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Alignment of the Strategic Program of Space Systems (PESE) with the National Defense Strategy (END)

Alineación del Programa Estratégico de Sistemas Espaciales (PESE) con la Estrategia Nacional de Defensa (END)

Alinhamento do Programa Estratégico de Sistemas Espaciais (PESE) à Estratégia Nacional de Defesa (END)

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ABSTRACT

This research had as objective analyzing to what extent the Strategic Program of Space Systems (PESE) influences the fulfillment of the strategic objective defined **as the priority of aerial surveillance**, established for the Brazilian Air Force (FAB) in the National Defense Strategy (END). Due to the characteristics of both documents, the theoretical basis was mainly based on the principles of strategic planning. The Value Focused Thinking (VFT) theory and the techniques of the content analysis provided support for data collection and structuring. Initially, the methodology consisted of a documentary research in order to define the concept of **aerial surveillance**. Subsequently, a hierarchy of objectives was constructed, composed of the strategic objective of the END and intermediate objectives. The measurement of the contribution of the PESE to the accomplishment of the intermediate objectives was obtained applying the principles of the VFT. Finally, these measures were integrated in order to identify the contribution of the PESE to the strategic objective of the END, resulting in a value index of 0.567. The data were interpreted and analyzed in light of the principles of strategic planning and it was concluded that the main contributions of the PESE are related to the strengthening of the national industry, the monitoring of areas of interest from space and the network operation between the Armed Forces (FA). On the other hand, the PESE contributes little to the issues related to obtaining access to space and the integration of space activities into FAB operations, through the Brazilian Aerospace Defense System (SISDABRA).

Keywords: Strategic objectives. Spatial systems. Strategic planning. Alignment.

RESUMEN

*Esta investigación tuvo el objetivo de analizar en qué medida el Programa Estratégico de Sistemas Espaciales (PESE) influye en el cumplimiento del objetivo estratégico de **la prioridad de la vigilancia aérea**, establecida para la Fuerza Aérea Brasileña (FAB), en la Estrategia Nacional de Defensa (END). En función de las características de ambos documentos, la fundamentación teórica se basó principalmente en los principios de planificación estratégica. La teoría Value-Focused Thinking (VFT) y las técnicas de análisis de contenido proporcionaron soporte para la recopilación y la estructuración de los datos. Inicialmente, la metodología consistió en una investigación documental a fin de definir el concepto de **vigilancia aérea**. A continuación, se construyó una jerarquía de objetivos compuesta por el objetivo estratégico de la END y por objetivos intermedios. La medición de la contribución del PESE para el cumplimiento de los objetivos intermedios se obtuvo aplicando los principios de la VFT. Por último, estas medidas se integraron a fin de identificar la contribución del PESE al objetivo estratégico de la END, resultando en un índice de valor 0,567. Los datos fueron interpretados y analizados a la luz de los principios de planificación estratégica y se concluyó que las principales contribuciones de la PESE se relacionan con el fortalecimiento de la industria nacional, el monitoreo de áreas de interés a partir del espacio y la operación en red entre las Fuerzas*

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The acronyms and abbreviations contained in this article correspond to the ones used in the original article in Portuguese.

Armadas (FA). Por otro lado, el PESE contribuye poco a los temas relacionados a la obtención de acceso al espacio ya la integración de las actividades espaciales con las operaciones de la FAB, a través del Sistema de Defensa Aeroespacial Brasileño (SISDABRA).

***Palabras clave**: Objetivos estratégicos. Sistemas espaciales. Planificación estratégica. Alineación.*

RESUMO

Esta pesquisa teve o objetivo de analisar em que medida o Programa Estratégico de Sistemas Espaciais (PESE) influencia o cumprimento do objetivo estratégico **a prioridade da vigilância aérea***, estabelecido para a Força Aérea Brasileira (FAB) na Estratégia Nacional de Defesa (END). Em função das características de ambos os documentos, a fundamentação teórica foi baseada, principalmente, nos princípios de planejamento estratégico. A teoria* ***Value Focused Thinking*** *(VFT) e as técnicas da análise de conteúdo forneceram suporte para a coleta e a estruturação dos dados. Inicialmente, a metodologia consistiu de uma pesquisa documental a fim de definir o conceito de* **vigilância aérea***. Em seguida, foi construída uma hierarquia de objetivos composta pelo objetivo estratégico da END e por objetivos intermediários. A medição da contribuição do PESE para o cumprimento dos objetivos intermediários foi obtida aplicando-se os princípios da VFT. Por fim, essas medidas foram integradas a fim de identificar a contribuição do PESE para o objetivo estratégico da END, resultando em um índice de valor de 0,567. Os dados foram interpretados e analisados à luz dos princípios de planejamento estratégico e concluiu-se que as principais contribuições do PESE são relacionadas ao fortalecimento da indústria nacional, ao monitoramento de áreas de interesse a partir do espaço e à operação em rede entre as Forças Armadas (FA). Por outro lado, o PESE contribui pouco para os temas relacionados à obtenção de acesso ao espaço e à integração das atividades espaciais às operações da FAB, por meio do Sistema de Defesa Aeroespacial Brasileiro (SISDABRA).*

***Palavras-chave**: Objetivos estratégicos. Sistemas espaciais. Planejamento estratégico. Alinhamento.*

1 INTRODUCTION

On April 9th 2015, the Commander's Guideline was published in the Aeronautical Command (COMAER) Bulletin, which emphasizes the importance of aligning the Organization's efforts to achieve the strategic objectives.

