

MANAGEMENT IN AEROSPACE COMPANIES: CASE STUDY OF SPACEX AND EMBRAER

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Abstract: This study aims to analyze the current management of the Grupo de Engenharias e Sistemas Aeroespaciais de Macaé (GESAM) (Group of Aerospace Engineering and Systems of Macaé) and identifies main challenges. Research includes aviation and aeroespacial companies, focusing on technology production and science, agile methods and a well-defined organizational structure, consisting of different levels of leadership and departments, were identified. The research highlights the importance of organizational culture in the efficiency and success of research activities in groups like GESAM. Based on the results, it is concluded that a restructuring of GESAM is necessary, with the implementation of agile methods, aiming to improve management and achieve the objectives set by the team.

Keywords: Management; Aerospace Company; Aviation Sector; Agile Methods; Organizational Structure.

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Resumo: Este estudo tem como objetivo analisar a gestão atual do Grupo de Engenharias e Sistemas Aeroespaciais de Macaé (GESAM) e identificar os principais desafios enfrentados pela equipe. Por meio de uma pesquisa que incluiu empresas do setor aviônico e aeroespacial, com enfoque em produção de tecnologias e ciência, foram identificados métodos ágeis e uma estrutura organizacional bem definida, composta por diferentes níveis de liderança e departamentos. A pesquisa destaca a importância da cultura organizacional na eficiência e sucesso das atividades de pesquisa em grupos como o GESAM. Com base nos resultados, conclui-se que a reestruturação do GESAM é necessária, com métodos ágeis para aprimorar a gestão e alcançar objetivos estabelecidos.

Palavras-chave: Gestão; Empresa Aeroespacial; Setor de Aviação; Métodos Ágeis; Estrutura Organizacional.



1. INTRODUCTION

The essence of a company is based on the organizational culture of its teams, encompassing values, norms, and attitudes displayed by its members. In the context of research groups, whose primary objective is to generate scientific knowledge in specific areas, the adoption of a hierarchical structure and effective management is crucial to ensure smooth functioning and the achievement of established goals. Through activity coordination, strategic planning, and people management, leadership plays a fundamental role in organizing and guiding the group, aiming to promote efficiency and success in research activities.

1.1. Purpose and Scope

The objective of this research is to analyze the current management of GESAM and identify the main challenges faced by the team. Based on this analysis, we aim to understand the impacts of these problems on the efficiency and productivity of GESAM. Additionally, we intend to investigate and propose updated approaches and methods to enhance the group's management, with a focus on improving research quality, strengthening internal and external communication, optimizing resource utilization, and promoting innovation and teamwork.

To achieve these objectives, a literature review will be conducted on management methodologies applied in research and knowledge production companies, such as SpaceX and Embraer, in order to extract lessons and best practices that can be adapted to the context of GESAM. Furthermore, internal documents of the group will be analyzed to understand the challenges faced and the specific needs of the team.

Based on the results obtained, concrete changes in the organizational structure of GESAM will be proposed, along with the adoption of agile practices to enhance the efficiency of activities developed by the group. These recommendations will be presented as contributions to improve the management of GESAM, providing a solid foundation for the continuity and growth of research and projects developed by the team.

1.2. The History of Management at Gesam

Gesam was founded on February 3, 2020, with the aim of developing products and technologies for the aerospace sector, conducting scientific research, participating in competitions, promoting science dissemination, and providing support to rocket modeling groups in schools.

The group was divided into 5 sectors: Aerodynamics and Structure; Avionics and Payload; Management and Marketing; Propulsion; and Recovery. Additionally, the project is managed by the executive council, consisting of coordination,



presidency, vice-presidency, general management, treasury, and technical management.

Subsequently, a process of team adaptation began, involving the development of the entire work methodology and the consolidation of sector management. Following this, an evaluation of the organization's scenario was carried out, identifying past management flaws and establishing potential improvements.

1.2.1. Challenges in Management Faced

The analysis of Gesam's adaptation period revealed significant challenges in this process, later identified as failures in the group's management system. The primary obstacle encountered was the lack of internal communication, which is essential for conveying values and integrating processes and people within the team. Subsequently, issues were identified in administrative, technical, and visual records, as well as a lack of proactive measures to train and integrate new members.

1.2.1. Impacts of Management Issues

The management problems in Gesam have resulted in a series of negative impacts on the team, including delays in development and loss of technical knowledge. This occurred due to a lack of transfer of experiences and skills from more experienced members to others. Additionally, there were adverse effects on experiment and project replicability, as well as on the review and validation of obtained results, due to the lack of organizational performance monitoring and evaluation.

