and the establishment of the Aerospace Technical Center in 1946 (AEB, 2021). Subsequently, two scientific institutes were established in the state of São Paulo: the Aeronautics Institute of Technology (ITA) in 1950 and the Institute for Research and Development (IPD) in 1954, both of which focused on both military and civil aviation.

In 1966, the Executive Group for Work and Studies on Space Projects (GETEPE) was created to involve the Ministry of Aeronautics in the work of the National Commission for Space Activities (CNAE). This group, which planned rocket development, became the Institute of Space Activities (IAE) in 1969. In 1971, CNAE was transformed into the National Institute for Space Research (INPE), also located in São Paulo (AEB, 2021; Souza, 2019).

On January 20, 1971, the Brazilian Commission for Space Activities (COBAE) was established to exercise interministerial coordination and advise the President on matters related to national space policy (AEB, 2021; Souza, 2021).

The second phase of the program commenced in 1979 with the COBAE proposal from the MECB — a comprehensive national space policy aimed at developing satellites, launch vehicles, and supporting infrastructure (Souza, 2019; AEB, 2021). The MECB aimed to build four satellites in ten years (two for environmental data and two for remote sensing), a satellite launch vehicle, and a new launch center in Alcântara, Maranhão (AEB, 2021).

Achievements under the MECB included the launches of SCD-1 (Data Collecting Satellite- SCD) and SCD-2 data collection satellites (abroad), three VLS-1 (Satellite Launch Vehicle - VLS) launch attempts, and the establishment of the Alcântara Launch Center (CEA) and the Brazilian Data Collection System.

The third phase began in 1994 with the creation of AEB, a civilian agency that replaced COBAE, responsible for coordinating and updating the PNDAE, as well as preparing the PNAEs (AEB, 2021; Silva, 2023). In 1996, the National Space Activities Development System (SINDAE) was created with AEB as its central coordinating body (AEB, 2021; Sousa & Souza, 2025).

The Brazilian Space Program is guided by the PNDAE, which aims to build national capacity to use space resources to solve domestic challenges and benefit society (Sousa & Souza, 2025; AEB, 2021).

The most recent PNAE (2022–2031) formalizes the strategic planning of Brazilian space activities for the decade, aiming to position Brazil as the leader in the South American space market. It identifies five key factors to strengthen the space sector: (i) articulation among government, academia, industry, and society; (ii) public awareness; (iii) investment opportunities; (iv) prioritization of innovative technologies; and (v) short- and medium-term product development (AEB, 2021; Sousa & Souza, 2025).

In the context of the latest PNAE, the Aerospace Projects Company of Brazil (ALADA) was created in 2024 as a state-owned enterprise under the Ministry of Defense to promote Brazil's space sector through the coordination of strategic aerospace projects and partnerships. It supports the development of national capabilities by managing infrastructure and fostering private investment (Força Aérea Brasileira, 2024). In parallel, the Brazilian Company of Aerospace Projects, also known as ALADA, is a Brazilian Air Force initiative designed to secure the use of the Alcântara Space Center (CEA) for orbital and suborbital launches under military oversight.

## The New Space in Brazil

In Brazil, *New Space* refers to the gradual emergence of private sector participation in a space industry that state-led initiatives have historically dominated. This process began in the 1990s, when researchers from public institutions, such as INPE and IAE, founded companies to supply components and subsystems for government projects (Bahdur et al., 2024; Vaz et al., 2024).

Military participation has also expanded through initiatives such as the Strategic Space Systems Program (PESE) and the commercial licensing of the Alcântara Space Center (CEA) for private orbital and suborbital launches (Bahdur et al., 2024). As part of this effort, the Alcântara Aerospace Defense Launch Area (ALADA) was created in 2024 as a military-controlled zone dedicated to space operations (Força Aérea Brasileira, 2024).

Public funding remains the primary driver of private sector involvement in Brazil's space sector. In December 2023, FINEP (Brazilian Funding Authority for Studies and Projects) approved approximately USD 76 million in non-reimbursable financing for the development of Small Launch Vehicles (VLPP) across two industrial consortia (Finep, 2023a). Additionally, in May 2023, around USD 44 million was allocated for the development of a high-resolution Earth observation satellite (Finep, 2023b). Complementarily, FINEP also approved approximately USD 23 million for the development of a hypersonic vehicle, reinforcing its role in advancing high-risk and strategic aerospace technologies (Finep, 2024a).