> At all levels, the management effort should focus on measuring and delivering concrete results [...]. In order to do so, it is imperative to integrate the planning and execution efforts from a strategic management that allows the necessary deployment of the major objectives up to the base of the structure [...]. (BRASIL, 2015, p. 1).

In this context, the National Defense Strategy (END) stands out, and its first edition has been approved in 2008. The END established guidelines and strategic objectives for each of the Armed Forces (FA), and also addressed the role of three sectors considered as "decisive for National Defense: space, cybernetic and nuclear." (BRASIL, 2008, p. 6).

In compliance with the mandate of the END, the Ministry of Defense (MD), through Ministerial Directive (MD) nº 14/2009, assigned COMAER the responsibility of conducting initiatives related to the Strategic Space Sector, in coordination with that Ministry and with the other FA, in order to propose sectoral objectives, plans and strategies "always in line with the END." (BRASIL, 2009, p. 1).

As a consequence, the Aeronautical General Staff (EMAER) coordinated the Space Strategic Working Group (GT), composed of representatives of the three FA, the MD and the Secretariat of Strategic Affairs of the Presidency of the Republic (SAE-PR), which produced a report detailing sectoral objectives and strategies. In compliance with established sectoral objectives, the Strategic Program of Space Systems (PESE) was created, which is implemented by the Commission for the Coordination and Implementation of Space Systems (CCISE).

The PESE is complementary to the National Space Activities Program (PNAE) and establishes the strategy for the deployment of dual-use space systems (civil and military), which should address both the interests of the MD and FA and of civilian government entities. Also, one of the basic criteria of the PESE is to be strategically aligned with the END (BRASIL, 2012b).

The investments needed to implement the PESE are estimated at R$ 8.4 billion over nine years (BRASIL, 2012a), but government entities are influenced by changes in the political, economic, social and technological environment in which they are inserted, which may impact the efficient application of these resources. In addition, the development of space products and services is marked by complexity, technological risks, high cost and long development cycles.

In such context, this research had as objective analyzing to what extent the PESE influences the fulfillment of the strategic objective within "The priority of aerial surveillance", established for the Brazilian Air Force (FAB) in the END (BRASIL, 2013, p. 16). For the sake of clarity, this objective will be referenced only as an **END strategic objective** in some parts of this work.

Aiming to guide the analysis, five specific objectives were established. Initially, the concept of **aerial surveillance** was defined, and then intermediate objectives were identified, subordinated to the strategic objective of the END. The next step was to identify the contribution of the PESE to the fulfillment of each intermediate objective aiming, later, to identify the contribution of the PESE to the fulfillment of the strategic objective of the END. Finally, this measure was employed to analyze the aspects of the PESE that influence the fulfillment of the strategic objective of the END. It should be emphasized that the objectives of this research refer to the content of the text of the PESE and not to the implementation of the Program.

The knowledge produced in this research contributes mainly to the EMAER and to the CCISE, as it allows identifying important aspects to be improved in the updates of the PESE, which contributes so that the resources destined to the Program are applied in a coherent way with the END.

2 THEORETICAL FOUNDATION

The theoretical fundamentals of this work have been based mainly on the principles of strategic planning, which emphasize the importance of aligning the plans of an organization with the strategic objectives that generated them. In order to measure the contribution of the PESE to the fulfillment of the strategic objective of the END, we searched for a basis in the Value Focused Thinking (VFT) theory. Finally, the data collection from the PESE was carried out using the techniques of content analysis.

2.1 Strategic planning

The evolution of strategic planning theories was highlighted by Mintzberg, Ahlstrand and Lampel (2010), who identified ten schools of corporate strategy formulation. Among the diverse definitions for the concept of strategic planning, we can highlight the one provided by Peter Drucker.

> Strategic planning is the continuous process of making present entrepreneurial (risk-taking) decisions systematically and with the greatest knowledge of their futurity; organizing systematically the efforts needed to carry out these decisions; and measuring the results of these decisions against the expectations through organized, systematic feedback. (DRUCKER, 1986, p. 92, our translation).

Bryson (2011) emphasizes that such systematic processes apply not only to private corporations but also to government organizations. They are intended to assist leaders and managers of these organizations to reason and act strategically, with a view to producing effective policies and programs for the benefit of society.

Unlike private corporations, government organizations do not aim for profit and have the obligation to apply public resources efficiently. Thus, Bryson (2011) proposed a strategic planning process aimed specifically at these organizations. One of the steps of this process is to identify strategic aspects that may be affecting the fulfillment of the organization's duties and that should be improved.

