

Between partnerships and challenges: defense offsets in the aerospace industry

Entre alianzas y desafíos: compensaciones de defensa en la industria aeroespacial

Abstract: This study analyzes the impacts of defense offsets arising from contracts with Brazilian companies in the aerospace sector, focusing on the factors that hinder their implementation. It adopts a qualitative approach, based on a multiple case study and content analysis of interviews with public managers. The results indicate that offsets established with national companies present specific characteristics that make them more complex and less effective, particularly the absence of a direct link between the commercial contract and the offset agreement, delayed participation in negotiations, and the limited bargaining power of the public entity. The study concludes that more flexible and context-sensitive offset policies tend to be more effective than mandatory models, thereby contributing to the strengthening of the Brazilian Defense Industrial Base (BID).

Keywords: Defense offsets; Offsets; Technology transfer; Offset policy; Case study.

Resumen: Este estudio tiene como objetivo analizar las repercusiones de las compensaciones de defensa (offsets) derivadas de contratos con empresas brasileñas del sector aeroespacial, centrándose en los factores que dificultan su implementación. Se pretende adoptar un enfoque cualitativo, basado en estudio de caso múltiple y análisis de contenido de entrevistas con gestores públicos. Los resultados indican que los offsets celebrados con empresas nacionales presentan peculiaridades que los hacen más complejos y menos eficaces, con énfasis en la ausencia de un vínculo directo entre el contrato comercial y el acuerdo de compensación, la tardía entrada en las negociaciones y el bajo poder de negociación de la entidad pública. Se concluye que las políticas de compensación más flexibles y contextuales tienden a ser más efectivas que los modelos obligatorios, contribuyendo al fortalecimiento de la Base Industrial de Defensa (BID) brasileña.

Palabras clave: Compensaciones de defensa; Offsets; Transferencia de tecnología; Política de compensación; Estudio de caso.

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1 INTRODUCTION

Brazil's aerospace industry has advanced technologically in recent decades, driven by technology transfers from defense acquisitions. Since 1968, with the manufacture of Italian aircraft under license by Embraer, the sector has established itself internationally, benefiting from offsets that have expanded its technological capacity-building. Nonetheless, the common practice of defense offsets in the international trade of military products remains poorly understood in the Brazilian public sector, especially in contracts with Brazilian companies.

The literature in the field recognizes offsets as relevant instruments for reducing technological dependence and fostering economic development in countries that seek to strengthen their defense industries. In Brazil, however, their application faces challenges such as multiple contractual arrangements, complex negotiations, and a lack of clarity between the parties—factors that raise costs and limit the potential for long-term strategic partnerships.

In this context, the following questions arise: how are defense offsets from contracts with Brazilian companies in the aerospace sector impacted? What factors hinder their execution compared to contracts with foreign companies?

The relevance of the study is both academic and practical. Academically, the scarcity of studies on offsets with Brazilian companies highlights the need for further theoretical development. Practically, the research aims to support the formulation of more effective public policies, overcoming obstacles and promoting strategic partnerships that maximize the benefits for the country.

The general objective is to analyze the impacts of offsets in contracts with Brazilian companies, identifying the factors that hinder their implementation. The specific objectives are therefore to: 1) identify the peculiarities of offsets with Brazilian aerospace companies; 2) analyze the factors that hinder their execution; and 3) compare offsets signed with Brazilian and foreign companies.

The study seeks not only to fill theoretical gaps but also to contribute to the formulation of public policies aimed at Brazil's technological and economic development. To this end, it continues the theoretical analyses of Silva and Santos (2022) by deepening the investigation with an empirical approach centered on the practice of offsets signed with Brazilian aerospace companies, using multiple case studies and interviews with public managers.

As for the limitations, the study focused exclusively on projects coordinated by the Coordinating Committee of the Combat Aircraft Program (Copac), which constitutes a selection bias that limits the diversity of the contexts analyzed. Although this delimitation is methodologically justifiable on account of its institutional importance and the accessibility of data, the results obtained should not be generalized to other agencies of the Ministry of Defense or to different segments of the Defense Industrial Base (BID).

The conclusions presented here therefore reflect a specific scope of the practice of defense offsets and should be interpreted in light of that context. Future investigations that include

projects conducted by other Forces or agencies may broaden understanding of the topic and allow more comprehensive comparisons.

Additionally, because this is a qualitative approach with coding performed by a single researcher, no formal coefficients of agreement were applied. Nonetheless, the use of ATLAS.ti software and the systematization adopted confer analytical validity. Future research could incorporate triangulation or cross-coding to reinforce interpretive consistency.

The following sections present the methodology, the literature review, the data analysis, and the final considerations.

2 METHODOLOGY

This qualitative study was conducted in distinct phases, based on an exploratory multiple case study focused on projects coordinated by the Brazilian Air Force's Copac.

2.1 Multiple Case Study

The research used a multiple case study focusing on four Brazilian Air Force strategic projects—I-X, KC-X/KC-390, F-5BR and A-1M—all with contracts signed with Embraer, in which the offsets were negotiated directly with foreign equipment suppliers. The selection of these cases is justified by their relevance within the Brazilian defense offset policy and by the diversity of negotiation approaches (Yin, 2011).

