

# The preparation of Air Force Infantry troops for Guarantee Of Law And Order (GLO) operations: a perspective on material resources

*La preparación de la tropa de Infantería de la Aeronáutica en el uso de las Operaciones de GLO: una perspectiva desde los recursos materiales*

**Abstract:** This article analyzes the impact of the supply chain on the preparation and deployment of Air Force Infantry troops in Law and Order Assurance (GLO – *Garantia de Lei e Ordem*) operations. The methodology combined bibliographic, documentary, and field research, focusing on specific regulations of the Brazilian Air Force (FAB) and the Army, in order to establish a comparative baseline for the materials prescribed in official manuals and used in such operations. The lack of critical equipment was found to impact both the preparation and deployment of troops. An analysis of the legislation and official documents revealed that only 21% of the necessary items are systematically provided, which forces units to make decentralized acquisitions. Applying the Theory of Constraints, FAB's supply chain was identified as the main limitation. The study concludes that efficient management of material resources is essential for the readiness and efficiency of units, and that improvements in the supply chain are necessary to ensure the success of future operations.

**Keywords:** Operational Preparation, Guarantee of Law and Order Operations, Qualitative Method, Supply Chain, Theory of Constraints.

**Resumen:** Este artículo analizó el impacto de la cadena de suministro en la preparación y el uso de la tropa de infantería de la Aeronáutica en las Operaciones de Garantía de la Ley y el Orden. Se realizó una investigación bibliográfica, documental y de campo con foco en las regulaciones específicas de la Fuerza Aérea Brasileña (FAB) y del Ejército, con el fin de establecer inicialmente un estándar comparativo con los materiales dispuestos en el manual y utilizados en este tipo de operaciones. La falta de equipo crítico demostró afectar la preparación y el uso de las tropas. El análisis de las normativas y los documentos oficiales reveló que solo el 21% de los ítems necesarios se proporcionan de forma sistémica, lo que lleva a las unidades a realizar adquisiciones descentralizadas. Al aplicar la teoría de las restricciones, se identificó la cadena de suministro de la FAB como la principal limitación. Se concluyó que la gestión eficiente de los recursos materiales es esencial para la preparación y eficiencia de las unidades, lo cual requiere mejorar la cadena de suministro para asegurar el éxito de las operaciones futuras.

**Palabras clave:** Preparación Operativa, Operaciones de Garantía de la Ley y el Orden, Método Cualitativo, Cadena de Suministro, Teoría de las Restricciones.

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## 1 INTRODUCTION

The study of the history of warfare provides us with great lessons that contribute to the development of new techniques and procedures in future conflicts. Thus, using as an example one of the most emblematic and decisive battles of the World War II—the Siege of Stalingrad (1942-1943)—we can see how the critical role of individual equipment and uniforms was decisive for the outcome of the confrontation.

In the grueling conditions of urban warfare that characterized the battle, the Red Army soldiers faced extreme challenges. As winter arrived, with temperatures plummeting and the city reduced to ruins, the Soviet forces found themselves in desperate need of adequate clothing and equipment.

An excerpt from *Stalingrad: the fateful siege: 1942-1943* (Beevor, 1998, p. 174) illustrates the adverse circumstances and the crucial role played by equipment:

For front-line soldiers at Stalingrad, replacement items did not come from the quartermaster's store, they came off the bodies of dead comrades. Nothing was wasted when it came to burial. Men were even sent forward at night into no man's land to strip corpses to their underclothes. The sight of fallen comrades, left half-naked in the open, revolted many. When winter came in its full force, snow-camouflage suits became especially precious. A wounded soldier would try to take off the White coverall before it became bloodstained.

This passage underlines how the supply of material for individual use, in the right quantity and quality and at the right time, plays a significant role in the course of a military campaign. In this sense, a parallel is drawn with Law and Order Assurance operations (GLO – *Garantia de Lei e Ordem*), insofar as the circumstances in which they are carried out require specific skills for the troops on the ground to perform the tasks assigned to them.

Currently, we can see that Brazil's troubled social scenario creates fertile ground for the escalation of violence, with urban centers being the epicenter of this problem. The presence of criminal organizations in the country's main capitals confronts the power of the state, imposing challenges to guarantee the protection of the population and preserve public order.

The 1988 Federal Constitution, specifically Art. 144, lists the bodies responsible for ensuring public order and the safety of people and property. However, Art. 142 states that the Armed Forces (FA) “are intended for the defense of the Country, for the guarantee of the constitutional powers, and, on the initiative of any of these, of law and order” (Brasil, 1988, p. 120, our translation).

However, as can be seen, the Federal Constitution was still silent on disciplining the use of the military apparatus, as can be seen in Paragraph 1 of Art. 142. Complementary Law no. 97 of June 9, 1999 was therefore drafted at the infra-constitutional level as a way of regulating the deployment of military forces in GLO Operations. And in its Article 15, we find the support required for the deployment of the Armed Forces in matters concerning the maintenance of law and order:

Art.15. The use of the Armed Forces in the defense of the Nation and in the safeguarding of the constitutional powers, law and order, and participation in peacekeeping operations is the responsibility of the President of the Republic, who shall direct the Minister of State for Defense to activate operational bodies, in accordance with the following chain of command:

Paragraph 1. It is the responsibility of the President of the Republic to decide on the deployment of the Armed Forces, either on his or her own initiative or in response to a request made by any of the constitutional powers, through the Presidents of the Federal Supreme Court, the Federal Senate, or the Chamber of Deputies.

Paragraph 2. The engagement of the Armed Forces in the maintenance of law and order, upon the initiative of any of the constitutional powers, shall take place in accordance with the guidelines established by an act of the President of the Republic, after all instruments aimed at preserving public order and the safety of persons and property, as provided in Article 144 of the Federal Constitution, have been exhausted. (Brasil, 1999, our translation).

It is in this context that the FA, as an exception, must act: as a police force, in order to guarantee public order. One of the main characteristics of this operation is its “non-war” character, since, although military power is used, the use of force is the exception, and even then, in a limited way.

For a better understanding, according to the Ministry of Defense’s MD33-M-10 manual (Brasil, 2013, p. 14-15, our translation), Law and Order Assurance Operations are defined as:

A military operation determined by the President of the Republic and conducted by the Armed Forces in an episodic manner, in a previously established area and for a limited time, with the aim of preserving public order and the safety of people and property in situations where the instruments provided for in Art. 144 of the Constitution have been exhausted or in other situations where it is presumed that order may be disturbed.

The issue is so relevant that, according to a survey carried out in 2022 by the Ministry of Defense, 145 operations of this nature were carried out from 1992 to 2021. This figure reveals the recurrence of this type of mission and, consequently, the need for the Armed Forces to be constantly prepared.