This step is considered by Bryson (2011, p. 185, our translation) as being "the heart of the strategic planning process" and involves the identification of misalignments, conflicts and inconsistencies between the various elements of governance, policies, and an organization's competencies. Such an approach is based on the assumption that good organizational performance requires a reasonable degree of coherence between these various elements.

Kaplan and Norton (2006) also stress the importance of aligning and coordinating the strategic efforts of large government organizations, which manage budgets of their own and need to integrate and articulate the actions between various administrative units. The analogy between conducting an organization and driving a boat underscores the importance of pursuing the objectives in a coordinated way.

> Winning teams invariably paddle in perfect sync; each member moves the oar vigorously, but in a coordinated way with the others, under the guidance of a helmsman, who is responsible for the rhythm of the paddles and the direction of the boat. [...] The helmsman of a boat is like the central administration. The bad helmsman takes up valuable space, increases the weight of the boat and compromises overall team performance. (KAPLAN; NORTON, 2006, p. 2).

According to Kaplan and Norton (2001), the success of a strategy depends on the fulfillment of the strategic objectives. For such, it is a fundamental condition that the initiatives, policies and programs of an organization be aligned with these objectives. Thus, verifying the extent to which the initiatives foreseen in the PESE contribute to the fulfillment of the strategic objective of the END is

a prerequisite for future implementation of the Program to be carried out in a manner consistent with the strategy envisaged for the efficient use of human, material and financial resources.

Finally, the National Quality Foundation (FNQ) corroborates this notion, since it generally defines action plans as a set of articulated initiatives for the implementation of the strategy (FUNDAÇÃO NACIONAL DA QUALIDADE, 2008). The unfolding process of these plans should consider verifying the alignment of the projects with the strategy, since "without the good integration of these practices, the strategies formulated and the plans defined are nothing more than a letter of intent." (FUNDAÇÃO NACIONAL DA QUALIDADE, 2008, p. 24).

2.2 *Value Focused Thinking*

In order to measure the contribution of the PESE to the fulfillment of the strategic objective of the END, we searched for a basis in the Keeney theory (1992), named Value Focused Thinking (VFT).

According to this theory, values guide the decision making process and are explained throughout the definition of objectives. In this context, Keeney (1992, p. 1, our translation) defines values as being "what we care about" and defines objective as "a statement of something that one desires to achieve." (KEENEY, 1992, p. 34, our translation).

In general, VFT predicts that, after the set of the appropriate objectives for a decision-making context is determined, the next step is measuring the degree with which these objectives are met, which is done by defining attributes. Afterwards, weights must be defined for the objectives in order to determine the relative importance of each of them and, finally, it is necessary that there exists a general structure to integrate the various attributes in an appropriate way. This structure, composed of qualitative and quantitative components, is expressed through a hierarchy of objectives we call value model[1] (KEENEY, 1992).

Thus, the VFT theory provided the theoretical basis for choosing the techniques that were utilized in order to construct the hierarchy of objectives, to define the attributes and to integrate them.

2.2.1 Qualitative component

The implementation of the VFT theory begins with the identification and definition of the objectives that make up the hierarchy. Parnell (2007) developed a structured technique for qualitative modeling of values called the gold standard. This technique is based on the collection of information from high level documents (policies, strategies, plans or doctrines).

Parnell (2007) also proposes the use of affinity diagrams to help organizing the ideas collected. Through this method, first, the ideas considered fundamental to the definition of the objective under analysis get listed. Then, similar ideas are aggregated into smaller sets.

This aggregation of ideas serves as a starting point for the derivation of intermediate objectives, which must be mutually exclusive[2], and collectively exhaustive.[3] This way, in the objective hierarchy, each lower-level objective pertains only to the upper-level objective directly above it.

Finally, it is important to measure the degree of achievement of each objective since, according to Keeney (1992, p. 99, our translation), "the measurement of objetcives clarifies their meaning". This measurement is achieved by means of attributes, which must be defined for each intermediate objetcive. Keeney and Raiffa (1976, p. 64, our translation) emphasize that the process of "articulating objetcives and identifying attributes are basically creative in nature", but, according to Keeney (1992), it is important to make sure that attributes are not ambiguous, so that they clearly contribute to the measurement of achievement of objetcives, thus facilitating the next step; the construction of the quantitative part of the model.

2.2.2 Quantitative component

Once the hierarchy of objetcives has been constructed and all attributes have been defined, the measures need to be integrated. Keeney (1992) explains that the structure for integrating the different attributes is constructed using a value model (also known as objetcive function). By means of this model, the value measures (V) obtained for each attribute (A) are multiplied by the importance weights (P) assigned to each intermediate objetcive. Then, these weighted value measures (VP) are integrated to obtain the total value (VT) and measure the degree of compliance with the overall objetcive of the model.

