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Supply Chain Management Control in the Aerospace Sector: An Empirical Approach

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Abstract: *Background*: The aerospace industry has been significantly disrupted by recent economic downturns, underscoring the need for robust supply chain management. This is especially important given the complexity of aircraft manufacturing, the globalization of supply chains, and the requirement to meet stringent regulatory standards. While outsourcing is widely adopted to improve cost competitiveness, it also introduces risks, such as compromised product quality, inefficiency, and delays. *Methods*: This study explores how aerospace firms manage outsourcing relationships using control mechanisms. Data were gathered through seven semi-structured interviews with supply chain managers from contracting and supplier firms focusing on both formal and informal controls in supplier selection and relationship management. *Results*: Supplier selection is primarily guided by trust, past performance, and delivery reliability. Firms employ formal controls, such as KPIs and certifications, alongside informal practices, including embedding internal staff within supplier operations. This dual approach ensures quality, mitigates risks, and maintains compliance with regulatory standards. *Conclusions*: This study concludes that combining formal and informal controls is vital for balancing outsourcing efficiency with risk mitigation, offering valuable insights into supply chain management practices in regulated industries like aerospace.

Keywords: management control systems; supply chain management; aerospace industry; partnership selection; outsourcing; interfirm relationships

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1. Introduction

The aerospace industry has been greatly impacted by the recent economic context. In recent years, COVID-19's economic downturn has detained its growth level, reaching a pre-pandemic level of USD 25.7B net profits in 2024 [1]. Despite the positive outlook for players in the sector in future years, new challenges have emerged regarding how supply chains need to be managed.

Supply chain management (SCM) of the aerospace industry is inherently complex and features several unique characteristics. On the one hand, the complexity of the aircraft manufacturing process has led to globalization of the supply [2], involving multiple firms in the production of aircraft. This involvement of diverse stakeholders necessitates robust control mechanisms to effectively manage interfirm relationships. On the other hand, the industry is closely monitored by governmental institutions, which impose stringent quality standards through regulations that companies must enforce [3]. Consequently, managing the supply chain is vital for performance, prompting companies to employ Management Control Systems (MCSs) to monitor supplier relationships and ensure compliance with manufacturing standards [4].

Additionally, global supply chains are costly for firms that attempt vertical integrating. The common strategy followed by players in the aerospace sector is outsourcing as a means of increasing cost competitiveness [5]. Manufacturers act as prime contractors, defining the core competencies of the product and delegating them to subcontracted companies. In this

sense, they are responsible for defining the relationships of different suppliers based on their capabilities and establishing controls for quality [2]. Nonetheless, the use of outsourcing poses a series of challenges for companies. By delegating part of the productive process, prime contractors are exposed to transactional risks, which directly affect the quality of the product, the efficiency of the resources used, and the lead time of production [6]. To mitigate the negative impact of such risks, formal and informal control mechanisms may be used.

In the aerospace literature, several authors have formulated frameworks to manage a global supply chain considering sectorial innovations and practices [7] or disruptive events [8]. However, there is a need for a practitioner-focused approach to analyze which control mechanisms aerospace firms are using to manage their interfirm relationships all over their supply chain. On these grounds, the present study aims to answer the following research question: how do firms in the aerospace sector use control mechanisms to manage their outsourcing supply chain?

To this end, qualitative exploratory research is carried out with the main objective of identifying interfirm control practices followed by aerospace firms. In management control research, case studies serve as an effective way to refine existing theories regarding the use of determined control mechanisms, as it helps reinforce theoretically based constructs [9]. Therefore, a multiple case study approach is taken through seven semi-structured interviews conducted with supply chain managers from diverse companies that are part of an aircraft manufacturing firm supply chain. Data collected from the interviews were subject to aggregate analysis, from which findings are presented in two sub-themes: the outsourcing process of the supply chain and management control mechanisms for interfirm relations used by companies in the sector.

The remainder of this study unfolds as follows. Section 2 provides an overview of the aerospace supply chain characteristics, as well as a literature review of control systems in interfirm relationships; Section 3 discusses the methodological approach used; in Section 4, findings are presented; and final conclusions are made in Section 5.