Regarding the regulatory environment for space activities, the recent approval of the Brazilian Space Law (Law No. 14,946/2024) introduced regulatory mechanisms to support commercial space activities. The legislation includes provisions for licensing, liability, reinvesting revenues in the national space sector, and environmental mitigation, aiming to provide greater legal certainty for commercial and institutional actors (Brasil, 2024).

Overall, Brazil's *New Space* trajectory reflects a transitional phase marked by incremental private sector engagement, strategic military initiatives, and targeted public investment.

## The National System for the Development of Space Activities (SINDAE)

Since 1996, the National System for the Development of Space Activities (SINDAE) has served as the governance structure for the Brazilian Space Program, with the Brazilian Space Agency (AEB) as its central coordinating body. SINDAE's objective is to organize and coordinate space activities of national interest, and it serves as the primary reference for the boundary critique in this paper. Its primary responsibilities include implementing the National Policy for the Development of Space Activities (PNDAE), promoting technological capabilities, supporting the formulation of space policy by contributing to the definition of guidelines and priorities, and seeking to integrate the country into international cooperation initiatives (Brasil, 1996; Velasco et al., 2020; Sousa & Souza, 2025).

The actors involved in SINDAE, illustrated in Figure 2, include public agencies, the private sector, and educational institutions. Public institutions are represented by four entities under the Brazilian Air Force—namely, the Department of Aerospace Science and Technology (DCTA), the Institute of Aeronautics and Space (IAE), the Barreira do Inferno Launch Center (CLBI), and the Alcântara Space Center (CEA)—as well as by the National Institute for Space Research (INPE), which is part of the Ministry of Science, Technology, and Innovation (MCTI). The private sector is responsible for executing projects aimed at developing space solutions. Universities are tasked with training qualified human resources.

**Figure 2.** National System for Space Activities Development (SINDAE).
Source: Adapted from Agência Espacial Brasileira (2020).


Figure 2 provides a structured overview of the institutional actors currently engaged in Brazil's space governance under SINDAE. This configuration forms the foundation for the boundary critique conducted in this study, enabling an assessment of which institutional arrangements are formally recognized and which remain outside the official framework. To explore these institutional asymmetries and propose targeted interventions, the following section outlines the methodological approach adopted, combining qualitative data collection with analytical tools from systems thinking and system dynamics.

## Methodology

This study combined semi-structured interviews with space sector experts, designed to capture their perceptions on New Space in Brazil, with methodologies from Systems Thinking and System Dynamics to structure an analysis of governance involving key stakeholders in the Brazilian Space Program (PEB). The interview guide, made available digitally (Vaz et al., 2024), was based on definitions of New Space found in the literature. This methodology allowed the exploration of specific areas while preserving flexibility for the interviewer and respondent to diverge or elaborate on particular points (Gill et al., 2008).

The guide was validated through a pilot interview using a preliminary questionnaire to assess its clarity and ensure a higher probability of respondents understanding and addressing the research questions (Gill et al., 2008). Each interview lasted 60 minutes and was recorded with participant consent.

Subsequently, the methodology followed the proposal of Spitzeck and Hansen (2010), which evaluates stakeholder dynamics across two main dimensions: power and scope of participation. The power dimension measures the degree of influence stakeholders exert over decision-making, ranging from no influence to high strategic impact. The scope of the involvement refers to the breadth of issues addressed, categorized as operational, managerial, or strategic. This approach enables the identification of governance patterns and illustrates the extent to which stakeholders are involved in organizational governance, as shown in Table 1.

