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ORIGINAL PAPER

Cooperative Systems Increasing the Chance of Success of Innovative Projects: A Case from the Brazilian Aerospace Sector

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ABSTRACT

This paper addresses the use of cooperative systems in the management of innovative projects and their contribution to increasing the chances of success in the case study of the KC-390 Program, a significant project in the Brazilian aeronautical industry. Based on the administrative theory of cooperative systems, the study focuses on collaboration and trust in innovative projects, using the Technology Readiness Level as a guide for decisions. Complex products and systems require customized approaches due to their complexity and high engineering costs. Innovation in these projects depends on collaboration and trust between the developer and the requester. The methodology used includes applied and qualitative research, exploring bibliographic, documentary, and field research data. The KC-390 case study highlights the partnership between the Brazilian Air Force Command and Empresa Brasileira de Aeronaves (Embraer), evidencing how this relationship has been fundamental for technological development. The paper also explores the dual certification process of the KC-390, where the implementation of a collaborative process in the Conformity Demonstration Planning phase brought innovation to military certification. This innovation broke with the traditional paradigm of certification of aeronautical products in the country and was possible, mainly, due to the relationship of trust between the certifying authority and the integrating company.

Keywords: Cooperative system; Complex products and systems; Aerospace industry; Certification; KC-390 Program.

INTRODUCTION

Complex products and systems (CoPS) are high-cost, engineering-intensive products, systems, networks, and constructs. In the aerospace sector, examples include satellites, avionics systems, flight simulators, aircraft engines, and air traffic control units (Jesus *et al.* 2021). They tend to be manufactured in single projects or small batches. In the aerospace and defense sector, technologies are generally advanced, involving complex, custom-made products and systems. These technologies require intensive engineering, offer high performance, have high costs and high added value, and are considered strategic for both the countries and the companies that produce them (Brandão Neto *et al.* 2024).

Due to the relevance of CoPS projects in organizations, the search for improvement in project management is increasingly relevant. Barnard (1938) highlighted in his theory, concepts of cooperative systems, where one or more people collaborate with the aim of achieving or fulfilling a common goal.

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Innovative projects consist of grouping people in specific circumstances for a specific period, with the aim of performing a unique set of tasks. For these projects, traditional management may not be sufficient to meet the needs of organizations, and it is necessary to consider the aspects of collaboration and trust (Noorderhaven 2023).

In projects aimed at creating knowledge, it is possible to note the presence of high levels of uncertainty and the complexity of the human factors to be managed is significantly greater in relation to other types of projects (Domingos and Chagas Jr. 2021).

Based on these concepts, the article examines the role of cooperative systems in the management of innovative projects and their impact on increasing the probability of success, using the KC-390 Program, considered an emblematic project in the Brazilian aerospace sector, as a case study.

The study presented in this article delves into the aspects of collaboration and trust established throughout the program's life cycle, from its conception, where technological development was chosen to start the project as a cooperative system, to the product certification process, where the concepts of cooperation, collaboration and trust were used to demonstrate the test requirements.

The article also explores the concept of technological development, supported by the Technology Readiness Level (TRL) scale to support decision-making. Technological development requires an adequate level of investment for the development of large complex systems. When this does not happen, there is an imbalance between technological development and product development, compromising the development of the project, as occurred in the KC-390 Program. As explored by Davies *et al.* (2023), successfully carrying out innovative projects becomes essential for the survival and growth of organizations, especially in a scenario of uncertainty, complexity, and rapid change.

Different from traditional management methods, the article provides empirical evidence of the cooperative model, inspired by Barnard (1938), applied to the management of the KC-390 Program, which allowed continuous adaptation and the construction of a strategic partnership between stakeholders, particularly in the processes of aeronautical product certification and technological development.

METHODOLOGY

This study is applied research, classified as exploratory, as it aims to provide more information on a given topic, making it more explicit. It used a qualitative approach and a single case study (Yin 2009), focused on the KC-390 Program, an emblematic example in the recent context of the need to re-equip the Brazilian Air Force (Força Aérea Brasileira [FAB]).