The last decade has been marked by a number of GLO operations, including some of great national importance: the federal intervention in Rio de Janeiro during the Olympic Games in 2016; Operation Capixaba in 2017, due to the police strike in the state of Espírito Santo; and Operation Furacão in the city of Rio de Janeiro in 2018. In all of these operations, military personnel belonging to the Air Force Infantry Troop (INFAER) participated directly.

According to DCA 125-5 (Brasil, 2019b)—Concept of Employment of the Air Force Infantry—the Air Force Infantry operates as a ground force and has as its main mission to ensure

the protection of facilities, personnel, and materiel under its responsibility, with the purpose of maintaining the Air Force's combat power.

It is important to emphasize that the same legislation affirms that “the Air Force Infantry troops, by virtue of their organization, equipment and training, are **capable** of being deployed in the constitutional mission of Law and Order Assurance (GLO)” (Brasil, 2019b, p. 10, our translation).

Taliaferro *et al.* (2019) argue that **capability** is directly related to the property of completing a task or producing an effect, considering the following aspects: doctrine, organization, training, equipment, leadership, personnel, and facilities. The interconnection of these elements not only defines what capability is, but also underlines the importance of preparedness in all its dimensions.

It is important to note that capability evolves in response to technological advances, changes in the operational environment and lessons learned from previous operations, giving importance to continuous preparedness.

Thus, preparedness can be seen as the foundation upon which military capability is built and enhanced, functioning as an integrative element that ensures the Forces' readiness to face the demands of a complex operational environment.

According to the FAB's perspective, preparedness is defined in DCA 55-40 (Brasil, 2019c)—*Adjudicação de Meios de Preparo e Emprego* (Allocation of Readiness and Operational Means)—as a cyclical capacity-building process that encompasses the equipping of Air Units, doctrine development, personnel training, and crew instruction. In a narrower sense, preparedness is directly connected to the provision of materiel and equipment intended for training and operational use (Brasil, 2019).

Therefore, analyzing the supply chain for the training and operational-use materiel of the INFAER, particularly in the context of Law and Order Assurance (GLO) operations, becomes imperative in order to identify potential obstacles.

Based on the National Defense Policy, a document of the highest political-strategic level, one of the national defense objectives is to ensure defense capability to fulfill the constitutional missions of the Armed Forces. To this end, it is necessary to equip the Armed Forces with modern technology and an adequate amount of equipment (Brasil, 2024).

Given this concern, the following research problem was formulated: What is the impact of the supply chain on the preparedness and deployment of Air Force Infantry troops in Law and Order Assurance Operations?

Therefore, the general objective of the research was to analyze, in the light of the Theory of Constraints, the impact of the supply chain on the preparedness and deployment of Air Force Infantry troops in GLO Operations, specifically in the 2016 Olympics, in Operation Capixaba in 2017, and in Operation Furacão in 2018.

The relevance of this study for the preparedness of the Air Force Infantry and, consequently, for the FAB lies in identifying bottlenecks and proposing opportunities for improvement in the supply chain, not least because, according to Rahman (2007, *apud* Sikilero *et al.*, 2014), little attention has been paid to applying the precepts of the Theory of Constraints to the supply chain (SC). The aim is therefore to optimize the preparedness and deployment of troops, contributing to more efficient action in crisis scenarios, reflecting the country's security and stability.

## 2 METHODOLOGY

Initially, it is important to emphasize that the conclusions of this study are directly applicable to the Air Force Command (COMAER), considering the existing gaps in the supply chain that meets the needs of the Air Force Infantry, especially with regard to specific equipment for GLO Operations, directly affecting the preparedness of the troops.

As such, this material can be understood as applied research, as categorized by Gil (2022), since it aims to solve specific problems faced by the Brazilian Air Force.

With regard to the objective outlined, this study falls predominantly within the exploratory field, given that its main intention is to provide a deeper understanding of the problem of supplying materials for the preparedness of the Air Force Infantry. This approach aims to uncover new dimensions and provide new insights.

In terms of procedures, the article required bibliographical research using books, articles, and dissertations. In addition, documentary research was used, drawing on legislation and information provided by the Preparedness Command (COMPREP) and the Brazilian Army (EB), as well as field research, with interviews conducted with previously selected experts whose profiles matched the objectives proposed by the research.

As for its nature, as highlighted by Gil (2022), this research is predominantly qualitative, since the main objective is to explore the phenomenon under study in depth, seeking to understand the meanings attributed by the participants, although some quantitative data was used to complement the analysis, enabling a more detailed interpretation of the results.

Therefore, in order to achieve the aim of this research, the methods used to collect data included: a) formal consultation with COMPREP, an organization dedicated to training activities for all Air Force operational units, as well as overseeing the current equipment of the Security and Defense Units (USEGDEF); b) analysis of TCA 125-1 (Brasil, 2021a), a standard that provides exhaustive guidance on the minimum amount of equipment for each type of mission assigned to INFAER troops; c) analysis of the Brazilian Army manuals EB70-CI-11.404 (*Caderno de instrução de aprestamento e apronto operacional*) (Brasil, 2014) and EB70-MC-10.359 (*Batalhão de suprimento*) (Brasil, 2020d) in order to establish a gold standard for comparing the equipment and materials that should be used in GLO Operations; d) analysis of the legislation that guides the provision of materials and equipment (TCA 168-2) (Brasil, 2020a) free of charge for the entire FAB; and e) analysis of the FAB's legislation on training and preparedness.

In addition to the methodological approach described above and as a way of complementing the analysis, field research was conducted using the descriptive interview technique in order to seek validation of the data collected by the specialists employed in the GLO operations analyzed.

Interviews were conducted with military personnel who took part in GLO operations, including the Olympic Games in 2016, Operation Capixaba in 2017 in the state of Espírito Santo, and Operation Furacão in the city of Rio de Janeiro in 2018. The aim was to extract from these specialists their perceptions of the equipment used and its influence on the operation.

It is worth noting that this interviewee profile was chosen because, according to Marconi and Lakatos (2003), in qualitative research, samples are intentional and non-random, i.e., individuals are selected based on characteristics that are considered relevant to the research objectives.

In this sense, experience and participation in GLO operations with major national repercussions were the characteristics taken into account when choosing the interview participants, ensuring that the information obtained was rich and detailed, enabling an understanding of the research problem.

The interview script was designed to identify, from the perspective of members of different GLO operations, whether material resources influenced these operations. Each question addressed to the interviewees was assigned an objective aligned with the research context.

In order to achieve the objectives of this research, various sources of data and methods of analysis were used. In this sense, Table 1 below summarizes these sources and justifies their use, detailing how each one contributed to understanding the aspects investigated regarding the preparedness of Air Force Infantry troops in the context of GLO operations, from a material resources perspective.