2. Literature Review

2.1. Aerospace Supply Chain Characteristics

The aerospace sector presents a series of characteristics that make it complex. It is a high-value-added sector reliant on innovation, and it is research and development (R&D) intensive, which pushes players to invest more resources into enhancing existing technologies to improve performance [2]. Additionally, the sector operates under significant government regulation due to the sensitive nature of its final products. Quality assurance is a fundamental requirement for participation in the industry, as regulatory bodies have heightened the number of controls necessary for product certification [3]. Moreover, final customers—predominantly airlines—prioritize aircraft with high reliability and low failure rates, making them increasingly selective and cautious when choosing manufacturers for their orders.

This industry is highly concentrated in terms of the supply of final products, with two main players, Airbus and Boeing, concentrating the total market share [10]. Furthermore, there is a limited number of suppliers that provide key systems and components due to the high specialization degree required to manufacture these components, which limits the bargaining power of both sides of supply. In terms of demand, although there is a higher number of customers (airlines), orders are large in quantity but with low frequency [6]. These orders are subject to changes or cancellations, which poses an additional risk to manufacturers and increases volatility and dependency on both supply and demand. In this context, the main aim of final products' suppliers is to manage a supply chain that can absorb this variation in demand while being flexible, which poses a challenge to players in the industry due to the high overhead costs and specialization required [7].

According to [2], the aerospace industry presents a tiered supply chain consisting of four different stages, as shown in Figure 1.

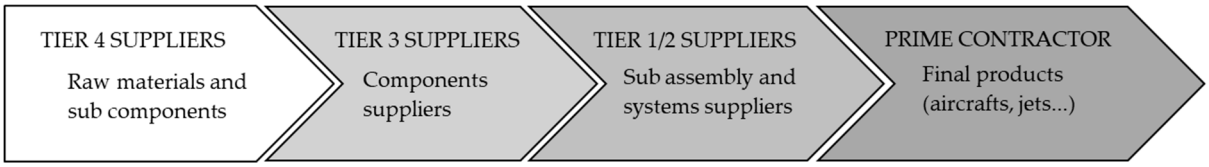

Figure 1. Stages/suppliers in the aerospace supply chain, adapted from [2].

Tier 4 involves the production and supply of raw materials and basic components that are not exclusive to the aerospace industry. These materials, such as metals, plastics, or electronics, are used in the manufacturing process of products across various industries; hence, the degree of specialization required from suppliers is not high. Suppliers at Tier 3 are responsible for the production of components that are more specialized for aerospace applications, although these components generally exhibit a relatively low level of technological complexity. Examples include parts like rotors, pumps, and basic mechanical components. While tailored for use within the aerospace sector, these items do not incorporate advanced technologies or require integration with more sophisticated systems. Tier 2 suppliers produce more complex components by integrating individual parts into sub-assemblies, which serve as crucial elements of larger aerospace systems. Tier 1 suppliers, in turn, are responsible for delivering fully integrated systems, such as engines, navigation systems, or entire airframe sections, that are essential to the final aerospace product. These suppliers maintain strong, long-term partnerships with prime contractors, often engaging in collaborative design, innovation, and risk-sharing arrangements [6].

Prime contractors are responsible for overseeing and managing the supply chain. In the last decade, they have increasingly focused on the downstream segment of the chain, keeping core competencies under their control and delegating responsibilities to first tier suppliers [2]. This has been achieved by involving these suppliers in product development by reinforcing interorganizational relationships and adapting them to the supplier's capabilities. Tier 1 suppliers contribute specialized knowledge and innovative solutions from the early design stages [11].

In this context, companies in the aerospace sector prioritize building stable and long relationships with their suppliers, both in the upstream (Tier 4 and 3) and downstream (Tier 2 and 1) segments [6]. Multiple reasons justify this approach. On one hand, formalizing these relationships allows aerospace manufacturers to ensure consistent quality and reliability of components critical to safety and performance, avoiding knowledge spillovers in an R&D intensive industry [12]. On the other hand, recent disruptions have highlighted the vulnerabilities in global supply chains. Long-term relationships with suppliers help companies build resilience by ensuring reliable access to critical components and materials, thus reducing the risk of shortages or delays [13]. However, although a significant portion of companies acknowledge their understanding of tier one suppliers and the key risks associated with them, awareness diminishes dramatically when it comes to suppliers in the third tier and beyond, reflecting a lack of visibility and comprehension of potential risks further down the supply chain [14].

Table 1 summarizes the main challenges present in the aerospace industry supply chain according to the literature.

Table 1. Challenges in the aerospace industry supply chain based on the literature.