Copac, the organization responsible for coordinating these projects, has been conducting Brazil's participation in programs such as AM-X since the 1980s. The A-1M project modernized the A-1 fighter jets, incorporating advanced technology in weapons, sensors, and mission systems. The F-5BR project upgraded 46 F-5 E/F aircraft, improving weaponry, secure communications, low-visibility operation, and self-defense. The I-X project replaced the IC-95 aircraft with four laboratory aircraft better suited to the new standards of the Brazilian Airspace Control System (SISCEAB). The KC-X and KC-390 projects involve the development and acquisition of the KC-390 aircraft, intended to replace the C/KC-130 in transport, in-flight refueling, and search-and-rescue missions (Copac, 2022).

2.2 Data Collection

Empirical data were collected between November 20, 2023, and January 18, 2024, through semi-structured interviews with managers directly involved in the analyzed projects. Participant selection considered their positions, places of work and degree of involvement with the projects, as detailed in Table 1.

Table 1 – Identification details of the interviewees

Identification details of interviewees					
Interviewee identification	Date and form of invitation	Interview date	Research-related projects	Positions held	Workplaces related to the projects
E01	Email on November 27, 2023	November 28, 2023	F-5; KC-390; I-X; A-1 M	Head of SDAC; Offset Manager at EMAER; Head of Division	Emaer; IFI; Copac
E02	Email on November 27, 2023	December 7, 2023	F-5; KC-390; I-X; A-1 M	Head of SDAC	Copac
E03	WhatsApp message on November 29, 2023	December 12, 2023	KC-390	Project Manager; Assistant to the Project Manager; Offset Inspector	Copac
E04	Email on November 27, 2023	January 5, 2024	F-5; KC-390; I-X; A-1 M	Head of SDAC	Copac
E05	Email on November 27, 2023	January 18, 2024	F-5; KC-390; I-X; A-1 M	Project Manager; Assistant to the Project Manager; Offset Inspector	Copac

Source: Prepared by the authors.

To protect the identity of the interviewees, codes ranging from E01 to E05 were assigned, allowing their identification only within the scope of the research. Each participant's consent was recorded in audio and video and incorporated into the respective transcripts, facilitating data collection and validation. All interviews were recorded, transcribed, and organized using ATLAS.ti, which enabled a systematic content analysis, as recommended by Bardin (2016). The audio and video recording of consent waived the requirement for signed informed consent forms.

2.3 Data Analysis

Content analysis consisted of three stages: pre-analysis, exploration of the material, and data treatment, inference, and interpretation (Bardin, 2016). The pre-analysis involved an initial reading of the documents and interviews. The exploration stage comprised the coding and categorization of the data. Finally, the materials were analyzed in depth, searching for patterns, contexts, and implicit meanings (Bardin, 2016; Yin, 2011).

2.4 Tools and Technologies Used

ATLAS.ti was essential for organizing and analyzing the data, enabling coding and grouping into categories aligned with the study's objectives. Microsoft Office 365 was used for interview transcription, and Excel for data tabulation.

Artificial intelligence (AI) tools were used only as auxiliaries. Scispace supported reading and organizing research notes, whereas ChatGPT 3.5 and Microsoft Copilot assisted with textual clarity and the preliminary writing of excerpts, always based on content defined by the author.

The use of these tools followed ethical guidelines, with full control and validation by the researcher and without interference in the analysis, interpretation, or scientific authorship. As highlighted by Limongi and Marcolin (2024) and Gridach *et al.* (2025), the ethical use of AI in research presupposes transparency, critical oversight, and the absence of delegation of analytical or authorial responsibility.

3 LITERATURE REVIEW

Offset agreements are legal instruments that formalize commitments by foreign suppliers to compensate for expenditures arising from imports, through contractual clauses that specify the scope of the offset (Brustolin; Oliveira; Senna, 2016). Although they entail higher costs, these agreements are valued by governments and armed forces because they provide access to critical knowledge and help reduce technological dependence (Modesti; Azevedo, 2004).

Udis and Maskus (1991) argue that offsets are not limited to trade policy but also function as industrial policy instruments, especially in the military aerospace sector, given the State's direct role in building an industrial base less dependent on foreign suppliers. This perspective is supported by Markowski and Hall (2014), who view offsets as opportunities for states to develop strategic capabilities and industrial relationships. Petersen (2011) also highlights their role in upgrading the local workforce.

The literature further indicates that offsets are not free benefits. Modesti and Azevedo (2004) state that the additional costs are significant, while Markowski and Hall (2014) highlight the direct impact on contract values. Matthews (2019) estimates that offsets raise the total cost of military acquisitions by an average of 5% to 10%.

Nonetheless, offset agreements are widely used due to their potential to foster local capabilities and reduce technological asymmetries between countries. However, the promises associated with offsets are not always fulfilled, which calls for a more in-depth critical analysis (Haines; Hosking, 2005).

3.1 Innovation via technology transfer

Innovation in the aeronautics industry is intrinsically linked to the incorporation of new technologies, both in products and processes. In this context, technology transfer plays a

key role, as it enables access to external knowledge and promotes the emergence of autonomous technological capabilities (Ferreira, 2009).

Souza and Oliveira (2017) highlight technology transfer as an essential strategy for strengthening Brazil's defense industry, seeking greater innovation, competitiveness, and operational autonomy. Such compensatory measures help reduce the technological gap and strengthen the BID by promoting the internalization of critical capabilities and the spillover to dual-use technologies (Silva, 2024).

Technology transfer agreements therefore represent not only a means of accessing innovations but also a driving force behind strategic alliances and collaborations in the aerospace sector (Ferreira, 2009).