**Table 1 - Data collection**

Subject	Source	Justification
<b>Capability/Preparedness</b>	DCA 55-40 / PND / NOSDE CAP 302	Identify the understanding of capability and preparedness from the perspective of the guiding legislation
<b>FAB supply chain analysis</b>	TCA 125-1 TCA 168-2	Verify the items provided by the supply chain and those required by the Preparedness Command
<b>Brazilian Army (EB) troop equipment</b>	EB70-CI-11.404 EB70-CI-11.404	Identify the equipment used by EB troops in GLO Operations
<b>Theory of Constraints</b>	SISCOMAT	Verify that the existing equipment in the USEGDEF is in line with the quantity required by the Preparedness Command
<b>Preparedness and deployment material</b>	Interviews	Identify, from the perspective of material resources, the perception of military personnel who have participated in GLO Operations

**Source:** Prepared by the authors, 2024.

In order to provide a better visualization of the general objective of the study and the paths taken to achieve the specific objectives, Table 2 below has been developed.

In addition, graphs and other tables with clear formatting were developed to facilitate the presentation of the data collected.

**Table 2 - General and specific objectives and methodological procedures**

<b>General objective: To analyze the impact of the supply chain on the preparedness and deployment of Air Force Infantry troops in Law and Order Operations.</b>		
<b>Specific objective</b>	<b>Procedure</b>	<b>Sources</b>
<b>SO1 - Identify the equipment used by INFAER in GLO Operations</b>	Documentary research	TCA 125-1, EB70-CI-11.404, and EB70-MC-10.359
<b>SO2 - Identify how INFAER supplies material for preparedness and deployment</b>	Documentary research	TCA 168-2, TCA 125-1, and SISCOMAT
<b>SO3 - Examine how INFAER troops are prepared</b>	Documentary research	NOSDE CAP 302
<b>SO4 - Examine the relationship between the supply chain and preparedness of INFAER troops for GLO operations</b>	Documentary research/ Field research	Theory of Constraints

**Source:** Prepared by the authors, 2024.

To begin with, we sought to achieve the first specific objective (SO1), which is to identify the equipment used by INFAER in GLO Operations, making an association between how it is used and the corresponding Air Force Action<sup>1</sup>. Additionally, in order to establish a gold standard for comparison, the materials provided for in the manual and used by the Brazilian Army in these types of operations were brought up.

Next, in order to achieve the second specific objective (SO2), which is to identify how material is supplied for INFAER preparedness and deployment, the specific legislation TCA 168-2 and TCA 125-1 were analyzed, which deal, respectively, with the Free Distribution Table for Quartermaster Materials and the Planning Factors for Infantry Units' Deployment Equipment, and the spreadsheet taken from the Material Control System (SISCOMAT).

In order to examine how Air Force infantry troops are prepared for GLO operations, which corresponds to the third specific objective (SO3), documentary research was carried out by analyzing NOSDE CAP 302 – Ground Operational Preparedness (Brasil, 2019a).

From this point, the research analyzed the impact of the supply chain on the preparedness and deployment of Air Force Infantry troops in Law and Order Operations, using the Theory of Constraints (TOC) as a reference. In addition, a theoretical review was carried out on the following topics: a) logistics; b) supply chain; and c) Theory of Constraints.

Finally, in order to achieve the fourth specific objective (SO4), i.e., to examine the relationship between the supply chain and the preparedness of INFAER troops, we drew on the teachings offered by Taliaferro et al (2019), which emphasize the importance of seeking the necessary capabilities to achieve national objectives, together with the notes drawn from the Theory of Constraints, which focus on identifying the main limiting factor that prevents an organization from achieving its objectives, and which, in this specific study, prevents us from having an Air Force Infantry that is properly trained and ready for operational use.

<sup>1</sup> "Air Force Action: refers to the effects that can be produced with Aerospace Means and Air Force Means and describes specific acts to be carried out at the tactical level to achieve strategic, operational or, primarily, tactical objectives" (Brasil, 2024c, p. 26, our translation).

The choice of Law and Order Assurance Operations is based on the fact that this type of mission is relatively new and of great importance, not only for the FAB but also for society in general, but also because these are the operations in which Brazilian Air Force ground troops have participated.

Finally, with regard to the limitations encountered in performing this study, it should be pointed out that, although considered of paramount importance to the author, materials such as weapons and operational vehicles were not covered by the study due to time constraints. Thus, this work was limited to materials that are supplied free of charge and for individual use by the military, known as quartermaster materials.

### 3 THEORETICAL BACKGROUND

The research was developed to analyze the supply chain and its impact on the preparedness and deployment of Air Force Infantry troops in Law and Order Assurance Operations. To this end, it is important to build an understanding of logistics and the supply chain, as well as TOC, which will provide a basis for analyzing the effectiveness of the supply chain and identifying possible bottlenecks.

To support the study, we used the teachings of authors with extensive knowledge in the areas of logistics and supply chain management, since one of the main factors in preparing troops for use in real operations is the quantity and quality of the equipment used. In a basic analogy, the soldier is the customer waiting for the products offered by the supply chain.

In addition, to make the work more robust, we focused on the Theory of Constraints, whose main goal is to identify the most critical limitations or restrictions that prevent the achievement of objectives.

Once these constraints have been identified, TOC proposes a systematic process to focus efforts on eliminating or optimizing them, thereby improving process flow and increasing operational efficiency.

#### 3.1 Logistics and the supply chain

The term “logistics” has its origins in the military and has been the subject of study by various theorists and strategists. Sun Tzu (1996), in his work *The Art of War*, already recognized logistics as a fundamental precept for success in a campaign, as it was necessary to supply the army on the battlefield.

Antoine-Henri Jomini (1982), another important military strategist of his time, argued that the art of war was divided into strategy, grand tactics, logistics, engineering, and minor tactics. According to him, logistics consists of a detailed planning process and the provision of constant support to campaigns, ensuring that they are meticulously prepared and properly sustained over time, thus guaranteeing their effectiveness and efficiency.

Proença Júnior and Duarte (2005) state that, for Jomini, logistics was the art of moving armies, including the order and details of marches and encampments, as well as



the quartering and supply of troops, and that this should go far beyond the supply of food, but also arms, ammunition, uniforms, and equipment, transposing to a more current view of the concept.

According to Bowersox and Closs (2001), until the 1950s, there was not a more epistemic account of what logistics was. They assert that logistics was treated in a piecemeal fashion, with each logistics function (procurement, storage, transportation, distribution) being addressed separately and considered a business support area.

However, understanding of the subject has evolved significantly since then. And, according to Ballou (2007), logistics can be understood as a comprehensive process involving the planning, implementation, and control of the flow of goods, services, and information from point of origin to point of consumption, with the aim of meeting customer needs efficiently.

One definition of the term “logistics” considers it to be the branch of military science that deals with obtaining, maintaining, and transporting material, personnel, and facilities. As this definition places logistics only in a military context, it does not encompass the essence of business logistics management (Ballou, 2007).