Challenge	Description	Literature
Complexity and Specialization	High levels of specialization and complexity require significant investment in R&D for technological advancements.	[2,15,16]
Regulatory Compliance	Stringent governmental regulations lead to increased quality assurance requirements and certification controls.	[3,5]

Table 1. *Cont.*

Challenge	Description	Literature
Market Concentration	The aerospace market is dominated by a few major players, limiting supplier options and bargaining power.	[10]
Order Volatility	Large but infrequent orders from airlines create uncertainty and volatility in the supply chain.	[6,17]
Limited Visibility	Many companies lack comprehensive knowledge of risks associated with suppliers in the third tier and beyond, leaving them vulnerable to potential disruptions in the supply chain.	[11,14]
Dependency on Long-Term Relationships	Emphasis on long-term relationships can limit flexibility and the ability to explore alternative sources.	[6,18,19]

2.2. Outsourcing in Supply Chain Management

Outsourcing is a common strategy followed by firms in the aerospace industry [15]. Outsourcing can be defined as the practice of delegating specific tasks or processes to external firms rather than managing them internally. This strategic approach enables organizations to reduce operational costs, enhance efficiency, and leverage specialized expertise, thereby allowing them to concentrate on their core competencies. Typical functions that are commonly outsourced include manufacturing, information technology, customer service, and research and development [17].

In the context of the aerospace sector, outsourcing provides several benefits to prime contractors. Firstly, subcontracted firms are key in product innovation, as they provide expertise in general components manufacturing [15]. This collaboration allows for the integration of innovative ideas and solutions that can lead to more effective manufacturing processes. This can provide companies with a competitive advantage in R&D, which is a key success factor of the industry. Secondly, the collaborative nature of co-development fosters knowledge sharing between manufacturers and suppliers. This exchange of information can lead to better alignment of goals, improved problem-solving capabilities, and a greater understanding of market needs, all of which contribute to higher product quality and performance [16]. Furthermore, outsourcing serves as a cost reducer, especially for original equipment manufacturers, as it lets them benefit from highly specialized suppliers' expertise to generate economies of scale [18].

However, several challenges arise when firms rely on outsourcing. Outsourcing often demands heightened coordination, as managing relationships between prime contractors and external suppliers becomes increasingly complex. This entails thorough communication, precise synchronization of project timelines, and alignment of objectives across multiple stakeholders, resulting in greater administrative burdens [15]. Prime contractors may also need to allocate additional mechanisms to oversee supplier performance, maintain quality control, and handle the logistics involved in integrating outsourced components.

In the aerospace sector, the high concentration of players as well as suppliers poses an additional challenge when outsourcing. Suppliers who serve multiple clients often experience increased pressure to maintain higher inventory levels, which can complicate their ability to deliver consistent performance [11]. This is because shared suppliers must balance the demands of several buyers, leading to potential stock shortages or delays. The global scope of outsourcing further amplifies these challenges, as it exposes the supply chain to greater risks, such as disruptions in transportation, geopolitical issues, or variations in regulatory environments, all of which can undermine organizational stability [20].

Another risk implied in outsourcing is knowledge leakage, where suppliers with access to proprietary information may inadvertently share or misuse sensitive knowledge. This is a significant concern in industries like aerospace, where intellectual property and

innovation are key competitive factors [11]. In this sense, companies need to implement formal controls to secure information sharing while mitigating the risks associated with knowledge spillovers.

The literature focuses on supplier selection and performance evaluation processes as key to mitigating risks related to outsourcing [6,16,19]. The selection process for potential suppliers involves a comprehensive risk assessment that examines their technical capabilities, financial stability, and historical relationships with the company [6]. Evaluating past collaborations is crucial, as prior performance can serve as an indicator of a supplier's reliability, quality, and ability to meet deadlines effectively. Post selection, suppliers undergo periodical performance evaluations, align organizational objectives among prime contractors and suppliers, communicate ex ante expectations, and provide ex post feedback, to foster continuous improvement while enhancing communication [16].

Despite the overall positive effects of implementing performance evaluation processes, academia shows mixed results [5,19]. Biases in rating can arise when evaluators inflate performance ratings to avoid conflict or maintain good relationships with suppliers. This tendency, often linked to a desire to reduce psychological discomfort for contracting managers, can undermine the accuracy of the evaluation process [19]. Firms need to properly assess the capabilities of suppliers while avoiding managerial biases in selection by implementing frameworks that foster sustainable relationships based on objectivity [5].