The research procedures used to develop this study included bibliographic research, documentary research, and field research (Yin 2001) to investigate the following research questions: (a) Does the use of cooperative systems contribute to the increased success of a complex and innovative project?; (b) What is the role of collaboration and trust in a cooperative system?; (c) How was the cooperative system established among the main actors of the KC-390 Program?; and (d) What is the role of collaboration and trust in the decision-making processes for technological development and in the product certification process for the development of the KC-390?

To conduct the field research, open face-to-face interviews were conducted with experts from the National Civil Certification Agency (Agência Nacional de Aviação Civil [ANAC]), the Industrial Development Institute (Instituto de Fomento e Coordenação Industrial [IFI]), and Empresa Brasileira de Aeronaves (Embraer), to understand and analyze the research questions. Four interviews were conducted with the participation of the head of the IFI Certification Processes Subdivision, the Certification Specialist at IFI, the Civil Aviation Regulation Specialist at ANAC, and the Product Development Engineer at Embraer.

Literature review

Concepts of cooperative systems in project management

Many definitions of projects involve the use of the term organization. Project definitions often use the concept of organization. Shenhar and Dvir (2007), Turner (2009), and Turner and Müller (2003) describe projects as temporary organizations that have resources assigned to carry out transitional and innovative efforts with the goal of achieving beneficial change. These definitions emphasize the temporary nature of projects and their purpose of fulfilling specific objectives and delivering beneficial change.

Galdino and Chagas Jr. (2011) note that the term "organization" in project definitions establishes a connection with Barnard's (1938) management theory, which describes an organization as a cooperative system of people working together to achieve a common goal. Thus, projects, being temporary organizations, also have a defined purpose, aligning with the idea of cooperation and shared goals.

Project management dynamics, trends, and frameworks evolve as the environment evolves. The Project Management Institute (PMI 2021) emphasizes the opportunity to consider global perspectives on changes in project management and the approaches used to derive benefits and value from project outcomes.

In traditional project management, success is often measured based on meeting deadlines and stipulated costs (Shenhar *et al.* 2001). However, projects that include innovation require a dynamic and flexible approach to deal with the uncertainty and complexity of creating new processes or products (Davies *et al.* 2023).

For projects that involve many uncertainties, such as innovative projects from CoPS organizations, a cooperative approach, aligned with Barnard's (1938) concepts, brings agility to adaptation through iterations that allow for improvement (Chagas Jr. *et al.* 2017). In this approach, responsibilities are decentralized, providing greater autonomy to teams to manage their activities while stakeholders remain more involved throughout the execution and decision-making process (Fernandez and Fernandez 2008; Levitt 2011).

Barnard (1938) explores how organizations are formed and consolidated through cooperative systems, where individuals interact to achieve a common goal. The sustainability of the organization depends on the adaptation and transformation of the initial purpose to maintain the cooperation and interaction of individuals.

Achieving an objective through interactions between individuals performs better than individual actions taken by each individual (Galdino and Chagas Jr. 2011), contributing to increasing the chance of success of projects that involve great complexity and high levels of uncertainty.

Collaboration and trust in innovative projects

Innovative activities are usually organized in temporary organizational forms, like research and development (R&D) projects or new product development projects (Noorderhaven 2023). However, according to Jesus *et al.* (2021), organizations involved in CoPS and innovative projects must expand their approach beyond traditional project management and operational efficiency.

Balestrin and Verschoore (2016) understand that due to the rapid advancement of science and technology, large companies are no longer able to cover all areas of knowledge necessary to improve and innovate their products. This means that they can no longer control the entire process or exclusively retain their resources, so for the development of innovative projects, it will be necessary to bring together other people or organizations in specific situations, for a limited time, to carry out a unique set of tasks.

According to Noorderhaven (2023), in these circumstances, contributions cannot be fully planned in advance. Improvisation in project management refers to the ability to respond spontaneously to unexpected circumstances or problems, deviating from conventional structured processes. This requires trust and collaboration among project participants.