Regrading military logistics, we can look at the definition provided by the *Dicionário de Segurança e Defesa* (2018), which shows us that the term encompasses all war activities that are preconditions or preparatory to confrontation, to combat itself. In addition, it is necessary to consider the performance of these activities so that combat forces are ready for deployment. In other words, here we see the clear relationship between logistics, preparation, and training of combatants for the ultimate goal of war.

Based on Clausewitz, Proença Júnior and Duarte (2005) interpret logistics as preparatory activities for the conduct of war, i.e., logistics would be an essential element and precondition for the conduct of war.

Going further, they divide the logistical activity into three phases, with maintenance being the phase involved in providing the supplies necessary for war efforts and, drawing a parallel with this study, the equipment necessary for the proper training and deployment of troops.

Therefore, understanding the concepts of “logistics” is of great importance to understanding how material resources and operational support directly impact the success of military operations. In addition to this, Kress (2002) analyzes the concept of “military logistics” as “being the inputs (means and resources) of a productive process called a military operation.” For him, logistics is not just about preparing or strictly supplying material, but about the whole process, including planning, managing and dealing with the resources needed for the operation.

A more faithful representation of this concept may be that promulgated by the Council of Supply Chain Management Professionals (CSCMP)<sup>2</sup>, an organization of logistics managers, educators, and professionals in the field, created in 1962 in the United States to encourage the teaching of logistics and the exchange of ideas. For them, “Logistics the process of planning, implementing, and controlling the efficient and cost-effective flow and storage of goods, services,

2 Originally called the Council of Logistics Management (CLM), it was renamed in 2004.

and related information from point of origin to point of consumption, all to meet customer requirements” (Ballou, 2007, p. 27, our translation).

This definition, however, also suggests that logistics is part of a supply chain process, rather than the whole process. Thus, Ballou (2007) explains that the supply chain encompasses all activities related to the flow and transformation of goods, from raw material extraction to the end user, as well as the associated information flows. Moreover, these flows move both vertically (up and down) through the supply chain.

Another important concept that Ballou (2007) clarifies is supply chain management, which is characterized by the strategic and systematic coordination of conventional business functions and strategies, both within a specific company and across the companies forming a supply chain. The goal is to enhance long-term performance for both individual entities and the entire supply chain.

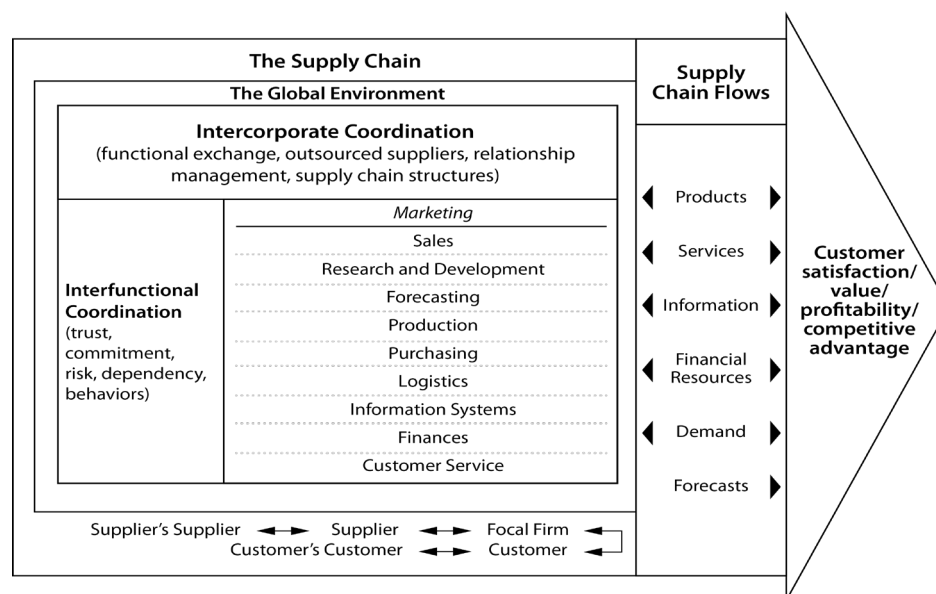
The author also argues that there are other theorists who make no distinction between supply chain management and integrated logistics management. In addition, other scholars consider logistics to be an auxiliary branch of supply chain management.

A company’s ability to manage its supply chain in a strategic and integrated way can result in significant competitive advantages, such as reduced operating costs, improved customer service quality, and the ability to respond quickly to market demands.

For the purposes of a better understanding, this study considered that logistics is part of the supply chain, playing a critical role in the efficiency and effectiveness of processes that range from the transportation and storage of raw materials to the delivery of final products to the consumer (Figure 1).

This integration allows logistics operators and, more specifically, military operators to optimize resources, reduce costs, and improve service to their stakeholders, among them the combatants involved in GLO operations, highlighting logistics as a vital element in the global supply strategy.

**Figure 1 - A model of supply chain management**



**Source:** Mentzer *et al.*, 2001, *apud* Ballou, 2007.

Thus, logistics, when well managed, ensures that the necessary supplies are available at the right time and place, minimizing interruptions and maximizing operational efficiency.

### 3.1.1 Logistics in the FAB

Within the Brazilian Air Force (FAB), the guiding document for logistics actions is DCA 2-1, Aeronautics Logistics Doctrine, which aims to be the doctrinal basis for the development of activities aimed at the applicability, conceptualization, standardization, and planning of Aeronautics Logistics (Brasil, 2022a, p. 7).

According to DCA 2-1, logistics is understood to be an organized system that includes infrastructure, devices, guiding principles, methods, and data; the objective of which is to anticipate and supply human, material, and animal resources, as well as specific services to meet the demands of the institution (Brasil, 2022a).

In the same document, there are various descriptions of terms applied to logistics; however, for the purposes of this study, the concepts of logistics, logistical support, logistical activities, logistical function, and aerospace logistics, as they are understood in the Air Force, are shown in Table 3.

**Table 3 - Conceptualization of logistics in the Air Force**

Term	Description
Logistics	The structure is designed to forecast and provide human, material, and animal resources, as well as services to meet the needs of the Air Force.
Logistical support	It is the set of activities related to the forecasting and provision of resources, of all kinds, aimed at ensuring the satisfaction of needs related to aeronautical material, war material, buildings, infrastructure, air and surface transportation, firefighting, and property, in the appropriate quantity, time, and place.
Logistics activities	It is the set of actions carried out by military organizations relating to the forecasting and provision of resources of all kinds necessary for the use of the Armed Forces, in peace or war.
Logistics function	The grouping together, under a single name, of a set of related, correlated, or similar logistical activities. The logistics functions consist of a grouping of specific activities and tasks, with the aim of meeting the needs of the Air Force, and are subdivided into human resources, health, supply, maintenance, engineering, and transportation.
Aerospace logistics	It is the set of activities related to the forecasting and provision of resources and services of all kinds necessary for the use of Aerospace Power.