2.3. Management Control Mechanisms and Interfirm Relationships

Outsourcing is the outcome of complex interfirm relationships. These relationships, formally defined as interorganizational relationships (IORs), refer to structured collaborations between firms that aim to enhance their collective capabilities and achieve common strategic objectives through the sharing of resources, knowledge, and expertise [21]. These partnerships are often formed to overcome individual resource limitations, minimize transaction costs, and expand market opportunities [22]. In the recent literature, IORs' focus has shifted from a dyadic to a network perspective due to the increasing interdependence of suppliers in global supply chains [23].

Such an increase in complexity and interdependence highlights the role of partner selection in IORs. Choosing an adequate partner is crucial for achieving the goals of the partnership, such as minimizing transaction costs, overcoming resource dependencies, and expanding business opportunities. Effective partner selection emphasizes compatibility in terms of trust, reliability, and cultural alignment, which helps to manage control mechanisms, reduce risks of opportunistic behavior, and facilitate long-term collaboration success [24]. Lou et al. [21] identify two main types of partner selection: innovation-oriented and efficiency-oriented. Efficiency-oriented selection prioritizes production flexibility, control, and response speed to improve operational efficiency and expand the market share. In contrast, innovation-oriented selection focuses on suppliers with strong capabilities in product development and technological innovation, thus fostering creativity and helping firms maintain competitiveness. The objective when selecting a partner influences the type of selection and the IOR control mechanisms implemented post-selection.

While effective partner selection is crucial in interorganizational relationships, as it reduces the need for additional control mechanisms [22], focusing solely on selection is not sufficient for ensuring success. As collaboration broadens, it introduces complexities that can challenge effective management, making inter-organizational controls increasingly vital for ensuring successful collaboration [25]. This is particularly relevant in the aerospace sector, where supplier concentration amplifies the importance of robust inter-organizational controls to mitigate supply chain risks, thus ultimately safeguarding operational efficiency and reliability.

In IOR research, two main classes are defined: formal and informal control mechanisms. Formal controls focus on setting expectations and monitoring the achievement of specific results through structured agreements or contracts while often paying less attention to how objectives are met [4]. In contrast, informal controls emphasize relational

aspects like trust and communication, fostering a collaborative environment that enhances adaptability and innovation [21,24]. Companies manage each type of partner selection by aligning their control mechanisms and trust-building strategies to the specific goals of the partnership. For innovation-oriented supplier selection, trust is key to fostering collaboration and driving radical innovation by encouraging creative risks. In contrast, efficiency-oriented selection relies on formal controls—outcome, behavior, and process controls—to ensure operational efficiency and support incremental innovation. Despite the different approaches, trust becomes essential in IORs, as the development of relationships with suppliers leads to more complex interactions that formal controls cannot solely contain [26].

Although perceptions of trust are somewhat similar in recent academic research [21,25,26], the relationship between formal control mechanisms and partner selection has been greatly discussed. On one hand, several theories see formal controls and selection as substitutes provided that carefully choosing a trustworthy and capable partner lets organizations rely more on the relationship's inherent trust and alignment, thus minimizing the need for formal mechanisms to monitor and enforce behavior [22]. On the other hand, these are viewed as complementary, as formal controls help manage opportunistic behavior while partner selection builds trust, thus enabling smoother collaboration. Together, these mechanisms enhance the firm's ability to manage supply chain transactions and improve their overall performance by combining trust and accountability [25].

3. Methodology

The objective of this article is to investigate how firms in the aerospace sector implement control mechanisms to manage interorganizational relationships in their outsourced supply chain. To this end, a case study approach is taken. According to [27], case study research involves an in-depth investigation of a real-life phenomenon within its natural context by focusing on individuals, groups, organizations, or events and selecting cases based on their relevance or theoretical significance rather than whether they represent a larger population. In the context of this article, case studies are valuable for analyzing interorganizational settings, as they offer insights grounded in practitioners' responses to the challenges of SCM and IOR.

For the theoretical framework developed, an initial literature review was performed focusing on three main aspects: the challenges of the aerospace supply chain, the outsourcing process in SCM, and the use of management control mechanisms for IOR. The aim of this review was to develop an initial theoretical base with the most relevant studies to refine the research objective and data collection method followed. Academic databases, such as Scopus, Google Scholar, and Web of Science, were consulted.

Several semi-structured interviews were carried out with high-level and medium-level managers from both prime contracting and subcontracted firms in the aerospace sector. The interview questions were designed based on the theoretical framework to elicit insightful and relevant responses from the participants. Table 2 shows a sample of questions asked.