[1] A model is an abstract or conceptual representation constructed to "lend some insight into a complex situation to complement intuitive thinking." (KEENEY, 1992, p. 130, our translation).

[2] Objetcives derived from the same top-level objetcive should not be redundant.

[3] Intermediate objetcives should fully define the higher level objetcive from which they are derived.

An important step in the construction of this model is to determine the relative importance of the objetcives through the definition of weights. The swing weights technique is one of the most common and "can be used in virtually any weight-assessment situation." (CLEMEN; REILLY, 2004, p. 615, our translation).

The final objetcive function, related to the highest level objetcive, is subdivided into parts and later integrated through formal models to find the final results. The Multi Attribute Utility Theory (MAUT), described by Keeney and Raiffa (1976), addresses the measurement of the objetcive function in such situations.

The methodology for defining intermediate objetcives utilizes the premise of mutual exclusivity and exhaustive collectivity. This structure indicates the use of an additive value model whereby the weighted values (VP) are summed to obtain the total value index (VT), which can vary within a scale of zero to one. In this paper work, the VT expresses the degree of fulfillment of the strategic objetcive of the END, which will be so better the higher the VT.

2.3 Content analysis

In order to achieve the objective of this research it was necessary to collect and structure data from the text of the PESE. One way to begin structuring the content of written material in order to analyze it is to summarize and list the main subjects it contains, and then identifying how often these issues occur. The techniques of content analysis are appropriate for this purpose and can be applied to assess whether a given government program is consistent with the legislative documents that generated it (UNITED STATES OF AMERICA, 1996).

Bardin (2011) explains that the content analysis is a set of communication analysis techniques organized in three phases: the pre-analysis, the exploitation of the material and the treatment of the results obtained. The pre-analysis involves the choice of the documents and the elaboration of the indicators that will base the final interpretation. Exploitation of the material involves coding processes in which

> [...] raw data is processed systematically and aggregated into units, which allow an accurate description of the characteristics relevant to the content. (HOLSTI, 1969 apud BARDIN, 2011, p. 133).

The treatment of results aims to transform the raw data into meaningful and valid data.

Still, according to Bardin (2011), the organization of codification involves the choice of registration units, the choice of enumeration rules and the choice of categories (classification and aggregation).

The record units can be defined as units of coded meaning that correspond to "the content segment considered as the base unit, aiming at categorization and frequency counting." (BARDIN, 2011, p. 134). According to Weber (1990), the most used registration units are the word, the word meaning, the phrase, the theme, the paragraph and the text.

As for the enumeration rules, frequency measurement "is usually the most used." (BARDIN, 2011, p. 138). The simple frequency measure relies on the assumption that the appearance of an item will be the more significant as the frequency repeats itself.

In turn, the categories provide the structure under which the log units are grouped. For Bardin (2011, p. 147), they are "classes, which bring together a group of elements [...] under a generic title, grouping made due to the common characteristics of these elements." In addition, the categories should be exhaustive, mutually exclusive and independent.

In short, the "essence of content analysis is coding, which provides a bridge from words to numbers." (UNITED STATES OF AMERICA, 1996, p. 43, our translation).

3 METHODOLOGY

The overall strategy of this work was based on a documentary research that sought to collect data referring to the content of the PESE and END, in order to analyze the relationship between these legislations. In addition, a bibliographic research was used to examine the publications related to strategic planning, VFT and content analysis, in order to establish the theoretical basis for this work.

Based on the strategic planning process proposed by Bryson (2011), focused specifically on governmental organizations, it was possible to relate the theory to the objetcive of this research. In addition, it was possible to highlight the importance of implementation programs to fulfill the strategic objetcives that generated them. Kaplan and Norton (2001) corroborate this idea and complement the theoretical support, since they emphasize the importance of aligning the efforts in pursuit of the strategic objetcives, which serves as a parameter for measuring the success of a strategy. In addition, renowned authors such as Henry Mintzberg and Peter Drucker were consulted in order to contextualize the subject and ratify important ideas.

The techniques used to reach the objective of this research were based on the VFT theory, in order to construct an express value model through a hierarchy of objetcives, as explained by Keeney (1992). The VFT was chosen because it is based on the principle that values,

expressed through objetcives, should guide any decision making process. Thus, the highest level objetcive of the hierarchy needed to be clearly defined in order to guide the identification of intermediate objetcives. Therefore, in order to understand the meaning of the strategic objetcive of the END, the research sought to establish a clear and unambiguous definition for the concept of **aerial surveillance**.

For this purpose, based on the **gold standard** method, the following documents have been consulted: END, Glossary of the Armed Forces (MD35-G-01) and Glossary of Aeronautics (MCA 10-4). Next, the main ideas related to the term **aerial surveillance** were aggregated in order to generate a clear and coherent definition within the documentation consulted. This definition was used as a starting point for the identification of the intermediate objetcives, which should express the important aspects of the higher level objetcive.