Regarding social media, the team faced challenges in documentation, external communication restrictions, limitations, and missed opportunities for scientific dissemination. An illustrative example of this occurred during the pandemic when Gesam had the opportunity to participate in the first in-person competition at the Festival Brasileiro de Minifoguetes (FBMF) (Brazilian Mini Rockets Festival) held from June 16th to 19th, 2022, in São José dos Campos - SP. Despite various limitations, the team successfully competed in the H-100 and H-200 categories and secured the second-place national position in the H200 category. However, there are only a few photos and videos available for this event, and no technical records are currently accessible for analysis.

2. METHODOLOGY

The present research adopted an approach based on the analysis of aerospace sector companies, aiming to identify efficient and up-to-date management practices that could be applied to Gesam. To achieve this objective, an extensive literature review on management methodologies applied in research and knowledge production companies was conducted, focusing on practices used by aerospace sector companies, such as SpaceX and Embraer, with an emphasis on their

organizational structures and management approaches. The review sought to extract lessons and best practices that could be adapted to the context of GESAM.

Subsequently, it was necessary to identify the main challenges faced by research and knowledge production teams. This step allowed for a better understanding of the obstacles encountered by GESAM and guided potential improvements. Based on the results obtained from the literature review, case study, and identification of challenges, changes in GESAM's management were proposed. These changes included the implementation of agile methods, such as SCRUM and Kanban, as well as organizational restructuring to ensure greater efficiency and strategic alignment.

Finally, the potential impacts of the proposed changes in GESAM's management were analyzed, considering the increase in productivity, improvement in research quality, and strengthening of teamwork. Based on the conducted analyses, it was concluded that the proposed changes have the potential to drive GESAM's success and sustainable growth. Through this methodology, the research aimed to provide a solid foundation for the continuous improvement of management in GESAM, aiming to enhance its research and knowledge production activities in the aerospace field.

3. RESULTS AND DISCUSSION

Currently, large companies are engaged in scientific activities, contributing to the advancement of knowledge in science. While they also conduct research, develop, and produce technologies and products in the aerospace sector, their main objective is to drive innovation and provide technological solutions for this industry. Therefore, the analysis of the management of these organizations is crucial to gather insights from successful experiences and enhance the management of Gesam.

3.1. SpaceX

While SpaceX's specific management methodology may not be publicly available due to the lack of specific administration-related publications, insights can be obtained from books and articles that analyze the history and steps taken in its management by its founder, CEO, and engineer, Elon Musk.

According to Vance [1], Musk adopted an approach of open offices and operated SpaceX in the spirit of a Silicon Valley startup. This approach fosters a culture of teamwork and collaboration by encouraging open communication among teams, promoting the exchange of knowledge, ideas, and solutions, contributing to an environment of innovation and continuous learning within the organization. Additionally, when Vance mentions that the company was operated like a "Silicon Valley startup," it means that an agile and iterative development mindset, typical of Silicon Valley startups, was implemented[1].

This adopted methodology values experimentation and rapid iteration, allowing teams to continuously test new technologies and design approaches, contributing to the swift evolution of their rockets and space systems. An example of this approach



is found in the development of the Falcon 9 rocket, mentioned by Cerqueira et al. [2]. Through rapid iterations, prototype testing, and continuous feedback, SpaceX was able to gradually improve the rocket, achieving the historic milestone of successfully executing the first vertical landing, showcasing the effectiveness of Agile methodology in the aerospace industry.

3.2. Embraer

Embraer, as a company known for investing in research and development to enhance its aircraft and technologies, implemented an effective management approach that resulted in improved efficiency, productivity, and quality of its production processes. According to Embraer's Annual Report [3], the introduction of the Embraer Business Excellence Program (P3E) based on the Lean Manufacturing management approach and production philosophy yielded even more significant results. The report indicated that the company achieved a considerable reduction in manufacturing cycle time, estimated at approximately 20%[3].

The Lean Manufacturing approach aims to eliminate waste and optimize industrial processes through standardized operations, teamwork, collaboration, and continuous improvement. By adopting this management philosophy, Embraer sought to "simplify" its work model and eliminate manufacturing waste. The results achieved in 2007 [3] demonstrated that this objective was successfully realized, with significant improvements in productivity and a reduction in the production cycle.

The successful application of this methodology by Embraer highlights the relevance of the company's adopted strategy, emphasizing the importance of pursuing greater efficiency and competitiveness in the aerospace industry.