A total of seven semi-structured interviews were conducted with managers from a prime contracting company in the aerospace sector and several of its suppliers. The selection of managers and companies was determined based on the level of collaboration between the firms and the availability of key personnel for interviews. Initial outreach was made through company email contacts, with additional connections facilitated through personal networks. Due to the sensitive nature of the information, particularly in relation to defense contracts, establishing a minimum level of trust was crucial for conducting the interviews.

Table 2. Sample of questions asked in interviews.

Theme	Questions
Supply Chain Management	• Is it an economic performance-based system or a risk-based system? • What activities are primarily developed in the city? • What is the usual number of suppliers for an operational unit?
The Outsourcing Process	• How are the bidding processes structured? • What is the candidate evaluation process? • What is the contract frequency (continuous or project-based)? • What are the payment terms per contract and what is the payment method?
Control Mechanisms in IOR	• What communications are maintained between the supplier and the prime contracting company? • What is the procedure to assess that the intended objectives have been met? • What level of defect is accepted? • What measures are in place to resolve potential issues?

In terms of the sample of interviewees selected, diversity in the positions held by managers provided different viewpoints regarding how IORs with suppliers are treated. The duration of the interviews ranged from 45 min to 2 h, with an average length of approximately 1 h and 25 min. All recorded interviews were transcribed and subsequently returned to the interviewees for feedback, clarification of any points, and final approval. This process served a dual purpose: it ensured the reliability of the information collected and confirmed that the interviewed managers were satisfied with the information provided.

Table 3 summarizes the types of companies in the supply chain, as well as the job positions of the interviewees.

Table 3. Interviews by company and job position.

Interview Number	Company	Job Position
Interview #1	Prime Contractor	Quality Improvement Leader
Interview #2	Supplier	Manager Content
Interview #3	Prime Contractor	HO Supply Chain
Interview #4	Prime Contractor	Materials Manager
Interview #5	Supplier	Operator Program
Interview #6	Prime Contractor	Partner
Interview #7	Prime Contractor	IT Manager

The information gathered through the interviews was systematically analyzed to identify the various control practices employed in interorganizational relationships. This analysis involved integrating and aggregately analyzing responses from different interviewees to understand their perspectives on how control mechanisms are implemented and managed in their interactions with outsourced suppliers. By consolidating these insights, the study aimed to capture the diversity of experiences and approaches to managing outsourced suppliers. Finally, through categorization and interpretation of the insights from the interviews, key patterns and practices were identified, highlighting both formal and informal control measures employed in the outsourcing process.

4. Findings

This section presents the findings from the interviews, organized into two subsections: the outsourcing process employed by the company under analysis and the control mechanisms established and implemented to manage its relationships with outsourced suppliers.

4.1. The Outsourcing Process: Selection and Execution

The studied company takes an efficiency-oriented approach when selecting partners for outsourcing. In this sense, the main objective is to reduce transactional costs and the lead time to deliver the products required at each stage of the supply chain: "the main priority of the 'internal client' is to fulfil the budget and production objectives, it is not our matter to reach a better performance or economics margins" (Interview #3). The outsourcing process involves three main agents: an internal client, the procurement department, and suppliers.

The process begins with the internal client, that is, one of the departments of the company that identifies a need that requires the introduction of an external firm that fulfills it. Following this, a request for information to suppliers is made. Considering the information provided, the internal client is responsible for drafting a comprehensive technical specification that outlines the precise requirements the selected supplier must fulfill. In the stage, the role of the internal client is mainly technical, being responsible for defining the operational needs of the outsourced service. In terms of constraints, there is little discretion in the use of outsourcing, although a balance is required between internal and outsourced workload: "A ratio must be maintained between outsourced hours and in-house hours, as, despite the freedom to request outsourced services, it is not permissible to externalize 100% of the hours required for an aircraft" (Interview #1).

After the initial technical specification is developed, the procurement department elaborates and submits a request for proposal to the supplier in the form of a work package, refining the necessities of the internal client considering productive needs and budget constraints. This process typically takes around a month to complete. Within the request for proposal, the work package outlines the tasks to be performed, while the work specification details the deliverables and delivery conditions for each task. Essentially, the request functions as a preliminary work contract being offered.