According to the Project Management Institute (PMI), "objetcives are something toward the direction that some work should be oriented" (what to do) and guidelines are "standards or procedures of how something should be done" (how to do) (PROJECT MANAGEMENT INSTITUTE, 2013, p. 539). In addition, END (BRASIL, 2013, p. 19) states that one of the specific guidelines for the FAB is "the integration of space activities into Air Force operations". In order to identify the main aspects that contribute to the achievement of the strategic objetcive under study, the following sections of the END were analyzed: the 25 (twenty five) general guidelines, the description of the strategic objetcive, the three (3) specific guidelines for the FAB and aspects related to the strategic space sector.

Then, affinity diagrams were constructed to aid in the identification of intermediate objetcives, which should be mutually exclusive and collectively exhaustive. The related ideas, collected from END, were grouped into general themes that guided the writing of intermediate objetcives.

The next step was identifying the contribution of the PESE to the fulfillment of each of the intermediate objetcives, in order to later integrate such measures. The attributes have been defined as the Relative Frequency (FR) of each category of PESE content analysis. The FR is expressed by the quotient between the absolute frequency of the variable and the total number of observations, expressed as a percentage.

In order to collect the measures of each attribute, it was necessary to apply the techniques of content analysis to the text of the PESE, and the work of the French psychologist Laurence Bardin provided the main theoretical basis for this step (BARDIN, 2011). Since the text "Is the part of the publication in which the subject is exposed." (BRASIL, 2014, p. 17), the other elements of the document structure have not been made part of the analysis. Within the text body, only chapters 1 (preliminary provisions) and 2 (program description) have been analyzed. Chapters 3 (concepts, acronyms and abbreviations) and 4 (final provisions) have not been analyzed because they addressed aspects common to all normative documents of the FAB.

Each of the intermediate objetcives has led to the derivation of a content analysis category, which, as well as such objetcives, must also be mutually exclusive and collectively exhaustive. Afterwards, based on the ideas gathered in the affinity diagrams, definitions were elaborated to clarify the meaning of the categories.

Before defining the registry units, a preliminary reading of the PESE was done, as recommended by Bardin (2011). It has been observed that one of the characteristics of the document is the existence of several long paragraphs, which approach different ideas. Thus, the registration units were defined as the phrase, as suggested by Weber (1990). Codification of the PESE text was done using the QDA Miner Lite software and, once completed, it was possible to measure the FR related to each of the categories in order to identify the contribution of the PESE to the fulfillment of each intermediate objetcive.

The aggregation of the values has been done through an additive objective function, according to the MAUT principles, and the Logical Decision for Windows (LDW) software aided in this task. The importance weights of each intermediate objetcive have been obtained using the swing weights technique proposed by Clemen and Reilly (2004). After the aggregation of the values, it was possible to establish a degree of contribution of the PESE to the fulfillment of the strategic objetcive of the END.

Next, the analysis has been achieved considering the fact that the PESE establishes a strategy of long term implantation of space systems, linked to the END. The approval of the PESE in 2012 represented the initial step in this process; therefore, the greater the alignment of its content with the strategic objetcive of the END, the greater its influence will come to be in order to achieve this objetcive. Based on this premise, it was possible to highlight the aspects of the PESE that contribute most to the accomplishment of the strategic objetcive of END.

Finally, it is important to note that the definition of importance weights of each intermediate objetcive was carried out with the help of two SAE-PR representatives and four MD[4] representatives, responsible for issues

[4] The representatives of the MD are from the Policy and Strategy Sub-forum (SCPE). The SAE-PR representatives are members of the Office of the Minister (GAB/SAE).

related to END. This can be considered a limitation, since the ideal case would be for this process to be done with the participation of the Ministers of State, both Defense and SAE-PR, who were not available. In addition, this research work relied on a single encoder to perform content analysis in the PESE text. This may be considered a further limitation because of the impossibility of applying statistical procedures for validating the results.

4 DATA PRESENTATION AND ANALYSIS

In order to establish the relationship between the variables of the research and to reach the proposed objetcive, we utilized data formed by both a qualitative component and a quantitative component. The qualitative portion consists of the affinity diagrams, the hierarchy of objetcives, and the content analysis categories. The quantitative component is composed of the data collected throughout the content analysis and also by the degrees of contribution of the PESE to the fulfillment of the objetcives of the hierarchy, obtained according to the principles of the VFT and MAUT.

For the construction of the hierarchy of objetcives a top-down approach was applied, therefore the objetcive of the highest level of the value model needed to be clearly defined in order to guide the specification of the intermediate objetcives. Although a literal definition of the concept of **aerial surveillance** does not appear in the **gold standard** documents consulted, the method proposed by Parnell (2007) has been used to derive the following definition, applicable for the purposes of this research: airspace control and surveillance capacity, of territory and of the Brazilian jurisdictional waters, from space, using systems under national control.

Then, for the purpose of constructing the value model, the strategic objetcive of the END inspired the definition of the highest level objetcive of the hierarchy: maximizing the contribution of the PESE for aerial surveillance. After that, this objective needed to be better specified and clarified, in order to divide it into logical parts and to indicate the set of intermediate objetcives on which the attributes should be defined, according to Keeney (1992).