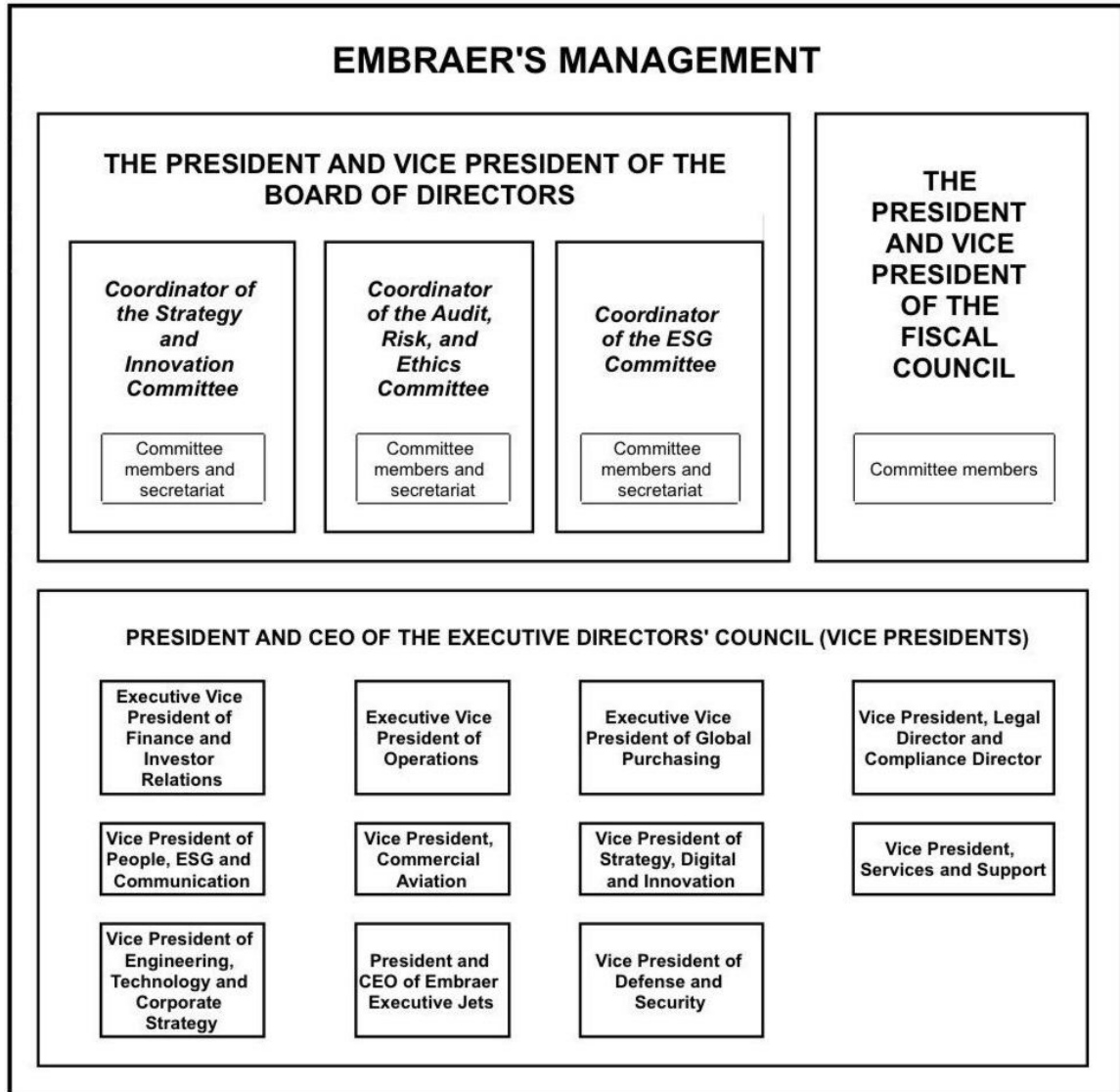
In the Embraer's Annual Report [4], it is possible to identify the business units and divisions in which the company operates, each with a specific focus, such as military solutions, technical support, commercial aircraft manufacturing, executive jet production, and agricultural solutions. These units include Defense & Security, Services & Support, and the Aviation divisions: Commercial, Executive, and Agricultural[4].

To ensure the efficient functioning of these business units, there is a well-defined organizational structure. According to Embraer [5], this structure is composed of different levels of leadership and departments. Important decisions of the organization, as well as alignment of actions with objectives, are ensured by the Board of Directors, which is divided into three key committees: the Strategy and Innovation Committee, the Audit, Risk, and Ethics Committee, and the ESG Committee[5-11]. These committees define strategic guidelines, supervise aspects related to auditing, risks, ethics, and social and environmental responsibility.

Additionally, there is the Fiscal Council, which monitors the company's financial and accounting activities. The Executive Directors' Council, comprising Vice Presidents, President, and CEO of the departments, manages daily operations and implements the strategies of the Board of Directors. Moreover, they are responsible for leading the teams.