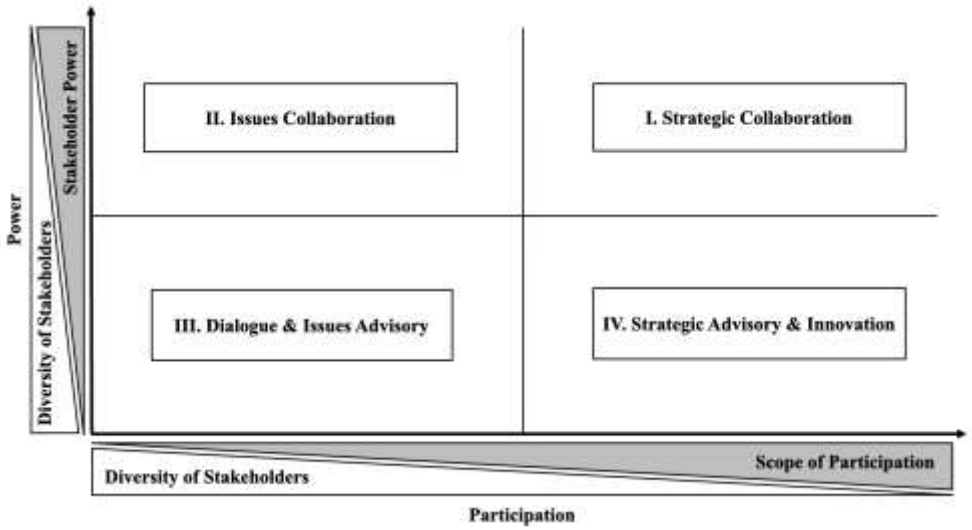
Causal loop diagram, a technique from System Dynamics, was used to understand and visualize feedback structures within complex systems (Morecroft, 2015). A causal diagram consists of variables connected by arrows indicating causal influence. A positive link means that an increase in the cause leads to an increase in the effect above its previous level, and a decrease in the cause leads to a reduction of the effect. Conversely, a negative link means that an increase in the cause results in a reduction of the effect, and vice

versa (Sterman, 2000). Recognizing these relationships helps identify reinforcing (positive feedback) or balancing (negative feedback) loops, which respectively amplify or stabilize system behavior. This approach enables policymakers and managers to identify intervention leverage points for effective and sustainable change (Cavana & Mares, 2004).

In this study, the causal loop diagram is applied to illustrate the main governance processes of the Brazilian Space Program (PEB), facilitating understanding of the variables and dynamics involved and supporting the formal modeling process (Ford, 2019).

The quadrants in Figure 3 represent four categories of stakeholder engagement.

**Figure 3.** Typology of Stakeholder Governance Mechanisms Based on Scope of Participation and Power of Influence.
Source: Spitzeck & Hansen (2010).




The first quadrant, Strategic Advisory & Innovation, encompasses actors with high levels of participation but lower levels of influence. The second quadrant, Issues Collaboration, involves actors with high impact power but low participation (mostly operational). The third quadrant, Dialogue and Issues Advisory, includes actors with low participation (operational level) and low impact power. Finally, the fourth quadrant, Strategic Collaboration, encompasses stakeholders with both high participation (at managerial and strategic levels) and high power.

**Respondent Profile**

Table 1 outlines the leading roles performed by the interview participants, along with their years of experience in the space sector. The respondents include individuals who have worked in the Brazilian space sector since the creation of the Complete Brazilian Space Mission (MECB), the establishment of the China-Brazil cooperation agreement under the CBERS (China–Brazil Earth Resources Satellite) Program, the negotiation of Brazil's participation in the International Space Station (ISS), as well as those involved in current academic and industrial projects.

Participants answered the questions outlined in the interview guide, as well as follow-up questions prompted by the semi-structured interview methodology, which allows the interviewer to pose additional questions to explore reported topics in greater depth (Vaz, 2024).