For this purpose, the definition of **aerial surveillance** has been used as a guide for the creation of the affinity diagrams, in order to identify the intermediate objetcives. The results were expressed through a set of 5 (five) mutually exclusive and collectively exhaustive groups, to which names have been assigned according to the nature of the ideas contained therein (Charts 1 to 5).

Chart 1 - END expressions organized through affinity diagrams.

Monitoring
Surveillance from airspace
Monitoring and controlling airspace
Monitoring and controlling territory
Monitoring and controlling jurisdictional waters
Monitoring and controlling of the Amazon Region
Viewing the own country
Monitoring from space
Expand search and rescue
View layers
Monitoring satellites
Remote sensing

Source: The author.

Chart 2 - END expressions organized through affinity diagrams.

Industry
Technologies under national ownership
Strengthening space sector
Not relying on foreign technology
Enabling domestic industry
Developing technologies
Seeking partnerships with other countries
Binational experiments
Developing national technology training
Manufacturing national defense products
Own platforms and systems
Dual employment

Source: The author.

Chart 3 - END expressions organized through affinity diagrams.

Networking
Networking at the FAB
Networking with the Singular Forces
Communications from space
Geostationary Satellites
Communication Equipment
GPS Signal Independence
Command and control in the Amazon Region
Communications Satellites
Communications from satellites
Command and Control from satellites
Networking with land forces
Networking with sea forces
Geographical coordinates by satellites

Source: The author.

Chart 4 - END expressions organized through affinity diagrams.

Access
Launch vehicles
Designing satellite launch vehicles
Manufacturing satellite launch vehicles
Remote Guidance Technologies
Inertial systems
Liquid propulsion technologies

Source: The author.

Chart 5 - END expressions organized through affinity diagrams.

SISDABRA[5]
SISDABRA will dispose of a monitoring complex
Integrating means of spatial monitoring
Integrating space activities into FAB operations
COMDABRA as Core of aerospace defense
COMDABRA leads integration of space media

Source: The author.

Next, the intermediate objetcives have been defined based on the ideas identified in the affinity diagrams, in order to specify important aspects for the accomplishment of the strategic objetcive of the END. These five intermediate objetcives have been drawn up as shown in Chart 6.

Chart 6 - Objetcive hierarchy.

Overall objetcive of the model
1. maximizing the contribution of the PESE to aerial surveillance.
Intermediate objetcives
1.1 maximizing the PESE contribution to monitoring and control of areas of interest from space.
1.2 maximizing the PESE contribution to network operation between the FA.
1.3 maximizing the PESE contribution to obtaining access to space.
1.4 maximizing the PESE contribution to integration of space activities into SISDABRA.
1.5. maximizing the PESE contribution for the strengthening of space industry.

Source: The author.

The identification of the objetcives that make up the hierarchy have completed the construction of the qualitative portion of the model. In order to build the quantitative portion it was necessary to fill in the attributes with the data resulting from the content analysis. That way, the intermediate objetcives served as a starting point for the definition of the established content analysis categories: access, Brazilian Aerospace Defense System (SISDABRA), monitoring, industry and network.

It was then necessary clarifying the meaning of each of the categories in order to guide the codification process of the PESE text. The definitions of the categories have been deduced from the affinity diagrams and are shown in Chart 7. The category **others** have been included so that the themes not related to this research could also be classified and quantified.

Chart 7 - Categories used for content analysis and their respective definitions.

Category Access
Designing and manufacturing satellite launch vehicles. National domain of associated technologies.
Category SISDABRA
Integration of space activities with FAB operations, under the leadership of SISDABRA. Strengthening of the Brazilian Aerospace Defense Command (COMDABRA).
Category Monitoring
Monitoring and control of Brazilian airspace, territory and jurisdictional waters using ground systems, earth observation satellites and environmental monitoring, under the national domain.
Category Industry
Areas of critical technologies required for the development of space systems, training of human resources and expansion of partnerships with other countries, as well as market for space products and services.
Category Networking
Usage of satellite communications links and satellite geographical coordinates systems, under national ownership, favoring networking among the Armed Forces.
Category Others
Themes not related to intermediate objetcives.

Source: The author.

Each analyzed sentence has been classified according to its meaning in one of the categories, as shown in Chart 8. The final results of the codification of the PESE text have been represented in terms of FR of each category, according to Table 1.

[5] The Brazilian Aerospace Defense System (SISDABRA) has as its central organ the Brazilian Aerospace Defense Command (COMDABRA). Its mission is ensuring the sovereignty of the Brazilian airspace both in times of peace and conflict (Brasil, 2013).

Chart 8 - Examples of PESE coding using content analysis.