In projects, building trust, especially that based on experience or knowledge, takes time to build, but is essential to facilitate knowledge exchange, reduce costs and conflicts, and promote efficiency and financial performance (Noorderhaven 2023).

Collaboration is a broad concept that includes coordination, which is the orderly alignment of actions, and cooperation, which involves the joint pursuit of goals based on a shared understanding (Castañer and Oliveira 2020). Thus, coordination is essential in organizational theory, managing task interdependencies, while cooperation is crucial for the success of innovative projects, affecting task performance and participant satisfaction.

Collaboration in projects is essential to drive product innovation, especially when external companies are partners. Trust in this partnership allows access to valuable knowledge, generating creative and innovative solutions (Maurer 2010).

Technology Readiness Level scale as a tool for selecting technologies in CoPS project management

The TRL scale was created by the National Aeronautics and Space Administration (NASA) in the 1970s and is now considered an important reference tool to support decision-making on the introduction of new technologies in complex systems under development (Jesus and Chagas Jr. 2020; 2022). The challenge for systems and technology managers is to be able to make clear and well-documented assessments of technological maturity and associated risks at critical points in the program life cycle (Mankins 2009).

The advancement of innovative technologies is an essential element for the economic and social development of nations, and recognizing the opportunities for applying these innovations is a key factor in achieving success (Brandão Neto *et al.* 2024).

System advancements in CoPS industries often rely on the development of previous technologies, and if there is no adequate investment in R&D to drive the progressive maturation of a new technology, the development of the new system will likely experience schedule delays, cost increases, and will not achieve expected performance objectives (Chagas Jr. *et al.* 2017).

In countries with developed economies, large investments in technology development programs (TRL 1-6) allow technologies to reach a stage of maturity where they can be seamlessly incorporated into a complex system. In this case, the product development effort (TRL 7-9) is transferred to the industry with an acceptable level of uncertainty (Chagas Jr. and Francelino 2023).

According to the Government Accountability Office's Good Practices Report (GAO 1999), a technology at TRL 6 represents an acceptable level of risk to be introduced during the program definition phase, while TRL 7 is appropriate for the engineering and manufacturing development phase.

In contrast, in countries with a late industrialization process, technologies have not yet reached a sufficient stage of maturity to be integrated into complex systems, since in most cases, the progress of certain technologies is driven by public programs, but this occurs in product development programs (TRL 7-9), rather than programs dedicated to technological development (TRL 1-6). This approach increases the chances of program failure (Chagas Jr. and Francelino 2023).

In Brazil, this was evident over decades in the Brazilian aerospace sector, where public programs demanded by the Air Force Command (Comando da Aeronáutica [COMAER]) were systematically responsible for the development of key technologies for Embraer and its suppliers (Chagas Jr. and Francelino 2023; Francelino *et al.* 2019; Ribeiro 2017).

CASE STUDY: KC-390 PROGRAM

The KC-390 Program originated from the necessity to replace the aging fleet of Hercules (C-130) aircraft. The objective was to combine in a single aircraft the capacity to fulfill numerous missions such as transporting cargo, troops, paratroopers, supporting humanitarian missions, fighting fires, search and rescue, aeromedical evacuation, and the capacity for aerial refueling (Francelino 2016; Santos 2021).

The Brazilian Armed Forces have three options for acquiring military equipment: acquisition of equipment available on the market (TRL 9), contracting services for modernization of equipment in use (TRL 7-9), and development of new products, which includes technological development (TRL 1-9). The Air Force General Staff (Estado-Maior da Aeronáutica [EMAER]), within the FAB hierarchy, is responsible for identifying operational needs at any organizational level of the air force. However, the decision to purchase a weapons system for use by the FAB rests with the COMAER, which is advised by EMAER (Ribeiro 2017).