Suppliers apply with a work package proposal, and the procurement department filters them using two selection mechanisms. First, an operating risk assessment is conducted in which the supplier's capabilities are compared to the fungibility of being able to deliver the required product in time. In this assessment, trust plays a necessary role: "in many selection processes are established evaluation criteria specifically to prevent the entrance again of past suppliers, basically due to bad experiences or previous unsatisfactory working relationships" (Interview #1). For the company, the outcome of previous relationships has a double edge by giving preference to previous suppliers that adequately fulfilled their responsibilities and eliminating negatively perceived past suppliers. After the operational assessment, financial analysis is performed as well by reviewing the supplier's financial statements, credit ratings, and historical performance to evaluate their financial stability. A minimum of three proposals are required to advance to the following stage, in which the procurement department performs various interviews with filtered suppliers. In this interviews, final technical and compliance aspects of each proposal are discussed.

During the selection of potential candidates, there are several factors that change the selection criteria used, these being the outsourcing objective and the degree of flexibility of the task performed. In terms of the objective of outsourcing, there are two main categories: operative and non-operative. Operative outsourcing focuses on obtaining direct inputs crucial for manufacturing aircraft and aerospace components, including engines, avionics, and structural parts. These suppliers are essential to the production process, significantly influencing the quality and efficiency of the final products. Conversely, non-operative outsourcing involves procuring auxiliary services or products that support operational functions, such as maintenance, logistics, IT services, and facility management. Complementary to the objective, the flexibility of the task outsourced influences the use of stricter assessment mechanisms. Flexibility refers to the ability to modify the scope, timing, or execution of work during a project. In specialized or critical tasks, especially in industries like aerospace, flexibility is limited due to technical complexities and strict requirements, making posterior adjustments more challenging. For highly specialized tasks to be outsourced, more rigid conditions are imposed by the firm.

After the selection of provisional suppliers, an internal evaluation takes place, in which the procurement department and the internal client assess the fitness of each proposal. The decision making power is somewhat balanced between both parties, although the internal client has a slightly higher influence on the final decision: "the 'internal client', who is the petitioner of the opening of the outsourcing process, through the technical specification details its needs, and in the internal evaluation, the technical area has 60% power decision" (Interview #5). In this phase, a relevant aspect considered is the ethical and normative compliance of the supplier. The result of this discussion is reflected in the selection report, a document signed by all agents in which the winning proposal is selected and a section detailing the ethical and compliance considerations is included.

The final stage of the outsourcing selection process involves formalizing the partnership through contract signing, which encompasses several key elements. These include detailed technical specifications outlining the services to be delivered, general contract conditions that define the rights and obligations of both parties, and Key Performance Indicators (KPIs) that serve as benchmarks for evaluating service performance. Additionally, penalty clauses are included to outline consequences for failing to meet the contract's terms. This stage is vital for establishing a clear framework for collaboration and ensuring that both parties are aligned regarding expectations and accountability. Table 4 summarizes the outsourcing selection process followed by the company analyzed.

Table 4. Stages in the supplier selection process. Source: Author.

Stage	Definition	Agents Involved
1. Need Identification	The internal client (a department) identifies a requirement that necessitates outsourcing.	Internal Client
2. Request for Information	Information is requested from potential suppliers to gather preliminary data.	Internal Client, Procurement Department, Suppliers
3. Technical Specification	The internal client drafts a detailed technical specification outlining the operational needs and requirements for the outsourced service.	Internal Client
4. Request for Proposal (RFP)	The procurement department refines the technical needs and submits a formal RFP, including a work package and delivery conditions, to potential suppliers.	Procurement Department, Internal Client, Suppliers
5. Supplier Evaluation	Proposals are assessed through operational risk and financial analyses, considering trust, prior experiences, and supplier capabilities.	Procurement Department
6. Final Interviews	Shortlisted suppliers are interviewed to finalize technical and compliance aspects of their proposals.	Procurement Department, Suppliers
7. Internal Evaluation	Procurement and the internal client review and assess the proposals, with the internal client having more influence in the decision.	Procurement Department, Internal Client
8. Contract Formalization	A partnership is formalized through contract signing, including technical specifications, KPIs, penalties, and terms of collaboration.	Procurement Department, Internal Client, Suppliers

Once the outsourcing selection finished, the execution process begins. The first stage involves monitoring of services, which is primarily assessed through Key Performance Indicators (KPIs) and deliverables. On the one hand, these KPIs serve as crucial benchmarks for measuring the effectiveness and efficiency of the services provided by the external supplier. The internal client plays a significant role in overseeing the KPIs, as they are responsible for tracking the level of service delivered by the outsourced partner.