3.2 Controversies over the effectiveness and challenges of offsets

Recent literature has highlighted both the strategic potential and the practical limitations of offset agreements in defense procurement programs. Although the instrument is widely adopted by countries seeking to reduce their technological dependence, controversies persist regarding the effectiveness of offset obligations and the factors that condition their successful implementation.

Previous studies had already proposed theoretical interpretations of the effectiveness of offsets from different institutional and contextual perspectives, suggesting, through analytical propositions, that the beneficiary's technological maturity, the type of contractual link, and the nature of the relationship between the actors involved significantly influence the results obtained (Silva; Santos, 2022).

Gunawan *et al.* (2024), analyzing the application of offsets in the fighter aircraft sector, argue that such mechanisms can contribute to bridging technological and material gaps between buyer and supplier countries. The study, which adopts a qualitative approach based on a literature review, suggests that well-planned and executed offsets can promote technology transfer, industrial investment, and research-and-development partnerships. Based on experiences in countries like Brazil, France, and the United States, the authors conclude that offset agreements can be effective in strengthening the BID and boosting national technological capacity (Gunawan *et al.*, 2024).

However, the same authors acknowledge recurring obstacles that undermine the effectiveness of offsets. Notably, these include legal and regulatory barriers to technology transfer, dependence on third parties for the execution of compensatory activities, insufficient infrastructure in recipient countries and, above all, the inherent complexity of technology transfer processes in defense systems (Gunawan *et al.*, 2024). Such obstacles highlight the need for more robust governance strategies on the part of purchasing states.

Yedvav, Kordova, and Fridkin (2022), analyzing the impact of offsets on the management of defense projects in Israel, identified negative impacts on budgets, schedules, and performance. They concluded that high offset percentages can represent additional risk, requiring management from the contractual phase onward.

These findings reinforce the critical perspective put forward by Correa and Urbina (2021), who argue that offsets in Brazil have yielded modest results compared with the expectations initially set out in the strategic guidelines of the Ministry of Defense's Offset Policy. Based on a case study of projects implemented by Copac and the Institute for Industrial Development and Coordination (IFI) between 2002 and 2018, the authors argue that, although there are records of some successful transfers, most offsets were limited to the acquisition of production capacities, with little evidence of technology transfer. According to the authors, this limitation stems from a structural arrangement in which supplier countries tend to protect their technological "crown jewels" while passing on only operational knowledge of lower added value (Correa; Urbina, 2021).

Additionally, Correa and Urbina (2021) highlight the institutional fragility of Brazil's mechanisms for evaluating and monitoring offset results. The absence of consolidated metrics and the scarcity of public data on the effectiveness of offset obligations make it difficult to assess the real benefits obtained. This lack of transparency, according to the authors, fosters a logic in which the perception of political and symbolic gains takes precedence over evidence of effective results.

Silva and Santos (2024) highlight the complexity of offsets with Brazilian companies, which results from the need for multiple subcontracting arrangements. The recent GM-MD Ordinance No. 3,990/2023 (Brasil, 2023) sought to address some of these gaps by assigning responsibility to the Brazilian company for ensuring the fulfillment of its foreign partners' obligations. Despite the progress made, operational challenges remain.

The recent studies analyzed (2021–2025) provide a comprehensive overview: they recognize offsets as useful industrial policy instruments but warn of obstacles such as technological asymmetries, budgetary risks, low technological depth, and regulatory shortcomings. Gaps identified include: 1) the absence of systematized effectiveness indicators; 2) the lack of distinction between productive and innovative capacities; and 3) a shortage of analyses of post-contract sustainability (Correa; Urbina, 2021).

It can therefore be observed that, although recent literature provides significant contributions on the challenges and benefits of offsets arising from acquisitions involving foreign companies, there are still few studies dedicated to examining offset agreements signed in the context of contracts with Brazilian companies. Nor is there a robust systematization of the factors that favor or hinder the implementation of these agreements at the national level. This theoretical and empirical gap justifies the present study, which analyzes the impacts of offsets resulting from defense procurement contracts with Brazilian companies, with particular attention to the institutional, operational, and technological conditions that shape their effectiveness.

4 DISCUSSION OF RESULTS AND ANALYSIS

4.1 Presentation of results

Since the literature on the subject of this study offered no pre-existing categories or codes, an inductive approach was used, starting from concrete, specific data to develop broader hypotheses, patterns, or categories—that is, moving from the observation of the phenomenon in everyday life to a more abstract theoretical plane in search of its explanation.

Thus, the coding and categorization of the communication excerpts selected during the analysis were conducted with a view to enabling inference, that is, the extraction of meaning that may involve analyzing the context, recognizing recurring patterns, and interpreting the implicit meanings or perspectives of the interviewees and the authors of the other texts that make up the research corpus (Bardin, 2016). In this way, the content analysis categories were aligned with Specific Objectives (SO) 1 and 2 proposed for the research.

It should also be clarified that aspects and factors are not the same: aspects are characteristics that can be described and identified, whereas factors are characteristics that, in some way, exert influence and contribute to a given situation.

Therefore, aligned with the first SO, and seeking to aggregate codes identified via analysis of the manifest and latent content of the research corpus, the categories were established as shown in Table 2.

Table 2 – Categories and acronyms of aspects

Category	Acronym
Aspects related to offsets arising from contracts with a Brazilian or a foreign company.	AO-EBE
Aspects related to offsets arising from contracts with a Brazilian company.	AO-EB
Aspects related to offsets arising from contracts with a foreign company.	AO-EE

Source: Prepared by the authors.