Based on information from Embraer [5], an organizational chart (Figure 1) of the company's management was developed as follows:

Figure 1. Organizational Chart from EMBRAER[5]



In addition to the leadership structure, Embraer has a variety of functional departments that perform specific roles within the organization. As visible in the organizational chart above, these departments include: Finance and Investor Relations; Operations; Global Sourcing; General Legal Counsel and Compliance; People, ESG, and Communication; Commercial Aviation; Strategy, Digital, and Innovation; Services and Support; Engineering, Technology, and Corporate Strategy; Embraer Executive Aviation; and Defense and Security

These departments, when combined with specific business units or divisions, form the organizational matrix of Embraer. Within this matrix, employees may have responsibilities across multiple dimensions, optimizing efficiency and specialization, allowing the company to meet the specific demands of each business unit while maintaining a cohesive structure aligned with the organization's strategic objectives [5-11].

3.3. Changes in Gesam's Management: Current Approaches and Methods

To implement efficient management at Gesam, constant efforts are made to adopt updated approaches and methods. Drawing from case studies, such as SpaceX and Embraer, changes in team management can be established.

The first step towards increasing Gesam's productivity and work quality was adopting team management based on agile methods, similar to SpaceX's approach. This is achieved by setting clear goals for each project or activity, which are divided into smaller and more manageable parts called incremental deliveries. Regular follow-up meetings are conducted to share updates and define next steps, fostering collaboration and effective communication among team members.

Furthermore, Gesam's management has implemented the Kanban method using Trello, a visual system that manages workflow. This method represents tasks as cards that can be moved on a board, showing the status and progress of each activity, facilitating better task prioritization and organization.

Regarding administrative and technical records, the implementation of a documentation system based on SCRUM principles is being discussed. This system will establish process standardization, a common element with Embraer's methodology. While Lean Manufacturing prioritizes waste elimination and efficiency, creating standards for the steps ensures consistency, avoiding rework and errors. The SCRUM method will function similarly, establishing clear procedures and ensuring that Gesam follows a set of common guidelines and practices.

Despite the Marketing team having already organized and defined a social media management strategy, the utilization of basic SCRUM concepts will facilitate content production. With better-defined workflows, the process of visually recording activities and participating in events, such as competitions or team promotion, will be improved.

In addition to changes in Gesam's management methodology, restructuring of the organizational structure is also being studied. These changes will involve separating the Management and Marketing sector so that the team's management functions in synergy with the executive council of GESAM. Furthermore, the role of managers responsible for delegating and supervising committee activities will be implemented, with technical and administrative sectors being separated. The administrative committee will handle internal and external communication, while the technical committee will be responsible for the team's operational tasks. These changes aim to improve organization and efficiency at Gesam, ensuring management is more aligned with strategic objectives and responsibilities are more efficiently distributed.

Although the proposal for Gesam's organizational restructuring represents a significant milestone for enhancing activities and striving for excellence in our projects, it is understood that implementing these changes will require an adaptation process for the entire Gesam team. To ensure a smooth transition, careful planning of the restructuring stages will consider the needs and expectations of all involved members. Open dialogue and active participation from all will be crucial to ensure that changes are understood and embraced by the entire team.

During this adaptation process, providing the necessary support and training for team members to familiarize themselves with the new work methods and understand the new dynamics within the committees will be essential. In this regard, Gesam's leadership will play a crucial role, encouraging collaboration, promoting a culture of continuous learning, and providing adequate resources for everyone to perform their roles efficiently.

Throughout this process, we will pay close attention to the positive impacts that efficient management can bring to Gesam, including improved communication, increased productivity, optimized resource utilization, improved research quality, and knowledge retention. These results will motivate the team to move forward and continually seek excellence in all activities, always pursuing new challenges and accomplishments in the field of research and knowledge production.

4. CONCLUSION

Throughout this article, we have explored the proposed changes for Gesam's management, seeking to update its practices and methods to achieve greater efficiency and excellence in its research and knowledge production activities. Recapping the main points discussed, we highlighted the implementation of agile methods, such as SCRUM and Kanban, which aim to increase productivity and work quality, as well as the creation of specialized committees for internal and external communication, as well as operational activities.

Our final recommendations aim to promote continuous improvement in the group's management. We encourage the constant pursuit of training and updates in the methodologies and practices used, as well as the promotion of an environment that fosters innovation and collaboration among team members. Additionally, it is crucial to maintain an open channel of communication between Gesam's leadership and all members to ensure understanding and support for all proposed changes.

Regarding the conclusions corresponding to the proposed objectives and hypotheses, we found that the implementation of agile methods and organizational restructuring are significant steps towards advancing Gesam towards excellence. The analysis of the results has shown that such changes have the potential to drive productivity, improve research quality, and strengthen teamwork.

In conclusion, efficient management is fundamental for Gesam to continue growing and overcoming challenges in its journey. be better prepared to face future challenges and achieve new milestones in our journey in the field of research and knowledge production.

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