**Source:** DCA 2-1 (Brasil, 2022a).

In this context, in the light of DCA 2-1, it can be seen that logistical support is implemented systematically, with logistical functions and activities of the same nature developed by different sectoral management bodies, and logistics must be compatible with the missions assigned to the Force.

Thus, the Air Force's logistics systems are divided into: a) Aeronautical and War Material System (SISMAB); b) Fire Fighting System (SISCON); c) Surface Transportation System (SISTRAN); d) Patrimony System (SISPAT); e) Engineering System (SISENG); f) Aeronautics Personnel System (SISPAER); g) Health System (SISAU); h) Aeronautics Cataloging System (SISCAE); i) National Airmail System (SISCAN); and j) Campaign Intelligence System (SISICAMP).

Of the systems mentioned, SISICAMP aims to ensure adequate logistical support for military personnel involved in deployed operations and exercises, "through welfare and morale maintenance activities, and the supply of I and II class materials"<sup>3</sup> (Brasil, 2024, p. 10, our translation).

Although it is not listed as an Aeronautics Logistics System, the Aeronautics Provisions System (SISPROV), like SISICAMP, is a system that is tasked with supplying Class II materials, i.e. quartermaster materials such as uniforms, equipment (backpacks, belts, suspenders, canteens, etc.), which are not provided by SISICAMP, including the equipment used by INFAER troops (Brasil, 2020).

SISPROV plays an important role in planning the needs, acquisition, storage, distribution, and administration of materials under the responsibility of the Supply Sub-Directorate (SDAB).

Through this system it is possible to manage the life cycle of materials, ensuring that all items are available at the right time and in the right place. In addition, it focuses on the specific material classes that are the subject of this study. However, not all items that are necessary and essential for the preparation and employment of ground troops are included and supplied systemically.

### 3.1.2 Supply chain in the FAB

To recap, according to Sikilero *et al.* (2014) the supply chain comprises the material and information exchanges in the logistics process that extends from the acquisition of raw materials to the delivery of finished products to the end user, encompassing all suppliers, service providers and customers, who are the links in the supply chain; it thus links many companies into a common whole.

Thus, within the scope of the Air Force Command, three supply chains are evident and, as seen above, logistics support activities are developed in a systemic way and sometimes have their functions concentrated by nature and managed by different Sectoral Management Bodies (ODS). Thus, Class III, IV, V, VI, VII, IX, and X materials are managed by the General Support Command (COMGAP). Class I and II supplies are managed by the Air Force Secretariat for Economy, Finance and Administration (SEFA), and a third chain is managed by the General Personnel Command (COMGEP), which deals with Class VIII supplies (Table 4).

3 "The Military Classification System is the system that groups all items of supply, according to their purpose of use, into ten classes, and is used in broad logistics planning and to simplify instructions and plans: a) Class I – Subsistence Material; b) Class II – Quartermaster Material; c) Class III – Fuels and Lubricants; d) Class IV – Construction Material; e) Class V – Armament and Ammunition; f) Class VI – Engineering and Mapping Material; g) Class VII – Communications, Electronics and Information Technology Material; h) Class VIII – Health Material; i) Class IX – Naval, Motor Mechanization and Aviation Material; and j) Class X – Materials not included in the other classes" (Brasil, 2022, our translation)

**Table 4 - Division of the FAB's supply chains**

Type of supply	Description	ODS Responsible
<b>Class III</b>	Fuels and lubricants	COMGAP
<b>Class IV</b>	Construction materials	
<b>Class V</b>	Armaments and ammunition	
<b>Class VI</b>	Engineering and cartographic equipment	
<b>Class VII</b>	Communications, electronic and computer equipment	
<b>Class IX</b>	Naval, motor-mechanization and aviation equipment	
<b>Class X</b>	Materials not included in other classes	
<b>Class I</b>	Subsistence equipment	SEFA
<b>Class II</b>	Quartermaster equipment	
<b>Class VIII</b>	Health equipment	COMGEP

**Source:** Prepared by the authors, based on DCA 2-1 (Brazil, 2022a).

Table 4 shows the systemic nature of the FAB's supply chain, in which different ODS manage different systems and supply chains. In this case, COMGAP is responsible for aviation-related supplies, such as fuels, lubricants, aircraft mechanics and others related to the direct use of military aerospace power.

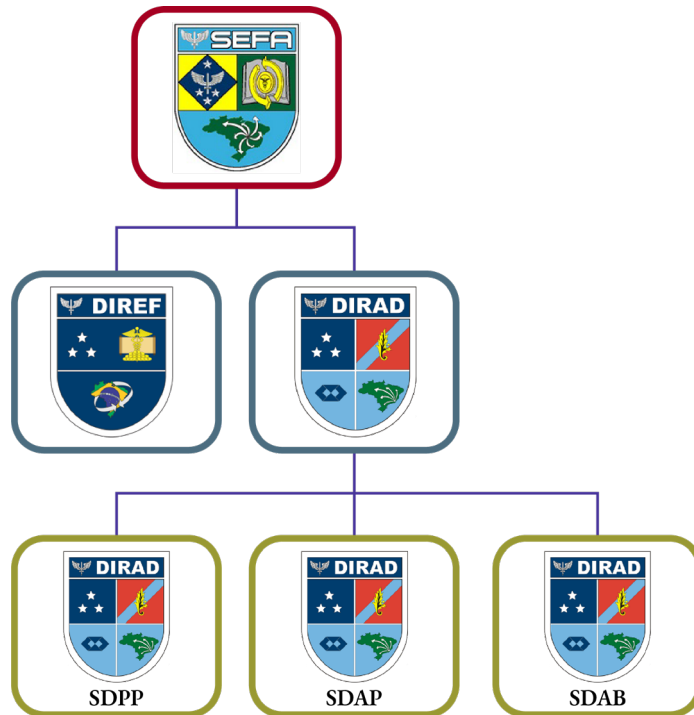
SEFA is responsible for the supply chains for Class I and II materials. It is responsible for the acquisition, storage, and distribution of the so-called quartermaster materials, which are the materials distributed via the systemic chain. These materials include those commonly used by Air Force infantry troops, such as uniforms, field tents, backpacks, canteens, non-ballistic helmets, and others.

And finally, COMGEP is responsible for managing Class VIII materials, characterized as health materials, such as the acquisition of medicines and the entire infrastructure of health personnel and material.

As the aim of this study is to analyze the supply chain related to materials and equipment used in campaigns, for which SEFA is the ODS responsible, Figure 2 illustrates the organizational chart, and the composition of the other bodies subordinate to this ODS and which are primarily responsible for acquiring this type of material.