Likewise, aligned with the second SO and bringing together the codes identified from the researched material, the following categories were established (Table 3):

Table 3 – Categories and acronyms of factors

Category	Acronym
Factors that hinder offsets arising from contracts with a Brazilian or a foreign company.	FPO-EBE
Factors that hinder offsets arising from contracts with a Brazilian company.	FPO-EB

Source: Prepared by the authors.

4.1.1 Peculiarities and contrasts of offsets in defense procurement with Brazilian companies

4.1.1.1 Aspects related to offsets resulting from contracts with a Brazilian or a foreign company (AO-EBE)

The AO-EBE category refers to the characteristics associated with offsets that emerge both when a contract is signed with a foreign company and when it is signed with a Brazilian company. Both types of agreements produce aspects that play a significant role in offset configuration and

execution, requiring a better understanding to optimize their effectiveness. The codes assigned to this category are presented in Table 4.

Table 4 – AO-EBE category and codes

Category	Related codes
AO-EBE	1) Access to technological capacity building; 2) Increased cost of the commercial contract; 3) Low importance relative to the commercial contract; and 4) Greater focus on technology transfer.

Source: Prepared by the authors.

Offsets resulting from contracts with Brazilian or foreign companies are instruments designed primarily to facilitate access to capacity-building and technology transfer, thereby reducing the time needed to achieve state-of-the-art technologies through activities such as licensed production and specialized training. However, the requirement for these mechanisms tends to increase contract costs, although the specific financial impact is difficult to measure due to a lack of transparency in the figures and the complexity of audit methodologies. Despite their potential to stimulate national development, offsets are viewed as a secondary obligation after supplier selection since they do not involve direct financial transfers, which reduces their relevance during contract execution. Nonetheless, technology transfer remains a central objective of Brazil's offset policy, as evinced by the regulatory evolution of GM-MD Ordinance No. 3,990/2023 (Brasil, 2023) which now prioritizes technological offsets over industrial and commercial ones, reflecting the country's strategic effort to strengthen its BID and expand its technological autonomy.

4.1.1.2 Aspects related to offsets resulting from contracts with a Brazilian company (AO-EB)

The AO-EB category refers to the specific features associated with offsets resulting from contracts with a Brazilian company that needs to import goods from foreign suppliers to fulfill the commercial contract, in accordance with the amounts established by GM-MD Ordinance 3,990/2023 (Brasil, 2023).

These peculiarities may affect the overall dynamics of the agreement and should be carefully considered when negotiating and formalizing such offset agreements. Codes were added to this category as shown in Table 5.

Table 5 – AO-EB category and codes

Category	Related codes
AO-EB	1) Poor project quality; 2) Difficulty in creating partnerships; 3) Lack of linkage between sanctions in the commercial and offset agreements; 4) Greater legal flexibility; 5) Greater variety of technologies offered; 6) More complex negotiations; 7) Different parties from the commercial contract; 8) Possibility of abrupt termination; and 9) Amount of the offset obligation differing from the total value of the commercial contract.

Source: Prepared by the authors.

Offset agreements resulting from contracts with Brazilian companies present several structural limitations that negatively impact their effectiveness. One major challenge concerns the poor quality of the projects submitted which are often developed with a focus solely on formal compliance with offset obligations, without proper strategic alignment with the public entity's technological interests. This problem stems, in part, from the distance between the government and the foreign suppliers subcontracted by the Brazilian prime contractor, which limits the potential for advance coordination to ensure projects that are more robust, sustainable, and aligned with BID's actual needs.

Moreover, the difficulty in forming strategic partnerships is compounded by the fact that international suppliers are not selected until after the contract with the Brazilian company has been signed, making it impossible to plan ahead and develop more structured proposals. Lack of prior integration, combined with the absence of a direct relationship between the public entity and foreign suppliers, also hinders imposing sanctions in the event of noncompliance with offset requirements and may lead to the abrupt termination of agreements—for example, if the supplier is technically replaced during project execution.

Despite these weaknesses, significant advantages include the wider variety of technologies available. A single project can result in multiple offset agreements covering a variety of technological areas, which can expand the scope of operations for Brazilian companies. However, this diversity does not necessarily imply technological depth or strategic relevance, since many offset proposals remain superficial or disconnected from national priorities. This discrepancy will be examined in greater detail in the comparative analysis below.

However, this diversity also makes negotiations more complex and time-consuming. Moreover, only import subcontracts exceeding US\$ 50 million trigger a compensation obligation, as provided for in GM-MD Ordinance No. 3,990/2023 (Brasil, 2023). Consequently, the offset amount represents only a portion of the total contracted amount, thereby reducing the scope of the public policy on offsets. Finally, the greater legal freedom enjoyed by the public entity—by not participating directly in the selection of suppliers—means less control over the outcomes of offset agreements.

4.1.1.3 Aspects related to offsets resulting from contracts with a foreign company (AO-EE)

The AO-EE category refers to the specific features associated with offsets resulting from contracts with a foreign company, in accordance with the amounts established by GM-MD Ordinance 3,990/2023 (Brasil, 2023).

These specific characteristics influence the implementation and execution of offsets, making a detailed understanding of global dynamics essential to ensuring the success and effectiveness of these agreements. Codes were added to this category as shown in Table 6.