Deliverables, on the other hand, not only allow for the assessment of service quality but also facilitate the invoicing process, ensuring that payments are made in alignment with the agreed-upon metrics. Should any issues or complaints regarding service quality arise, the internal client can initiate a commercial review to address these concerns. This review process may lead to claims against the supplier, prompting a re-evaluation and potential re-definition of the existing KPIs to better align with service expectations and performance standards.

The outsourcing contract stipulates specific timelines, including a start date and a completion date, with provisions for initiating a new request for proposal process six months prior to the contract's expiration. It is common practice to issue new requests to avoid stagnation with the same suppliers, to enhance service performance, and to explore alternative options.

In situations requiring immediate action, an alternative direct assignment process may be employed. This involves the use of a deviation sheet, which must be signed by senior representatives to document and authorize deviations from standard procedures. This mechanism ensures that any changes made during the outsourcing process are formally recognized and agreed upon by both parties, thus maintaining a level of accountability and transparency throughout the execution stages.

4.2. Interorganizational Control Mechanisms

Aerospace companies are required to not only deliver high-quality final products but also adhere to rigorous quality standards enforced by governmental institutions through comprehensive regulations. To achieve this, companies implement management control systems designed to oversee supplier relationships and ensure adherence to manufacturing standards. These systems facilitate compliance monitoring and enhance the overall quality assurance process within the industry.

The control measures applied differ significantly according to the type of supplier outsourced. For general or non-specialized suppliers, the company maintains a flexible, competitive environment, frequently rotating suppliers to foster competition and improve overall performance. However, for highly specialized suppliers who provide unique products, services, or expertise, the firm adopts a more careful and stable approach. These suppliers are often difficult to replace due to their specific know-how or the exclusivity of their offerings. On this basis, the firm implements a higher proportion of formal mechanisms when managing relationships with non-specialized suppliers, while the number of informal mechanisms is higher with specialized suppliers. The control mechanisms used by the company are defined in Table 5.

The company primarily employs formal mechanisms for supplier selection and performance assessment, such as certifications, Key Performance Indicators (KPIs), delivery notes, and quarterly reviews. Additionally, it uses informal mechanisms, including retaining internal employees for continuity and evaluating past supplier performance, to improve decision making.

One of the main informal control mechanisms implemented by the company is the permanence of internal workers from supplier to supplier: "many of our intern employees in (The company) facilities already were in the company when we won the contract with (The company)" (Interview #6). In this sense, the presence of familiar workers who understand the company's processes and standards helps mitigate risks associated with contract transitions, ensuring that operational knowledge and expertise are retained. This approach also encourages suppliers to maintain high standards, as they know they will be working with the same employees, who are accustomed to the buyer's expectations. By ensuring that a stable workforce is maintained across different suppliers, the firm effectively exercises control over the quality and consistency of the work being performed.

Table 5. Interfirm mechanisms used by the analyzed company. Source: Author.

Control Mechanism	Type	Definition
Certifications	Formal	A process ensuring that suppliers meet essential quality standards and regulatory requirements, promoting fairness and compliance with ethical and legal norms in selection.
Key Performance Indicators (KPIs)	Formal	Metrics established to evaluate supplier performance and effectiveness, reviewed annually, and used for ongoing assessment and potential adjustments in service delivery.
Delivery Notes	Formal	Monthly documentation that facilitates performance monitoring and serves as a basis for invoicing, ensuring alignment with contractual obligations and service expectations.
Quarterly Reviews	Formal	Regular evaluations to assess supplier performance and address potential issues with order fulfilment, allowing for timely adjustments to maintain quality standards.
Permanence of Internal Workers	Informal	Internal employees are retained across different suppliers to ensure continuity of operational knowledge and adherence to company standards, thus mitigating risks during transitions.
Past Performance Assessment	Informal	An evaluation of supplier capabilities compared to the risks associated with their ability to deliver on time, factoring in trust and previous performance.

Certifications are a key formal mechanism in the partner selection process, ensuring that suppliers meet essential quality standards and regulatory requirements. This approach guarantees compliance with ethical and legal norms while promoting fairness among competitors. Before participating in tender opportunities, suppliers must obtain approval from the buyer firm through a certification process that verifies adherence to quality norms, such as ISO regulations.