Among the COMAER documents, Directive DCA 400-6 – Life Cycle of Aeronautical Systems and Materials, aims to organize the planning and execution of the phases and main events of the life cycle of systems and materials acquired by the FAB. The document includes phases such as conception, feasibility, definition, development or acquisition, production, implementation, use, revitalization, modernization or improvement, and deactivation (COMAER 2007).

In the feasibility phase of the KC-390 Program, during the process of analyzing the development or acquisition of an aircraft that would meet the need to replace the C-130, several issues were analyzed by committees and subcommittees established for this purpose, including the investment required for each of the two options, the operational cost of the aircraft, the possibility of obtaining financing to make the purchase viable, and incentives for the Brazilian Aeronautical Chain (Ribeiro 2017).

As a result, the COMAER considered the product development risk acceptable, taking into account the history of successful relationships with Embraer. Acquisition in the market did not present any advantage for the Brazilian government, either in terms of cost or in terms of technology absorption (Chagas Jr. and Francelino 2023; Francelino 2016).

In 2009, COMAER signed a contract with Embraer to develop two prototypes of the military transport and refueling aircraft (KC-X aircraft). In this context, the beginning of the KC-390 Program was established with a trust link for the development of a cooperative project between COMAER and Embraer. The contract included services for managing the production and assembly of the aircraft, delivery of project documentation, development and certification reports, test flight and operational evaluation reports, and a product data package (Ribeiro 2017; Silva 2023).

The development of the preliminary design of the future freighter was divided into two main stages: the first, focused on conceptual studies (TRL 1-3), and the second, dedicated to preliminary studies (TRL 4-6). Embraer conducted the conceptual studies phase before being officially contracted by COMAER to develop the project (Ribeiro 2017). However, the decision to develop the prototypes was established based on trust, given the history of partnership between COMAER and Embraer, since some technologies that would be included in the program were not sufficiently mature and established at the TRL 6 level, such as the fly-by-wire (FBW) flight control system (Francelino *et al.* 2019; Ribeiro 2017).

According to Noorderhaven (2023), trust based on experience or knowledge takes time to built. The beginning of the relationship between COMAER and Embraer started with the development and manufacture of the EMB-110 Bandeirante and the purchase of the EMB-326 Xavante, which enabled Embraer to serially produce the Bandeirante and subsequent aircraft.

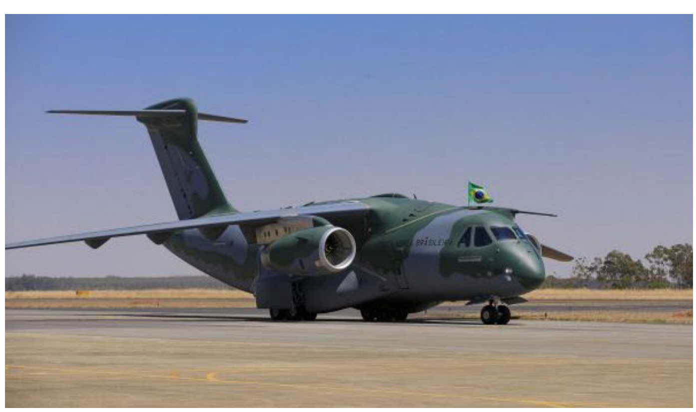
The partnership also resulted in the success of the EMB-312 Tucano, the EMB-314 Super Tucano, and the AMX project, which stood out for its significant impact on the Brazilian aeronautical industry. This collaboration provided Embraer with advanced capabilities in design, engineering, and production, as well as the ability to jointly develop technologies and improve quality control (Francelino 2016; Ribeiro 2017).

In this way, the relationship between COMAER and Embraer was strengthened, creating a link of cooperation in a positive cycle of mutual benefits in the development of the CoPS aerospace industry and consequently in the results of the projects (Francelino 2016; Ribeiro 2017). It can be said that this history of partnership and trust allowed COMAER to assume the risks inherent in a project of this magnitude and complexity.