Table 6 – AO-EE category and codes

Category	Related codes
AO-EE	1) Offset with little technology transfer; 2) Condition for the effectiveness of the commercial contract; and 3) Preliminary offset agreement prior to the commercial contract.

Source: Prepared by the authors.

Offset agreements signed directly with foreign companies present greater institutional oversight and the possibility of a direct link to the commercial contract. This enables treating the offset as a condition for the contract's effectiveness, ensuring that failure to comply with the offset obligations may result in commercial sanctions. Additionally, one can sign preliminary offset agreements before the expenditure contract is formalized, which ensures that only satisfactory proposals proceed to the contracting stage, thereby strengthening the government's bargaining power.

However, these agreements typically involve little technology transfer, especially in the aeronautics sector. Foreign companies' expertise lies in the integration of complex systems produced by their own suppliers, and the offsets they offer are generally limited to peripheral activities such as local assembly or basic maintenance. Since there is no requirement for the foreign company's subcontractors to be involved in offset agreements, access to critical technologies—such as engines and mission systems—ends up being restricted.

4.1.2 Challenges in implementing offsets in aerospace contracts with Brazilian companies

4.1.2.1 Factors that hinder offsets resulting from contracts with a Brazilian or a foreign company (FPO-EBE)

The FPO-EBE category encompasses the codes relating to challenging factors or conditions that may have a negative impact on the offsets arising from contracts with either a Brazilian or a foreign company. Factors that adversely affect offsets arising from contracts with Brazilian or foreign companies may include behaviors, characteristics, circumstances, attitudes, challenges in adapting to local commercial practices, and instabilities arising from economic or political realities.

Understanding these factors is essential to overcoming potential obstacles and enhancing the successful implementation of these agreements, thereby achieving positive outcomes for both parties involved. Codes were added to this category as shown in Table 7.

Table 7 – FPO-EBE category and codes

Category	Related codes
FPO-EBE	1) Budget availability; 2) Beneficiary's development level; 3) Incomplete planning; 4) Fear of creating competition; and 5) Single source.

Source: Prepared by the authors.

Several factors negatively impact the implementation of offset agreements, regardless of whether they relate to contracts with Brazilian or foreign companies. One main challenge concerns budget availability: although offsets do not involve direct payment, activities like training, travel, and contract execution depend on the budget flow. A shortage of resources may jeopardize essential stages, thereby reducing the effectiveness of compensatory actions.

Another important factor is the beneficiary's level of development, which encompasses not only technical capability but also organizational maturity and strategic vision. Hasty decisions made without careful assessment—which are common in contracts with Brazilian companies due to the pressure to meet deadlines—result in ineffective projects. Even when contracting with foreign companies, the inappropriate selection of beneficiaries jeopardizes the expected results.

A lack of strategic planning, particularly with regard to the target technologies to be acquired, also undermines these agreements. In the absence of clear governmental guidelines on which capabilities should be prioritized, offset projects tend to be generic or disconnected from BID's actual needs.

Added to this is the fear amongst foreign suppliers that technology transfer could lead to competition. Considerations relating to national security, the protection of competitive advantage and the preservation of domestic production capacity mean that many companies are reluctant to share strategic knowledge, particularly in sensitive sectors such as defense.

Finally, in cases where there is a single source, the lack of competition reduces the incentive to submit robust compensation proposals. This limits the bargaining power of Brazilian contractors or prime contractors and, consequently, undermines the quality and scope of the offset agreements entered into.

4.1.2.2 Factors that hinder offsets resulting from contracts with a Brazilian company (FPO-EB)

The FPO-EB category covers codes relating to unfavorable factors or conditions that may have a negative impact on offsets resulting from contracts with a Brazilian company. Factors that adversely affect offsets resulting from contracts with Brazilian companies may include behaviors, characteristics, conditions, attitudes, challenges in adapting to local commercial practices, and instabilities arising from economic or political realities.

An in-depth understanding of these factors is essential to overcoming potential obstacles and enhancing the successful implementation of these agreements, thereby achieving positive outcomes for both parties involved. Codes were added to this category as shown in Table 8.

Table 8 – FPO-EB category and codes

Categories	Related codes
FPO-EB	1) Weak bargaining power; 2) Workload; 3) Lower commitment; 4) Control of the equipment supplier selection process; 5) Discrepancy between commercial contracts and offset arrangements; 6) Management challenges; 7) Late entry into the process of approaching suppliers; 8) Order splitting; 9) Initial inaccuracy; 10) Lack of clarity regarding the relationship between the prime contractor and the subcontractor; and 11) Timing.

Source: Prepared by the authors.

Implementing offset agreements arising from contracts with Brazilian companies faces a number of structural and operational obstacles. One major challenge concerns the public entity's weak bargaining power vis-à-vis subcontracted foreign suppliers, a situation exacerbated by the fact that the offset agreement is an ancillary contract with no direct financial consideration or condition for the contract to take effect. Entering too late into the process of engaging with suppliers, and the lack of control over their selection—which is conducted by the prime contractor after the main contract has been awarded—reduces the chances of building strategic partnerships and compromises the quality of projects.

These limitations are reflected in a reduced level of commitment on the part of the parties, given that the offset tends to be treated as a mere formal obligation. Additionally, discrepancies between commercial contracts and offsetting agreements, the unclear relationship between the prime contractor and the subcontractors, and the initial inaccuracy regarding the import values and suppliers involved make it difficult to manage the agreements efficiently. In many cases, contractual changes are not promptly reflected in offset agreements, which highlight shortcomings in communication and monitoring.