The supply chain for the equipment used in GLO operations by infantry troops is part of SISPROV, through the Supply Subdirectorate (SDAB), which in turn reports to the Aeronautics Administration Directorate (DIRAD), which finally reports to SEFA.

**Figure 2 - SEFA organizational chart**



**Source:** Prepared by the authors, 2024.

In the figure, we have SEFA, whose purpose is to oversee, through the bodies of its regimental structure, not only activities related to financial administration and to budgetary, financial, patrimonial, and accounting execution of all resources, but also activities related to the areas of provisions and quartermaster materiel, personnel payment, subsistence, productive occupation of subordinate areas, surface transportation, lodging services, as well as activities related to special acquisitions, campaign logistical support, among others, in support of COMAER personnel and organizations (Brasil, 2024, p. 5)

It is made up of two other major directorates, the Aeronautics Economy and Finance Directorate (DIREF) and the Aeronautics Administration Directorate (DIRAD).

Within DIRAD, we can observe three other sub-directorates: the Sub-Directorate of Personnel Payment (SDPP), the Sub-Directorate of Administrative Support (SDAP), and the Sub-Directorate of Supply (SDAB), whose function is to carry out governance and coordination of SISPROV, the Reimbursable Uniform System (SIFARE), the Subsistence System (SISUB) and SISICAMP, to ensure the quality and standardization of troops uniforms and quartermaster materials, food, and Field Quartermaster Services (Brasil, 2023, p. 33). 33)

### 3.2 Theory of Constraints

The Theory of Constraints had its origins in the studies of physicist Eliyahu M. Goldratt in the mid-1980s, which focused on constraints in factory operations. It is a management approach focused on identifying and managing the main bottleneck (constraint) that limits an organization's effectiveness (Sikilero *et al.*, 2014).

According to Goldratt (1990), the aim is to maximize overall performance through a process that covers five stages, defined as follows: identify the constraint, exploit the constraint, subordinate it to the improvement process, elevate the constraint and repeat the process.

Even though the theory was designed to be applied to manufacturing processes, in companies that seek to maximize profits and the competitive advantages that come from this improvement in production, it can easily be used by other companies and organizations, such as the Armed Forces and the Air Force, specifically.

Although military organizations don't make a profit, they are responsible for continuously improving their final and support processes in order to offer quality products and services to their various stakeholders, and here we must include society as a part of this public, but we must also include their internal public, which depends on good management to be able to fulfill the mission assigned to the FAB.

As time has gone by, various studies have appeared with a different focus, seeking to relate the theory proposed by Goldratt to supply chain management. So much so that, according to Sikilero *et al.* (2014), the scenario in Brazil has been similar. Studies on this subject were developed by Souza, Chiminazzo, and Pires (2005) and by Menezes and Luz (2007). In the former, the authors developed some theoretical speculations on the subject, while in the latter they compared, by means of computer simulation, the approach proposed by the TOC in relation to the traditional one employed in Supply Chain Management (SCM).

However, to stay true to our research goals, the focus will remain on analyzing how a given restriction affects, in a generic way, the FAB supply chain focused on supplying equipment to the Infantry troops, without, however, turning the analysis to any specific logistical function, as some studies have proposed.

Goldratt's approach is based on two main premises: firstly, the company is considered to be a system whose performance results from the interaction between various processes; secondly, a constraint is defined as any factor that prevents the system from achieving its goal. Therefore, every system necessarily has at least one constraint or limiting factor. It follows that a constraint in itself is neither good nor bad, it simply exists and needs to be managed (Goldratt, 1990).

For better visualization, Table 5 below shows the definitions of the five stages and their definitions:

Therefore, according to Cox III and Spencer (2000), this proposed management model considers that the influence of constraints or bottlenecks is decisive for the results of a system. This allows for a continuous improvement of operations by coordinating the flow, taking into account the key resources of organizations. For the authors, improvements in operational processes not only open up new opportunities, but actually offer the company a decisive competitive advantage.

**Table 5 - Stages of the theory of constraints**

Stages	Definition	EQPT for GLO, FAB scope
Identification of constraints	Locate the element that most impedes the achievement of goals	The supply chain does not provide all the necessary materials
Exploiting the constraint	Increase the efficiency of the constraint by using available resources, without significant additional costs	Preparation and employment take place without the planned material
Subordination to the improvement process	Adjusting all other parts of the system to support constraint optimization, even if this means operating below maximum capacity	Procurement through support units
Elevating the constraint	When necessary, invest in solutions to expand the capacity of the constraint, such as purchasing equipment, increasing staff, or adopting new technologies	Incorporate the missing items into the list of equipment supplied by SISPROV
Repeating the process	Once the current constraint is relieved or eliminated, the process starts again to find and improve the next constraint	Repeat the process

**Source:** Prepared by the authors, inspired by Goldratt (1990).

#### 4 DATA PRESENTATION AND ANALYSIS OF RESULTS

The purpose of this section is to present the main findings of the research in order to achieve the specific objectives and, from there, the general objective, which will reveal the impacts of the supply chain on the preparedness and deployment of INFAER troops in GLO Operations.

##### 4.1 Equipment used by INFAER in GLO Operations

According to Holanda (2018, p. 11, our translation), during the 2016 Olympic Games, INFAER troops “were responsible not only for the security and defense of the facilities at Rio de Janeiro International Airport, but also for patrols, escorting convoys, escorting authorities, and checkpoints<sup>4</sup> in part of Ilha do Governador”.

Several other GLO-type operations had characteristics of overt policing, as unanimously identified in the interviewees’ statements, which described that one of the main activities carried out was road patrolling and unannounced vehicle inspection.

That said, it was noted that the troops performed typical overt policing duties and, therefore, the first specific objective of the research was achieved by revealing that the equipment used was typical of the Air Force Police, as described in regulatory document TCA 125-1 (Brasil, 2021a) (Table 6).

<sup>4</sup> Term used by the Air Force to classify the organization of a Roadblock and Control Post (PBCV), when a reduced structure is adopted, with few military personnel, according to MCA 125-7, Roadblock and Control Post Manual (Brasil, 2020b).