**Table 1.** Participation vs. Power Analysis for PEB Main Stakeholders.

| Respondent | Years of Experience | Roles |
|---|---|---|
| 1 | 37 | Space Engineering at INPE, Director at AEB, Executive Role in Industry |
| 2 | 54 | Director at INPE, Responsible for Establishing the CBERS Program, Executive Role in Industry |
| 3 | 49 | Researcher at IAE in Propulsion |
| 4 | 26 | Executive Role in Industry and in a Remote Sensing Startup |
| 5 | 37 | Retired General Officer, Executive Role in Industry and Professional Associations |
| 6 | 50 | Legal Structuring of the CBERS Program, Brazilian Participation in the ISS, President of a Professional Association |
| 7 | 5 | PhD Student and Participation in University Research in Space Missions |
| 8 | 12 | Financial Manager for Space Investment Thesis in a Private Investment Firm |
| 9 | 37 | Retired Officer, President of a Professional Association |
| 10 | 41 | Director at AEB, Teaching and Academic Research at INPE |
| 11 | 23 | PhD Student and Executive Role in Industry |
| 12 | 36 | Retired Officer, Former Director of a Research Institute, Executive Role in Industry |
| 13 | 40 | Space Engineering at INPE, Executive Role in Industry |
| 14 | 39 | Researcher at INPE, Executive Role in a Space Applications Startup, and Participant at the International Space University (ISU) |
| 15 | 12 | Master's Student and Position at a Funding Agency |
| 16 | 10 | University Teaching and Research in Space Law |

In this analysis, stakeholders were grouped into four quadrants to understand their different roles in terms of participation and influence. The intent was not to perform a quantitative assessment of these variables, but rather to qualitatively explore their positioning within the governance structure.

**Figure 4.** Participation vs. Power Analysis for PEB Main Stakeholders.


Table 2 presents the rationale for allocating stakeholders into different quadrants. The Brazilian Air Force, in this case, encompasses the DCTA – Department of Aerospace Science and Technology, the CEA – Alcântara Space Center, the CLBI – Barreira do Inferno Launch Center, and the IAE – Institute of Aeronautics and Space, as illustrated in Figure 3.

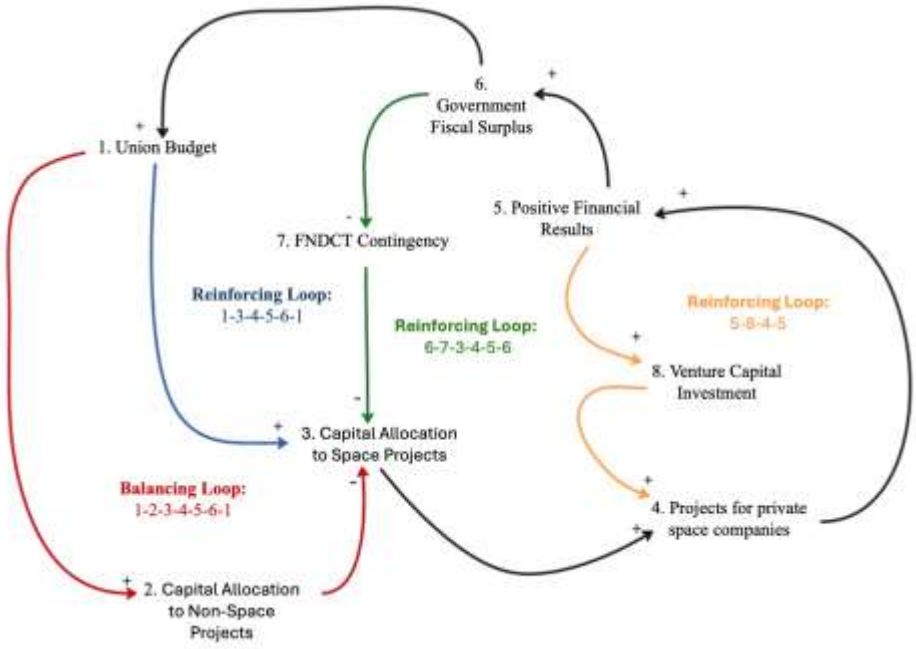
**Table 2.** Rationale for the Participation vs. Power Analysis.