Another critical issue is the heavy workload placed on management teams, who have to negotiate and monitor multiple agreements linked to a single contract. Added to this is the splitting of purchase orders, which is common in complex, long-term programs. This can delay reaching the legal threshold that triggers offset, thereby hindering the start of negotiations. Difficulties in managing these agreements stem from the large number of parties involved, the lack of standardization and governance limitations regarding subcontracts.

Finally, poor timing in negotiations and decision-making—whether due to pressure, a lack of preparation or a missed opportunity—is a cross-cutting factor that undermines the successful conclusion of agreements. Taken together, these factors make the environment less conducive to achieving consistent results and hinder the full realization of the strategic potential of offsets.

4.2 Comparative presentation of results

The third SO defined for this study concerns a comparison of offsets resulting from contracts with Brazilian and foreign companies in the aerospace sector. For this purpose, presenting the results in tables will allow for this visual comparison based on the data collected during the study.

In the tables below, the left-hand side lists the aspects and factors identified during the research; in the two columns, an “x” is marked when they relate to a Brazilian company, a foreign company, or an “x” in both columns when they relate to both.

Table 9 summarizes the aspects related to offsets resulting from contracts with Brazilian and foreign companies, allowing a clear comparison between the two types of contracts.

Table 9 – Comparison of aspects related to offsets resulting from contracts with a Brazilian and foreign company

	Aspects related to offsets resulting from contracts with a	
	Brazilian company	Foreign company
Access to technological capacity-building	x	x
Poor quality of projects	x	
Lack of linkage between sanctions in the commercial and offset agreements	x	
Increased cost of the commercial contract	x	x
Low commercial significance	x	x
Offset with little technology transfer		x
Condition for the effectiveness of the contract		x
Difficulty in creating partnerships	x	
Greater legal freedom	x	
Greater variety of available technologies	x	
More complex negotiations	x	
Greater focus on technology transfer	x	x
Different parties from the commercial contract	x	
Possibility of abrupt termination	x	
Preliminary offset agreement prior to the commercial contract		x
Amount of the offset obligation differing from the total value of the commercial contract	x	

Source: Prepared by the authors.

Table 10 – Factors that hinder offsets resulting from contracts with Brazilian and foreign companies

	Factors that hinder offsets resulting from contracts with	
	Brazilian company	Foreign company
Weak bargaining power	x	
Workload	x	
Lower commitment	x	
Control of the equipment supplier selection process	x	
Discrepancy between commercial contracts and offset arrangements	x	
Management challenges	x	
Budget availability	x	x
Late entry into the process of approaching suppliers	x	
Order splitting	x	
Beneficiary's level of development	x	x
Initial inaccuracy	x	
Incomplete planning	x	x
Lack of clarity regarding the relationship between the prime contractor and the subcontractor	x	
Fear of creating competition	x	x
Single source	x	x
Timing	x	

Source: Prepared by the authors.

After presenting the obtained results, we discuss below how these findings align or contrast with the existing literature and what this implies for defense compensation practices in Brazil.

4.3 Results discussion

Our study results reveal a series of challenges and opportunities in implementing offset agreements in the Brazilian aeronautics, highlighting factors that influence the practice of defense offsets in contracts with Brazilian companies. One of the key findings was the inherent complexity of offset negotiations resulting from contracts with Brazilian companies, compared to those conducted with foreign companies (Silva; Santos, 2024).

Aspects identified here, such as poor quality of submitted projects, difficulty in establishing partnerships, and the absence of a sanctioning link between commercial contracts and offset agreements, suggest that the practice of offsets faces obstacles that limit its effectiveness. In line with the literature, as noted by Modesti and Azevedo (2004), offset requirements often result in higher costs for commercial contracts, without necessarily delivering the expected strategic benefits in terms of technology transfer and industrial development.

Moreover, our research revealed that while offsets are seen as an opportunity to access cutting-edge technologies and promote economic development, as noted by Markowski and Hall (2014) and Matthews (2019), these benefits are often mitigated by implementation issues. A lack of clarity in contractual relationships and the poor timing of negotiations emerged as critical barriers, which support Petersen's (2011) concerns regarding the limited effectiveness of offsets when not properly implemented.

Conversely, a more flexible offset policy, adapted to the specific circumstances of each contract, could significantly improve results. This suggests that a less rigid and more context-specific approach, as advocated by Haines and Hosking (2005), may help overcome the identified challenges and maximize the economic and technological benefits for Brazil. Our study also confirms the findings of Brustolin, Oliveira, and Senna (2016), who emphasize the importance of proper strategic planning and well-coordinated implementation for the success of offsets.

A comparison of offset agreements signed with Brazilian and foreign companies revealed that the former require more complex negotiations and a greater workload, due to the large number of agreements and the lack of integration with commercial contracts. These inconsistencies undermine the effectiveness of offset measures, as noted by Petersen (2011), who highlights the complexity of offset arrangements and the lack of a cohesive government policy.

Finally, our results suggest that adopting a mandatory offset policy, especially in acquisition processes involving Brazilian companies, may limit negotiating options and result in excessive costs, without providing the expected benefits to the government. Instead, a more flexible approach, one that considers the specific circumstances of each situation, is preferable. This perspective, which proposes adapting offset policies to maximize results,

supports the findings of previous studies and offers new insights for formulating more effective public policies.