**Table 6 - Air Force police equipment**

System	Equipment
Traffic control	Reflective vest
	BH barrier (orange)
	“A” frame barricade (orange)
	Barrel traffic cone (orange)
	Flexible cone, 75 cm (orange)
	Traffic flow channelizer (“gelo baiano” type)
	LED traffic signal light
	Portable speed bump
	Tire shredder
	Traffic sign
Miscellaneous equipment	Retractable baton
	Tonfa baton
	Olive drab tonfa holder
	Assault backpack
	Tactical flashlight
	Whistle
	Vehicle inspection mirror
	Olive drab holster
	Olive drab tactical vest (MOLLE)
	Double pistol magazine pouch, 9 mm (MOLLE)
	Rifle magazine pouch, 5.56 mm (MOLLE), 40 rounds
	Small square pouch (MOLLE)
	Vertical pouch (MOLLE)
	First aid backpack (MOLLE)
	APH backpack
	Olive drab radio holder (MOLLE)
	Retractable lanyard
	Portable hydration pack (CamelBak type)
	Poncho
	Medium olive drab backpack
	Metal handcuff, plastic restraints
	Video camera
	Forensic case
	Megaphone
	Handheld metal detector
Communication	Portable radio with accessories

**Source:** TCA 125-1 (Brazil, 2021a, p. 14-5).

#### 4.2 Equipment used by the Brazilian Army in GLO operations

When analyzing the regulations that deal with equipment used by the Brazilian Army, two pieces of legislation were identified that address this issue, namely: EB70-CI 11.404 (*Caderno de instrução de aprestamento e apronto operacional*) (Brasil, 2014) and EB70-MC-10.359 (*Batalhão de suprimento*) (Brasil, 2020d).

To a large extent, the items for traffic control systems, various equipment, and communication devices share similar nomenclature, but the specifications are not identical, as they do not belong to the same supply chain.

Table 7 lists the materials classified for use in GLO operations and in campaign situations, according to the readiness and operational preparation instruction manual. It is important to note that the information was taken from the aforementioned manual and classified into systems—similar to the method used by FAB—in order to facilitate the identification and perception of equipment similarities.

**Table 7 - Materials used by the Brazilian Army**

System	Equipment
Traffic control	75 cm traffic cone
	Warning strobe light
	Reflective accordion-style pantograph barrier
	Barrel cone
	Reflective gloves
	Speed bump
	Stackable plastic barrier
	Reflective vest
	Rotating beacon light (giroflex-type)
	Searchlight
	Traffic signal wand
	Anti-escape spike barrier (tire deflator)
	Various traffic signs
Miscellaneous equipment	Holster with lanyard
	Duty belt
	Tactical vest
	Magazine pouches
	Canteen holder
	Canteen with cup
	Backpack
	Handcuffs
	Retractable tonfa baton
	Vehicle inspection mirror
	LED safety vest
	Asbestos gloves (pair)
	Camera
	Multitone megaphone
Communication	Camcorder
	Metal detector
	Radio (with spare battery) and accessories

**Source:** Prepared by the authors, based on Instruction Booklet CI-11.404 (Brasil, 2014).

This finding is in line with the perceptions of interviewees A and B, who agreed that the equipment of EB soldiers did not differ significantly from that of INFAER.

Thus, in a comparative way, it is possible to have a parameter that can identify that the equipment used by INFAER does not differ significantly from that already used by the Brazilian Army in GLO Operations.

#### 4.3 Acquisition of material for the INFAER troop

The materials used by the troops are acquired systemically, as described above, but not in their entirety, given that the supply chain does not include all the necessary items described in TCA 125-1, as can be seen in the Table of Free Distribution of Quartermaster Materials of TCA 168-2 (Brasil, 2020a), which deals with Class II materials, supplied free of charge.

To facilitate identification, Table 8 shows that, of the 37 items selected by the author as necessary for the Air Force Police activities, only eight are supplied through the supply chain, resulting in a total availability of just 21% for distribution.

**Table 8 - Items supplied and not supplied, according to TCA 168-2**

Items supplied (TCA 168-2)	Metal handcuffs, whistle, retractable lanyard, olive drab tonfa holder, olive drab tactical vest (MOLLE), tactical flashlight, medium-capacity olive drab backpack, 5.56 mm rifle magazine pouch (MOLLE), for 40 rounds
Items not supplied (TCA 168-2)	Reflective vest, BH barrier (orange) “A”, frame barricade (orange), barrel cone (orange), flexible traffic cone, 75 cm (orange), “gelo baiano”-type traffic flow channelizer, LED traffic signal light, portable speed bump, tire shredder, traffic sign
	Retractable baton, tonfa baton, assault backpack, vehicle inspection mirror, olive drab holster, double pistol magazine pouch, 9 mm (MOLLE), small square pouch (MOLLE), vertical pouch (MOLLE), individual first aid kit (MOLLE), first aid backpack, olive drab radio holder (MOLLE), portable hydration pack (CamelBak type)
	Poncho, plastic restraints, video camera, forensic case, megaphone, and handheld metal detector  Portable radio with accessories

**Source:** Prepared by the authors, 2024.

Thus, these items that are not covered are purchased by the Security and Defense Units (USEGDEF) through a bidding process, which is conducted by a Support Unit<sup>5</sup>. It is important to note that COMPREP, the central body of the Air Force Command's Security and Defense System (SISDE), is working to standardize materials in order to avoid discrepancies in the acquisition of these items.

5 “Support Unit: According to the conceptualizations of the Electronic Manual of the Aeronautics Administration Regulation (RADA-e), it is the administrative Military Organization responsible for full execution and budgetary, financial and asset management” (Brasil, 2021, our translation).

This decentralized acquisition sometimes doesn't happen at the right speed or in the right quantity for preparation and use, not only in GLO operations, but also in other activities carried out by the USEGDEF, which, according to Taliaferro *et al.* (2019), has an impact on capability, since one of its aspects is related to equipment.

The second specific objective was thus achieved by identifying how material is supplied for the preparation and deployment of the Air Force Infantry.

#### **4.4 Air Force Infantry troop preparation (INFAER)**

Preparation, in terms of specific training for the USEGDEF, is fundamental for effectiveness across all operational activities. This process is structured in programs that guide the training, qualification, and operational maintenance activities of INFAER military personnel, especially in relation to the Air Force Police, which is directly related to GLO Operations.

As set out in NOSDE CAP 302 (Brasil, 2019a) —Ground Operational Preparedness— the training of military personnel for these functions is organized in detail, covering initial training, specific qualification and operational maintenance, the latter on an ongoing basis.

Initial training aims to develop the skills needed to carry out police tasks, such as access control, surveillance, and patrolling. This training is essential to ensure that military personnel are prepared to deal with internal security situations and, in exceptional cases, to act in GLO operations.

After the completion of initial training, the process moves on to specific qualification, which involves advanced training and specialized courses, including the following: Riot Control, Security and Protection of Authorities, Escort by Motorcycle Scouts, Motorcycle Patrol, of War Dog Training, War Dog Handling, Horsemanship, and Criminal Forensics.

Once the training is over and the qualification has been completed, with the aim of ensuring excellence in the fulfillment of missions, a cycle of operational maintenance instructions is maintained, allowing operational activities to be performed with maximum competence and effectiveness.