After the critical project review meeting, it was found that the project was mature enough and had achieved the necessary security for the parties to start negotiating the series contract. Thus in 2014, COMAER contracted Embraer to manufacture 28 units of the KC-390 freighter (Ribeiro 2017).

Given the complex nature of the project and the high level of uncertainty, it was inevitable that adjustments would be made to the program schedule. Budget cuts caused by the severe economic crisis that developed in the country, together with problems related to the testing of one of the aircraft prototypes, significantly altered the delivery of the first aircraft (Santos 2021).

Almost 3 years behind the original schedule (Ribeiro 2017), in September 2019, Embraer delivered the first KC-390 aircraft to FAB, as shown in Fig. 1 (Santos 2021).



Source: FAB.

Figure 1. Arrival of the first KC-390 aircraft delivered to FAB, in Anápolis, state of Goiás. In 2021, COMAER renegotiated with Embraer to reduce the purchase of aircraft from 28 to 22 units and, in 2022, adjusted the schedule to 19 aircraft, aiming to reduce costs (Silva 2023).

Embraer's relationship as an integrating company in the KC-390 Program

The creation of the Brazilian aeronautics industry is closely linked to the programs implemented by COMAER, whether these were acquisition programs (TRL 7-9) or aircraft development programs (TRL 4-6). These programs were crucial to the advancement of technological capabilities in the aeronautics sector in Brazil (Ribeiro 2017).

Embraer, founded in 1969 by the Ministry of Aeronautics and privatized in 1994, maintained strong ties with the Brazilian State and COMAER (Francelino 2016). These ties were crucial to the development of the company's technological capabilities, especially through projects led by the aeronautics department (Ribeiro 2017).

Embraer, recognized worldwide for its success in manufacturing regional and military aircraft, has benefited from acquisitions made by COMAER, which allowed the maturation of dual-use technologies (Chagas Jr. and Francelino 2023). Over the past 50 years, military aircraft programs (AM-X, AL-X, F5-BR, KC-390) have driven innovation at the company, with advances also being applied to the civilian sector (Francelino *et al.* 2019).

The KC-390 Program enabled Embraer to carry out the entire development of the KC-390 aircraft, meeting COMAER's engineering requirements. This project represented a significant innovation for the company in several areas, being the largest aircraft ever developed by Embraer (Francelino *et al.* 2021).

The Program provided technological advances that were essential for Embraer to maintain its global competitiveness, with emphasis on the development of the entire FBW flight control system, a critical technology for an aircraft manufacturer, for which Embraer, until that moment, was not in the necessary state of readiness for this development.

FBW is described as the replacement of mechanical control systems with electrical controls. Instead of cables and pulleys, electronic signals are transmitted from the onboard computers that process the pilot's commands to the actuators that move the control surfaces (Spitzer 2011).

Embraer fully developed the FBW system for the KC-390 (Silva 2023). This advancement began with the AMX Program and evolved into the EMB 170/190/175/195 civil programs in partnership with Honeywell (Chagas Jr. *et al.* 2017).

The company has observed along the way that in an aircraft project, certain technologies cannot be delegated to third parties. Given the complexity involved, having full control over development is essential to deal with systemic uncertainty. The KC-390 Program allowed Embraer to develop the FBW software internally, resulting in significant advances for the Brazilian aeronautical industry (Francelino 2016).

Embraer, as an integrator, also needed to demonstrate compliance with the requirements for aircraft certification. In this context, when a technology is not in the necessary state of readiness for development, the impact of uncertainty is also felt in the certification process. In this context, the process of collaboration and trust established in the KC-390 Program in the cooperative system between Embraer and COMAER was extended to other phases of the project life cycle.