An additional control mechanism is the setting of KPIs and the use of delivery notes. Monthly communications are established through delivery notes, which serve a dual purpose: they facilitate performance control and provide a basis for invoicing against the order. The client firm employs systems like “click and buy” and “e-invoicing” to streamline this process. Additionally, an annual evaluation of KPIs is conducted in accordance with the signed contract, while quarterly reviews are implemented to make internal financial adjustments and to address any potential issues with order fulfillment. This flexible approach allows for modifications and renegotiations of the contract as necessary, providing resilience to the company.

5. Discussion and Conclusions

The primary objective of this research analysis was to answer the following question: how do firms in the aerospace sector use control mechanisms to manage their outsourcing supply chain? To achieve this, insights were gathered through interviews with managers from a contracting company and its outsourced suppliers, which were subsequently subjected to a thorough examination. This analysis aims to compare theoretical supply chain management and interfirm relationship models with actual empirical data. The information collected through these interviews proved invaluable in developing the hypotheses for this research analysis.

Findings indicate that the company adopts an efficiency-focused outsourcing process, prioritizing reduced transactional costs and lead times. The process involves collaboration between the internal client, the procurement department, and suppliers, beginning with the identification of needs and the drafting of technical specifications. The selection of

suppliers incorporates rigorous operational and financial assessments, emphasizing trust and past performance. Control mechanisms include formal practices, like certifications, Key Performance Indicators (KPIs), delivery notes, and quarterly reviews, along with informal methods, such as retaining internal workers across suppliers to ensure continuity and mitigate risks. Overall, the company employs a mix of formal and informal controls to effectively manage supplier relationships and maintain high-quality standards in the aerospace industry.

Empirical findings support the previous literature on IORs. In the selection process, the analyzed firm puts great emphasis on trust and cultural alignment, giving preference to those suppliers with a past positive relationship [24]. Additionally, informal controls, such as the retention of internal staff during supplier transitions, act as stabilizing mechanisms, providing suppliers with valuable operational knowledge. This practice enhances collaboration between the firm and its suppliers, fostering stronger, more cohesive partnerships [21].

In the case presented, the use of formal mechanisms and a thorough selection process were complementary, following approach by H. Dekker et al. [25]. Despite the stringent selection criteria, additional formal controls were instituted in the post-selection phase. This is likely due to the high level of oversight in the aerospace sector by governmental regulatory bodies, coupled with the requirement that final products must undergo rigorous quality testing before delivery [3]. These factors necessitate enhanced control measures throughout the entire outsourcing and production process.

In conclusion, this research highlights that the behavior of the buyer company is closely linked to the specialization of the outsourced activity and its added value to the supply chain. The findings confirm that the contractor's decisions significantly influence the supply chain configuration, which is shaped by a range of control mechanisms aimed at measuring the performance of outsourcing contracts. These controls reflect the asymmetrical nature of the contracted-supplier relationship, where interactions are largely driven by individual interests rather than a cooperative or relational approach. This is reflected in the efficiency-driven approach in outsourcing and the use of control mechanisms based on fulfilling the internal client's necessities rather than generating shared value.

This article contributes to the existing literature on inter-organizational relationships and supply chain management by providing empirical insights into how firms in the aerospace sector employ a combination of formal and informal control mechanisms to manage outsourcing relationships. It builds on prior research by demonstrating the critical role of trust, cultural alignment, and past performance in supplier selection, as well as describing the outsourcing process followed by companies in the industry.

Limitations of the study are those inherent in the methodology followed. The use of a case study with a limited sample of seven firms restricts the generalizability of the findings, as the insights are based on a single firm's outsourcing processes within the aerospace sector. While this provides detailed and context-specific information, the conclusions may not apply universally across different industries or firms with varying operational structures.

Future research could investigate firms that implement emergent technologies to manage outsourcing, providing a basis for comparing the balance between informal and formal control mechanisms in such contexts. Additionally, research could benefit from developing more structured conceptual models by drawing on the existing literature that explores the interplay of trust and power, transactional versus relational governance modes, trust versus contracts, and the integration of trust and control mechanisms. While this study focuses on supplier management within the outsourcing process, future research could explore how these control mechanisms influence other supply chain aspects, such as logistics, inventory, or client delivery efficiency, or even examine suppliers' perspectives on these mechanisms, particularly those managing concurrent relationships with multiple contractors, to gain deeper insights into how control mechanisms are perceived and navigated in multilateral outsourcing arrangements.

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