According to the factors identified, despite common structural elements in agreements with Brazilian companies, there are significant differences in the institutional and contractual arrangements analyzed.

Although our findings are limited to the strategic projects under Copac's purview, we can identify analytical patterns that may manifest in other BID segments, particularly in offset contracts characterized by a high degree of technical specificity and institutional uncertainty. Nonetheless, caution is advised when extrapolating the results, given the diversity of contractual arrangements and absorption capacities across different segments and contracting entities.

4.4 Analysis

Our first specific objective sought to identify the peculiarities of offsets resulting from contracts with Brazilian aerospace companies. These contracts are characterized by greater complexity and fragmentation due to the large number of subcontracts and the diversity of parties involved. Main characteristics include: poor quality of the projects submitted, difficulties in forming strategic partnerships, greater legal flexibility, absence of a direct link between commercial contracts and offset agreements, presence of different parties in the contractual instruments, and possibility of abrupt termination of the commitments made.

Despite the wider range of technologies available—due to the involvement of multiple subcontracted foreign suppliers—this potential rarely translates into tangible results for the public sector. Analysis revealed that structural factors, such as the late start of the process of engaging with suppliers and the mismatch between the procurement contract and the offset agreement, undermine the government's bargaining power and the coordination needed to secure tangible benefits. This finding reinforces the conclusions drawn from the data collected by Silva (2024), as it highlights the recurring gap between the technological potential stated in the offset proposals and its actual implementation within the projects analyzed.

Another critical issue concerns the lack of government involvement in the selection of foreign suppliers, which limits its ability to evaluate offset proposals in advance and reduces its room to maneuver in influencing the terms of the negotiations. A lack of a legal relationship between the public entity and international suppliers, in turn, hinders imposing sanctions and ensuring effective compliance with offset obligations.

This misaligned contractual structure, combined with the fragmentation of stakeholders and overlapping interests, undermines the timing of negotiations and weakens the instruments for promoting technology adoption. In this scenario, more flexible offset models—based on long-term strategic partnerships—tend to offer greater potential for

success than standardized, mandatory models, which often result in administrative overhead and costs without a commensurate return.

5 FINAL CONSIDERATIONS

Our study discussed and analyzed the impacts of offsets resulting from contracting defense products with Brazilian companies, focusing on the factors that hinder the implementation of said agreements in the aerospace sector. For this purpose, we defined three SOs whose findings are consolidated below.

Regarding the first SO, which consisted of identifying the peculiarities of offsets resulting from contracts with Brazilian aerospace companies, we found that such agreements are marked by complexity, fragmentation, and instability. Identified aspects include poor project quality, difficulties in establishing partnerships, absence of a direct link between the commercial contract and offset agreement, presence of distinct parties in the contractual instruments and risk of abrupt agreement termination. Despite offering a greater variety of technologies, these contracts do not necessarily result in greater technological depth, revealing structural and operational limitations that compromise their effectiveness as instruments of industrial and technological policy.

As for the second SO, which sought to analyze the factors hindering the practice of offsets with Brazilian companies, the mismatch between the expenditure contract and the offset agreement, late entry into the process of approaching foreign suppliers, the absence of a contractual relationship between the public sector and suppliers, and the low bargaining power of the public entity stood out as main obstacles. These factors hamper imposing sanctions, compromise the timing of negotiations, and increase administrative burden. Other challenges identified included the large number of parties involved, initial inaccuracies in the imported figures, and the splitting of orders. Such elements evince that the effectiveness of offsets depends not only on formal clauses, but also on institutional dynamics and the time alignment between involved parties.

The third SO, aimed at comparing offsets resulting from contracts with Brazilian and foreign companies, revealed that agreements with foreign companies tend to offer greater control, predictability, and legal certainty through mechanisms like pre-agreements and contractual conditions. On the other hand, such agreements are often limited to offsets with low added value. Contracts with Brazilian companies, in turn, present greater technological diversity but suffer from operational and structural limitations, requiring greater articulation capacity by the public sector. Thus, each model has its own advantages and weaknesses, necessitating different approaches in public policy.

Given these findings, we recommend adopting a more flexible offset policy, especially in contracts with Brazilian companies, to avoid imposing obligations out of touch with institutional and operational realities. More contextualized and adaptable guidelines have greater potential to

contribute to strengthening BID, especially when focused on building strategic partnerships and obtaining long-term technological benefits.

Although the results are grounded in robust empirical evidence, reflecting on their applicability in broader contexts is important. Regarding the transferability of results, our findings are anchored in a specific context—the projects coordinated by Copac. However, the analytical categories developed and the factors identified can serve as a preliminary reference for analyses in other BID segments. Future studies may test the applicability of these findings in different organizational and sectoral contexts of defense policy.

Finally, the results presented here refer exclusively to projects conducted within the scope of Copac, thus limiting the generalization of the conclusions. Future studies should expand the sample to include other defense agencies and segments and adopt complementary methodologies that reinforce analytical reliability. Nonetheless, our findings offer concrete evidence for formulating more effective public policies and for improving the strategic use of offsets in the Brazilian defense sector.

REFERENCES

BARDIN, L. **Análise de conteúdo**. São Paulo: Edições 70, 2016.

BRASIL. Portaria Normativa nº 3.990/GM-MD, de 25 de julho de 2023. Estabelece a Política de Compensação Tecnológica, Industrial e Comercial de Defesa - PComTIC Defesa.. **Diário Oficial**, Brasília, DF, 16 ago. 2023.