| Quadrant | Stakeholder | Provision in the National System for the Development of Space Activities (PNDAE)? | Rationale |
|---|---|---|---|
| **I** | **FINEP Funding Agency** | No | Although FINEP is hierarchically at the same level as the Brazilian Space Agency (AEB), it has been responsible for issuing public calls, contracting projects, and managing the allocation of resources (FINEP, 2024a; 2024b; 2024c). |
| **II** | **Presidency of the Repulic** | No | The Brazilian Space Agency was initially under the Presidency of the Republic, but after 1996 it became subordinate to the Ministry of Science and Technology. Despite being the highest level of executive authority, the federal government did not reposition the agency within its structure, which reflects the prioritization of other policy areas (Rollemberg et al., 2009; Matos, 2024). |

| | | | |
|---|---|---|---|
| **III** | **Universities** | Yes | Universities are part of SINDAE and are responsible for training qualified human resources, conducting academic research, and participating in space-related projects through partnerships with public agencies (Velasco et al., 2020; AEB, 2021). |
| **IV** | **ALADA** | No | ALADA is a state-owned company created by the Brazilian Air Force, demonstrating its interest in the commercialization of space activities. In terms of power, as a new entrant, there are no evidences yet of its performance. |
| | **Brazilian Space Agency** | Yes | Despite its strategic relevance, the Brazilian Space Agency operates as a third-level structure within the federal government. In recent years, the largest transfers of public funding have been allocated to other entities, particularly FINEP (FINEP, 2024a; 2024b; 2024c). |
| | **INPE** | Yes | INPE plays a central role in the execution of Brazil's space policy, especially in Earth observation, satellite development, and international cooperation and is subordinated to the Ministry of Science, Technology and Innovation. |
| | **Brazilian Air Force** | Yes | The Brazilian Air Force launched its Strategic Space Systems Program in 2012, marking the beginning of space militarization. In 2024, it also created ALADA, a state-owned company aimed at commercializing space activities (Força Aérea Brasileira, 2024). |
| | **Industry** | Yes | The private space industry in Brazil has historically emerged from state-led research institutes and currently depends on public funding. Its role has expanded with downstream applications and commercial projects supported by government procurement (Bahdur et al., 2024; Vaz et al., 2024). |

Figure 5 illustrates the causal loop diagram for the main processes of the Brazilian Space Program (PEB), showing the flow of federal budget allocations to both space and non-space projects. It highlights the allocation of resources to private companies in the space sector through contracts for the provision or development of space systems. These companies, by generating positive financial results, contribute fiscally to the government's surplus, which in turn reduces the need to freeze resources from the National Fund for Scientific and Technological Development (FNDCT). The participation of private capital investment in the sector is stimulated by state capital allocation and the generation of positive financial outcomes.

**Figure 5.** Causal Loop Diagram of the main processes of the Brazilian Space Program.




Three reinforcing loops and one balancing loop were identified. The loop highlighted in blue in Figure 5 illustrates the significance of public financial resource allocation to the sector, which in turn influences the federal budget through companies' fiscal contributions. The second reinforcing loop, in green, highlights the significance of the FNDCT as a funding mechanism for the sector. The third reinforcing loop, in orange, illustrates the role of private capital in companies that generate financial returns. Finally, the balancing loop, shown in red, reflects the competition for budgetary resources, which directly impacts companies, private capital attraction, and the generation of financial results.

## Systemic Intervention Proposals

The systemic intervention proposals for improving the Brazilian Space Program in light of the New Space paradigm, as collected from the respondents, are presented in Table 3 following the Systemic Intervention Methodology proposed by Midgley (2020).

**Table 3.** Proposed systemic intervention in the Brazilian Space Program.

| Proposed Systemic Intervention | Boundary Critique | Action | Judgement |
|---|---|---|---|
| **Grant the Brazilian Space Agency a higher hierarchical status** | Comprised | Promote Brazilian Space Agency to Ministerial Level | Space for civil applications |
| **Establishiment of a Space Force** | Not Comprised | Create a Brazilian Space Force | Space as Defense |
| **Promote Entrepreneurship through regional hubs** | Not Comprised | Create regional hubs, such as ESA's BICs. | Entrepreneurship as a driver for growth |

| | | | |
|---|---|---|---|
| **Create State Space Secretariats** | Not Comprised | Create Space Secretariats within State Governments | Descentralization from Federal Government |
| **Investments in Research Institutes** | Comprised | Invest in research institutes focused on space-related topics. | Space Research |
| **Deploy and attract Venture Capital investments** | Not Comprised | Creation of investment funds and attraction of investors | Venture Capital as a financial source for private companies |
| **Foster industrial developments** | Comprised | Support industrial development through funding | Focus on industrial national development |
| **Creation of a Ministry of Space** | Not Comprised | Establishment of a new ministry for civil-military integration | Space as a transversal area for the country |

The National System for the Development of Space Activities (SINDAE), as illustrated in Figure 2, is employed here to examine whether the proposed governance structures are currently in place, as part of a boundary critique.