Category Industry
"In order to obtain a favorable and sustainable industrialen v ironmentfrom the point of view of increasing a utonomyand independence, PESE contemplates activities that lead to annualla unches of space systems." (BRASIL, 2012b, p. 9).
Category Monitoring
"Space monitoring will be an integral part and indispensable condition for accomplishing the strategic tasks that will guide the Air Force, namely: multiple cumulative e (and) surveillance, local air superiority and fire focused on the context of join operations." (BRASIL, 2012b, p. 8).
Category SISDABRA
"The strategic guidelines established by END represent much more than a task, since they consist of an opportunity for transformation of the Aeronautics, when determining the integration of the space activities in the operations of the Air Force." (BRASIL, 2012b, p. 8).

Source: The author.

Table 1 - Results of content analysis.

Coding categories expressed in terms of Relative Frequency (FR) (%)					
Industry	Monitoring	Networking	SISDABRA	Access	Others
36.6	28.3	15.1	2.0	1.0	17.0

Source: The author.

From these data on, it has been possible to fill in the attributes in order to measure the contribution of the PESE for the accomplishment of the intermediate objetcives. The upper limits of each attribute have been defined based on the weight in importance of each intermediate objetcive, according to Chart 9.

For example, a weight of 19.1% was assigned to the SISDABRA category. Thus, an upper limit of 19.1% was established for the FR of the SISDABRA[6] attribute on the premise that, ideally, the importance the content of the PESE should attribute to that category is similar to that attributed by SAE-PR members and the MD to its intermediate objetcive. Any measurement of FR above 19.1% would result in a maximum score for this attribute (V=1.000). In this particular example, the measurement of FR SISDABRA resulted in a FR of 2.0% with consequent Value of 0.105. The other attributes have been constructed using the same logic. Graph 1 shows attributes constructed for the intermediate objetcive 1.4 and Chart 9 details the final results of the aggregation of the attributes.

The results of the codification of the PESE text showed that the Industry and Monitoring categories obtained FR above the upper limit of the attribute and thus reached the maximum score (V=1.000) in terms of contributing to the achievement of the respective intermediate objetcives.

The high FR of the Industry category can be interpreted as evidence of the great emphasis that PESE gives to the aspects related to the strengthening of the national space industry. A considerable portion of the document intends to describe processes aimed at generating a constant demand for space systems and related services.

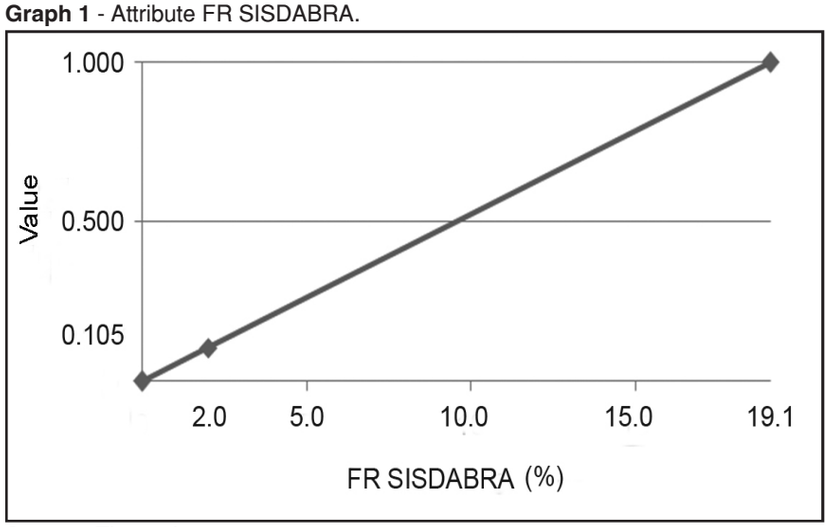
Chart 9 - Detailing of the integrated data through the Multiple Attribute Theory.

Category	Measurement FR (%)	Value of Attribute (V)	Weight (P) (%)	Weighted value (VxP) /100 (VP)
Industry	36.6	1.000	16.8	0.168
Monitoring	28.3	1.000	21.8	0.218
Networking	15.1	0.868	17.4	0.151
SISDABRA	2.0	0.105	19.1	0.020
Access	1.0	0.040	24.9	0.010
Others	17.0	N/A	N/A	N/A
Total value (VT – index of accomplishment of the strategic objetcive)				0.567

Source: The author.

[6] The lower limit of the measure of all attributes is zero.

Graph 1 - Attribute FR SISDABRA.



Source: The author.

According to the PESE strategy, such demand can be established through the use of low-cost space systems, smaller in size and with reduced life-cycle. In addition, the PESE stresses the importance of investing in personnel training and seeking partnerships with other countries, aiming at technology transfer, in order to gradually increase the degree of technological autonomy of the national industry.

The FR of the Monitoring category, although inferior to the FR of the Industry category, also resulted in a maximum score (V=1.000) for the attribute of the corresponding intermediate objetcive. This high FR is a reflection of the prominence that the PESE gives to the space systems with capacity to monitor the air space and the surface areas of the interest of Brazil. The program provides constellations of satellites for optical remote sensing, radar remote sensing, meteorological monitoring and space monitoring systems.