Relationship of certification authorities in the KC-390 Program

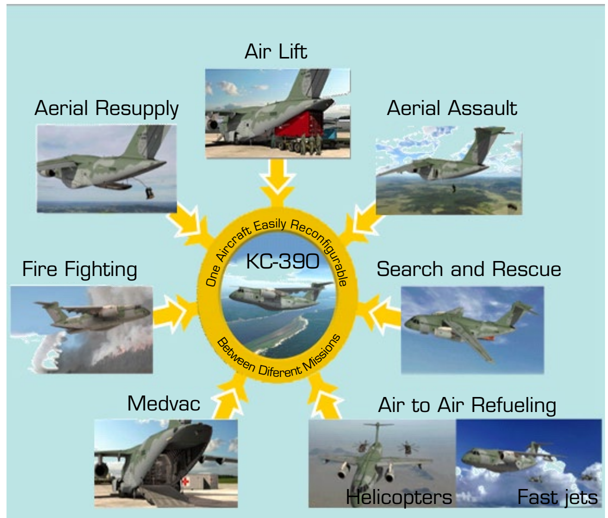
The KC-390 aircraft project was developed from the outset with support for dual certification. This process combined the efforts of Brazilian civil and military airworthiness authorities, aiming to carry out all missions safely (Pleffken 2021).

In Brazil, military certification is conducted by IFI, based on instruction ICA 57-21 (COMAER 2017, 2019), while civil certification is carried out by ANAC, according to RBAC nº 21 (ANAC 2024b). Both processes are similar, requiring the design to meet regulatory requirements and demonstrate operational safety.

The typical type certification process involves five phases: conceptual design, requirements definition, compliance planning, implementation, and post-certification (Pleffken 2021). In the case of the KC-390 aircraft, the certification strategy was divided between Civil Type Certification, which comprises the certification of the basic aircraft carried out by ANAC, and Military Type Certification, which comprises the acceptance of the certification of the basic aircraft, plus the certification of the military systems carried out by IFI, in accordance with the technical, logistical, and industrial requirements of the contract (Pleffken 2021).

The civil certification program, which began in 2011, verified more than 2,500 requirements, culminating in the issuance of the Type Certificate (TC) by ANAC in 2018, authorizing the operation of the model in Brazil and its delivery to the FAB (ANAC 2018).

The military certification program began in 2014. The Certification Plan for military systems included the acceptance of civil certification and the verification of 624 additional requirements by IFI (Pleffken 2021). On March 23, 2023, Embraer received the TC in the full operational capability (FOC) version from IFI, guaranteeing the full operability of the aircraft in all planned activities. Figure 2 illustrates the inclusion of military systems added to the basic platform of the KC-390 aircraft.



Source: IFI.

Figure 2. Military systems added to the basic platform of the KC-390 aircraft.

For the Conformity Demonstration Planning phase, IFI used the process that allowed Embraer to become an Accredited Design Organization (Organização de Projeto Credenciada [OPC]) (COMAER 2017), enabling the company to take on some activities of the certification process, such as: preparation of reports, technical opinions, simulations and tests. Although already adopted worldwide by aviation regulatory agencies, such as the European Aviation Safety Agency (EASA), this approach was innovative in Brazil (Pleffken 2021).

In the European approach to aeronautical certification, EASA uses the term Design Organization Approval (DOA) to identify design organizations that have a system called Design Assurance System (EASA 2023). This system allows the implementation of a philosophy that ensures a high level of quality in the development process from the outset, but requires trust and cooperation between the developer and the certification authority. The idea is that the design organization carries out activities to demonstrate the requirement and verify compliance, instead of the aeronautical authority directly verifying compliance with the certification basis (COMAER 2017; Pleffken 2021).

To increase the reliability of the process, IFI established that the applicant must submit, for acceptance by the certification authority, a strategy to demonstrate compliance with each requirement of the Certification Base. This strategy includes the description of the activities to be performed, the interrelationship between them and a justification of their sufficiency to meet the requirement.

During the Certification Plan acceptance analysis, the certification authority's Level of Involvement (LI) was also defined for each requirement, which could be "Indirect" (remote monitoring with the possibility of auditing) or "Direct" (need for closer monitoring for validation). Direct LI was mandatory in cases where the requirements are critical for safety or mission, or when systems and technologies were being developed or integrated for the first time.