The first systemic intervention proposed is to elevate the Brazilian Space Agency (AEB) to a ministerial level, thereby enhancing the development of civil space activities, which aligns with its historical mission. Military space initiatives, by contrast, are currently under the responsibility of the Brazilian Air Force through the Strategic Space Systems Program (PESE).

A second intervention would be the establishment of a dedicated space force, a structure not currently foreseen in SINDAE. This would represent a shift in focus to the military applications of space systems, marking a significant change.

A third proposal for governance involves creating regional hubs for startup development, similar to the European Space Agency's Business Incubation Centres (BICs), to promote the emergence of new space companies. Startups are not explicitly mentioned in SINDAE, although the space industry is included.

Subsequently, the creation of venture capital funds and mechanisms to attract investors is suggested as a means of boosting early-stage companies in the space sector. Such structures are not currently provided for in SINDAE. To date, only one such fund was established in 2014, with no sustained effort since then, highlighting the lack of entrepreneurial strategy in public policy.

Another recommendation is to strengthen industrial development through public funding. For example, FINEP has launched public calls for small launch vehicles, high-resolution satellites, and hypersonic platforms. SINDAE supports this role under the industry category.

Lastly, the creation of a Ministry of Space is proposed to integrate civil and military efforts, recognizing space as a transversal domain with broad applications. Such a governance body does not currently exist within the SINDAE framework.

These proposals are further examined through the stakeholder participation vs. power analysis and the causal loop diagram developed in this study.

**Discussions**

The analysis reveals significant governance asymmetries in Brazil’s space sector. The low hierarchical status of the Brazilian Space Agency (AEB) limits its institutional autonomy and continuity of funding, which, as illustrated in the causal loop diagram in Figure 5, directly impacts industrial development and the attraction of private capital. While ALADA represents an institutional innovation for commercializing

military launches, it is still a new entrant with no proven results. The Brazilian Air Force has increased its role through the PESE and the operation of research institutes and launch centers, indicating an initial move toward space militarization. However, the establishment of a Space Force remains unconfirmed.

FINEP has emerged as a central actor in channeling public investments, despite not being formally included in SINDAE's structure. This shift illustrates the dynamic evolution of stakeholders and the lack of institutional coherence in the current governance framework. The systemic interventions proposed in this study—ranging from raising AEB's hierarchical level and fostering entrepreneurship to establishing a Ministry of Space—reflect divergent views on the program's future direction.

These divergent priorities signal a critical governance gap. There is no precise strategic coordination at the federal executive level, nor is there a structured dialogue with Congress to define Brazil's national priorities in space. The PEB faces multiple possible trajectories—supporting critical technologies, promoting venture-backed entrepreneurship, or expanding military capabilities—without a shared vision. As a result, systemic interventions must be preceded by an explicit boundary critique, supported by participatory processes to build a coherent and future-oriented governance model.

## Conclussions

The New Space era introduces new dynamics to the Brazilian Space Program (PEB), including commercialization, militarization, and the mobilization of private capital. Brazil currently lacks a high-level governance structure aligned with these developments, and there is no precise national mechanism for setting priorities. Systemic interventions can only be effective once boundary critiques are explicitly defined.

There is a critical need to enhance governance at the highest level. Brazil must be equipped to develop vital and dual-use technologies while leveraging emerging commercial opportunities, such as satellite sales and launch services from the Alcântara Space Center.

The PEB stands at a pivotal juncture. Revisiting its governance structure and the roles of its principal stakeholders—potentially through the establishment of a dedicated Ministry of Space—could promote visibility, ensure sustained investments, and position Brazil competitively on the global stage.

Future research could apply system dynamics modeling to simulate governance reforms, while participatory methods, such as stakeholder workshops, may refine boundary critiques and facilitate consensus-building. Additionally, comparative studies with other emerging space nations could offer insights to guide Brazil's institutional adaptation in the New Space context.

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