The FR of the Network category evidenced the high degree of contribution of the PESE to the fulfillment of the respective intermediate objetcive (V=0.868). The aspects related mainly to the use of communications satellites are emphasized in the PESE as being fundamental to the command and control processes and network operation between the FA.

On the other hand, the FR of the Access and SISDABRA categories were quite low. This indicates that the PESE gives little emphasis to these subjects, contributing very little to the fulfillment of the respective intermediate objetcives (V=0.040 and V=0.105 respectively). The FR of the Others category has been interpreted as being adequate since issues not related to intermediate objetcives are addressed only to grant greater clarity to the document.

The integration of the FR by means of the additive objetcive function, based on the concepts of VFT and MAUT, generated a value VT=0.567, on a scale ranging from zero to one. As discussed in Chapter 2, the degree of achievement of the strategic objetcives expresses the measure of success of a strategy. Thus, in light of the principles of strategic planning, it can be inferred that the index of 0.567 expresses the degree of contribution of the PESE to the fulfillment of the strategic objetcive, the **priority of aerial surveillance**, established for the FAB in the END.

Throughout this research, it was to identify aspects related to the strategic objetcive of the END that is not predicted to be implemented by the PESE, since the document contributes very little to the intermediate objetcives related to the integration of space activities to the operations of the FAB, through SISDABRA, and to gain access to space. This highlights the need to address such issues in future revisions of the PESE, or even to prepare specific documents that complement it, aiming to meet intermediate objetcives that have achieved poor performance.

Therefore, we conclude that the main influence of the PESE for the accomplishment of the strategic objetcive of the END comes from aspects related to the strengthening of the national industry, the monitoring of the areas of interest and the network operation among the FA. The measure of this influence is expressed by the value index VT=0.567, resulting from the aggregation of the attributes.

Finally, the results of this research corroborate aspects of the principles of strategic planning, which emphasize the importance of verifying, through systematic processes, the alignment of an organization's programs with the highest strategic objetcives. Possible misalignments hinder the achievement of objetcives and the efficient use of financial, material and human resources.

5 CONCLUSION

The END established three strategic sectors, one of them being the space sector, which was in charge of the FAB. In this way, due to the conclusions of the Strategic Space Sector GT, PESE was created, complementary to the PNAE, in order to establish the strategy for the implementation of dual-use space systems.

In such context, this research had as objective analyzing to what extent the PESE influences the fulfillment of the strategic objetcive within the **priority of aerial surveillance**, established for the FAB in the END. In order to achieve it, the theoretical fundamentals have been based mainly on the principles of strategic planning, which emphasize the importance of aligning the plans of an organization with the strategic objetcives that generated them. The VFT theory and the techniques of the content analysis provided support for data collection, structuring and aggregation.

Initially, a clear and unambiguous definition has been established for the term **aerial surveillance**. Afterwards, it was possible to start the construction exercise of the affinity diagrams from the text of the END. Such diagrams allowed the identification of 5 (five) related areas, which motivated the definition of the respective intermediate objetcives. These objetcives comprised a hierarchy designed to highlight the main contributory aspects to the fulfillment of the strategic objetcive of END.

Then, attributes capable of measuring the degree of fulfillment of each intermediate objetcive were constructed. The attributes have been defined as the FR of each category of content analysis. In order to obtain such data, it was necessary applying the techniques of content analysis to the text of the PESE, and the categories were derived from the intermediate objetcives. The information collected was used to fill in the respective attributes and the results for each intermediate objetcive were integrated through MAUT in order to obtain a single index.

By analyzing the data, it was observed that the PESE contributes strongly to the accomplishment of the intermediate objetcives related to the strengthening of the national industry, the monitoring of the areas of interest and the network operation among the FA. On the other hand, PESE contributes very little to the intermediate objetcives related to the integration of space activities into FAB operations, through SISDABRA, and the means for access to space.

Thus, after the analysis, it was possible to achieve the general objetcive of this research. The measure of the influence of the PESE to the fulfillment of the strategic objetcive of the END was expressed by means of the value index VT=0.567, in a scale ranging from zero to one.

By collaborating in the identification and prioritization of the necessary capacities to reach the strategic objetcive of END, this research contributes to the improvement of the PESE, aiming to optimize the application of the resources destined to the Program, in line with the END.

The limitations of this work refer to the verification of the weights of the intermediate objetcives, carried out with advisors of the Ministers of State, and to the codification of the text of the PESE, carried out by only one author. As a result, it is advisable that a subsequent investigation should conduct interviews with the Ministers of Defense and SAE-PR in order to refine the definition of weights. In addition, as the PESE is being implemented, it is suggested that further research be carried out focused on the implementation of the Program.

Finally, the results of this research corroborate the principles of strategic planning, which emphasize the importance of verifying, through systematic processes, the alignment of an organization's programs with the highest strategic objetcives. This enables the refinement of planning, contributes to the success of the strategy and to the efficient use of resources.

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