IFI and Embraer introduced an innovation by adapting the European model to the specificities of Brazilian military aviation. This action broke with the paradigm of the model traditionally adopted in the certification of aeronautical products in the country. This innovation was viable mainly due to the relationship of trust established between the certifying authority and the integrating company.

During the certification process of the KC-390 aircraft, a cooperative system was established with the aim of delivering a high-quality and complex product. For both parties, Embraer and the civil and military certification authorities, the certification process involved great uncertainty due to the size of the program.

Right at the beginning of the KC-390 certification process, in the conceptual design phase, where the developer defines the conceptual design of the product and, in parallel, the developer and the certification authority maintain interactions to discuss new technologies, materials, processes, and other factors important to the project, the first interactions between Embraer and the civil and military certification authorities began.

At this stage, as already highlighted in this article, Embraer integrated technologies that were not in the necessary state of readiness for development, such as the FBW flight control system, requiring efforts from the organization not only for the technological development of the system but also for planning and demonstrating compliance. The role of the certification authorities at that time was to promote the integration of trust for the development of innovative solutions required in a project with so many complexities.

Therefore, the benefits were also evident in the harmonization of knowledge among those involved in the certification process, especially with regard to demonstrating compliance with the design requirements of an aeronautical product. As a result, in future knowledge creation projects, risk management and stakeholder expectations tend to reduce the level of uncertainty (Domingos and Chagas Jr. 2021).

Another highlight of this cooperative system in the KC-390 certification process was in the Conformity Demonstration Planning phase, where IFI certified Embraer as an OPC, establishing a link of collaboration and trust in an activity that was typically carried out by the certifying authority.

According to the interviewees, the application of the methodology was only possible due to the history of competence and integrity added to the relationship of trust between the integrating company and the certification authority, as it requires collaboration between the organizations and reliability in the acceptance of the requirements.

In February 2024, Embraer made its first formal request to ANAC to be certified as a Design Organization in the civil area according to subpart J of RBAC nº 21 (ANAC 2024a), based on the success of the military certification process of the KC-390 aircraft, where the organization acted as OPC.

CONCLUSION

One of the critical factors for the success of the KC-390 Program was the relationship of trust established between COMAER and Embraer, the company responsible for the development and production of the aircraft. The experience accumulated by COMAER in previous projects with Embraer reinforced the confidence in the company's technical capacity to overcome the challenges of the program. This cooperative system provided mutual benefits to the participants.

Embraer's participation in the aircraft development and acquisition projects promoted by the FAB has been fundamental to the consolidation of its technological capabilities. The company realized throughout this process that certain technologies cannot be outsourced. The KC-390 Program enabled Embraer to develop the FBW software internally, strengthening its competitiveness and promoting the Brazilian aeronautical industry.

The certification process for the KC-390, both civil and military, brought considerable challenges due to the size of the program. It is worth noting that, in the military certification process, the transfer of activities typically performed by the certifying authority to Embraer was only possible due to the company's technological and managerial maturity, but this depended on collaboration and mutual trust to ensure the reliability of the process.

The trust built between Embraer and IFI during the KC-390 certification became a model for future processes. Embraer's request for certification as a Design Organization with ANAC will facilitate future civil certifications, increasing the company's autonomy to adapt its fleet to safety and operational requirements more quickly.

The application of cooperative systems in the management of innovative projects, such as the KC-390 Program, has proven to be a determining factor for success and innovation in the Brazilian aerospace sector. Collaboration between organizations has generated significant transformations, with emphasis on new certification processes and complete mastery of technology by the project integrator.

CONFLICT OF INTEREST

Nothing to declare.

AUTHORS' CONTRIBUTION

Conceptualization: Santana MKA and Chagas Jr. MF; **Methodology:** Santana MKA; **Investigation:** Santana MKA; **Writing - Original Draft:** Santana MKA; **Writing - Review & Editing:** Santana MKA; **Supervision:** Chagas Jr. MF; **Final approval:** Chagas Jr. MF.

DATA AVAILABILITY STATEMENT

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