BRUSTOLIN, V. M.; OLIVEIRA, C. A.; SENNA, C. J. D. Análise das práticas de offset nos contratos de defesa no Brasil. **Revista da Escola de Guerra Naval**, Rio de Janeiro, v. 22, n. 1, p. 169-196, 2016. DOI: <https://doi.org/10.21544/1809-3191/regn.v22n1p169-196>

COPAC – COMISSÃO COORDENADORA DO PROGRAMA AERONAVE DE COMBATE. **Relatório de Dados de Gestão de 2022** – No 1/COPAC/22. Brasília: [s. n.], 2022. Disponível em: https://www.fab.mil.br/Download/arquivos/sic/relatoriodegestao2022/Principais_projetos.pdf. Acesso em: 6 maio 2026.

CORREA, G. M.; URBINA, L. M. S. Padrões de transferência de tecnologia em aquisições de defesa no Brasil. **Revista Brasileira de Estudos de Defesa**, v. 8, n. 1, p. 115-135, 2021. DOI: <https://doi.org/10.26792/rbed.v8n1.2021.75215>

FERREIRA, M. J. B. **Dinâmica da inovação e mudanças estruturais**: um estudo de caso da indústria aeronáutica mundial e a inserção brasileira. 2009. Tese (Doutorado em Ciências Econômicas) – Instituto de Economia, Universidade Estadual de Campinas, Campinas, 2009.

GRIDACH, M. *et al.* Agentic AI for scientific discovery: a survey of progress, challenges, and future directions. Arxiv, 12 mar. 2025. DOI: <https://doi.org/10.48550/arXiv.2503.08979>

GUNAWAN, H. *et al.* The optimising offset defence implementation as fulfilment efforts in fighters aircraft materials and technology. **International Journal of Humanities Education and Social Sciences**, v. 3, n. 4, p. 1745-1751, 2024. DOI: <https://doi.org/10.55227/ijhess.v3i4.724>

HAINES, R.; HOSKING, S. A bridge too far? the arms deal, the Coega IDZ, and economic development in the Eastern Cape. **Society in Transition**, v. 36, n. 1, p. 1-23, 2005. DOI: <https://doi.org/10.1080/21528586.2005.10419125>.

LIMONGI, R.; MARCOLIN, C. B. AI literacy research: frontier for high-impact research and ethics. **BAR** – Brazilian Administration Review, Maringá, v. 21, n. 3, e240162, 2024. DOI: <https://doi.org/10.1590/1807-7692bar2024240162>

MARKOWSKI, S.; HALL, P. Mandated defence offsets: can they ever deliver? **Defense and Security Analysis**, v. 30, n. 2, p. 148-162, 2014. DOI: <https://doi.org/10.1080/14751798.2014.894294>

MATTHEWS, R. The rise and demise of government-mandated offset policy. *In*: MATTHEWS, R. (ed.). **The political economy of defence**. Cambridge: Cambridge University Press, 2019. p. 148-168.

MODESTI, A.; AZEVEDO, A. E. M. Offset: teoria e prática. *In*: WARWAR, Z. (org.). **Panorama da prática do offset no Brasil: uma visão da negociação internacional de acordos de compensação comercial, industrial e tecnológica**. Brasília, DF: Projeto Editorial/Livraria Suspensa, 2004. p. 25-53.

PETERSEN, C. D. Defense and commercial trade offsets: impacts on the U.S. industrial base raise economic and national security concerns. **Journal of Economic Issues**, v. 45, n. 2, p. 485-492, 2011. DOI: <https://doi.org/10.2753/JEI0021-3624450226>

SILVA, F. A. **A prática brasileira das compensações de defesa: o caso dos offsets decorrentes de contratos com empresas brasileiras do setor aeronáutico**. 2024. Dissertação (Mestrado em Ciências Aeroespaciais) – Universidade da Força Aérea, Rio de Janeiro, 2024.

SILVA, F. A.; SANTOS, R. A. S. Defense offsets: propositions and different perceptions. *In*: **Production and operations management**. Cham: Springer, 2022. p. 295-311.

SILVA, F. A.; SANTOS, R. A. S. Indústria aeroespacial e offsets: o caso de contratações de empresas brasileiras. **Revista da Escola de Guerra Naval**, Rio de Janeiro, v. 30, n. 3, p. 677-721, 2024. DOI: <https://doi.org/10.21544/2359-3075.30335>

SOUZA, D. R. O.; OLIVEIRA, M. A. G. Tecnologia e indústria de defesa no Brasil: caminhos e alternativas. **Revista Política Hoje**, Recife, v. 26, n. 1, p. 7-14, 2017. DOI: <https://doi.org/10.51359/1808-8708.2017.8865>

UDIS, B.; MASKUS, K. E. Offsets as industrial policy: lessons from aerospace. **Defence Economics**, v. 2, n. 2, p. 151-164, 1991. DOI: <https://doi.org/10.1080/10430719108404687>

YEDVAV, H.; KORDOVA, S.; FRIDKIN, S. Offset obligation in defense projects: schedule, budget, and performance implications. **Sustainability**, v. 14, n. 18, 11184, 2022. DOI: <https://doi.org/10.3390/su141811184>.

YIN, R. K. **Estudo de caso: planejamento e métodos**. 2. ed. Porto Alegre: Bookman, 2011.