Although the preparation of troops includes the entire framework of instructions necessary for deployment in GLO operations, in terms of training and qualification, Taliaferro *et al.* (2019) state that in addition to specific training, doctrine, organization, equipment, leadership, personnel, and facilities are also required.

Therefore, the shortage of certain equipment needed for use in all USEGDEFs is a deficiency that, to a certain extent, directly influences the operational effectiveness of the units, compromising their ability to respond quickly and efficiently to missions.

This brings us to the third specific objective, which is to examine how INFAER troops are prepared, taking into account only the training methods.

#### **4.5 Analysis of the SISCOMAT spreadsheet**

Following a request to COMPREP for information on the materials of all USEGDEFs, by means of Official Letter No. 11/COA/796, dated May 2, 2024, Official Letter No. 2478/

SPOT-20/5346, dated May 6, 2024, made available a spreadsheet containing all of these items, called the Material Control System (SISCOMAT).

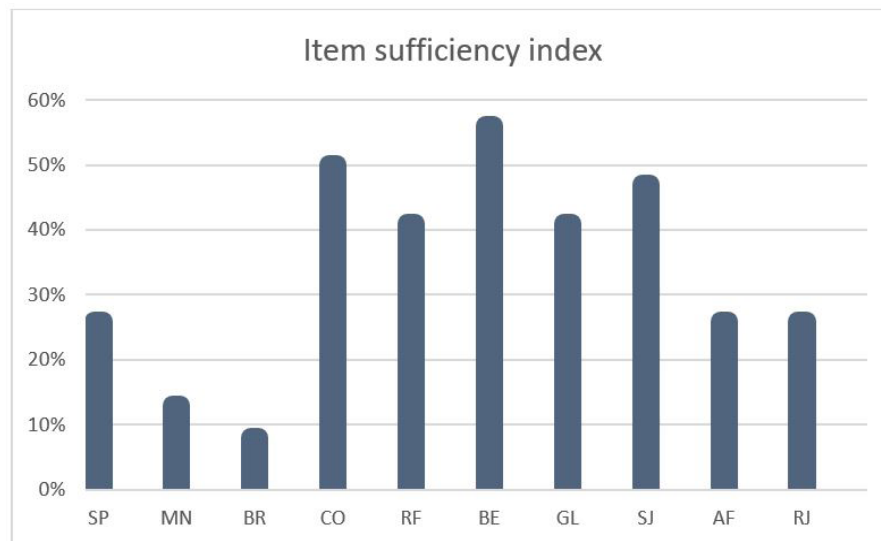
The Type 1 Security and Defense Groups (GSD) were selected for analysis because they are the USEGDEFs with the largest numbers of personnel compared to the other types. It is important to note that these units have between 500 and 1,200 men, according to NOSDE ORG 101 A (Brasil, 2022b)—Operational Standard for the Security and Defense System—which deals with the organization of Type 1 GSD.

First of all, it should be noted that the table in Appendix C, which was drawn up on the basis of the SISCOMAT spreadsheet, was divided into two quantitative columns, one with existing material and the other with planned material. The quantity of planned material was obtained from the product of the material planned for an Air Force Police platoon multiplied by three, given that a GSD is made up of three to four such platoons, according to the aforementioned standard.

As a result, it was possible to see that these GSDs do not have all the materials required in quantity, according to TCA 125-1. The items in red refer to the quantity of material that did not meet the minimum required by the aforementioned legislation.

The Material Sufficiency Index, which represents the percentage of items whose quantity is equal to or greater than the minimum required, was calculated by dividing the number of sufficient items by the total number of items evaluated (Graph 1).

**Graph 1 - Sufficiency index of items in GSD Type 1**



**Source:** Prepared by the authors, based on the SISCOMAT spreadsheet.

In general, all the USEGDEFs have material deficiencies, with a sufficiency rate below 60%, highlighting the need for improvements in the supply chain to ensure that troops are adequately prepared for Law and Order Assurance Operations.

The documentary analysis revealed that the decentralized form of procurement, through Support Units, was not enough to mitigate the deficiencies in the supply chain. To overcome these deficiencies, the implementation of TOC-based management strategies enables the most critical

limitations in the supply chain to be systematically identified and addressed, as will be seen in the following section.

In this way, it was possible to examine that the FAB's supply chain, particularly with regard to Class II materials destined for INFAER troops, is not able to fully supply the USEGDEFs with the necessary materials to be used, with a direct impact on the troops' preparedness.

#### **4.6 Data interpretation in the light of the Theory of Constraints**

The documentary analysis, together with the interviews conducted, revealed that the lack of suitable equipment was a recurring problem that compromised the operational efficiency and safety of the military personnel in the field during the operations studied, as only 21% of the necessary items were systematically supplied, in accordance with the quantity provided for in TCA 168-2, a rule that deals with the free distribution of quartermaster materials within the scope of the Air Force supply system. This situation implies decentralized procurement by the units, often resulting in an inefficient and time-consuming process.

Applying the principles of TOC to the context of the research, the analysis of the data obtained revealed that the main constraint is found in the supply chain, which does not provide all the necessary materials, as provided for in the Planning Factors for the Infantry Units' Employment Equipment (TCA 125-1) (Brasil, 2021a).

Identifying this constraint is fundamental for understanding the impact of these limitations on the troops' operational capability, as well as for guiding the necessary improvement actions. In order to better understand the challenges faced in GLO operations and propose effective solutions, the TOC was used as an analytical framework. A detailed study of the SISCOMAT spreadsheet and interviews with military personnel revealed how the availability of material resources directly influences the planning and execution of missions.

Exploiting the constraint involves maximizing the use of available resources to minimize the adverse effects of material shortages. In practice, this may include redistributing materials across units, given that some have quantities of certain items well above the minimum required, or adopting temporary alternatives to address deficiencies.

However, even with these efforts, operational efficiency remains compromised, highlighting the need for a more comprehensive approach. Adjusting all other parts of the system to support optimization of the constraint implies prioritizing the supply of critical materials and adapting procurement processes to ensure a faster response to emerging demands.

Elevating the constraint requires investments in solutions that increase supply chain capability, such as seeking new suppliers, increasing stocks of critical materials, and implementing advanced supply management technologies. These measures would not only ensure the availability of necessary materials, but also increase the supply chain's resilience against future disruptions.

After recognizing the constraint, it is essential to repeat the process to identify new limitations and promote continuous improvement. The application of TOC concepts to the data obtained shows that the lack of suitable materials in sufficient quantity is a critical constraint that affects not only the preparedness but also the deployment of troops in GLO operations.

Table 9 summarizes the phases of the TOC applied to the interviewees' answers, highlighting the main constraints, their impacts, the strategies suggested for mitigation and the lessons learned for future operations.

**Table 9 - Interviewees' responses**

Phase	Description	Interviewees' answers
Identification of constraints	Determine which are the main constraints affecting the performance of operations	Lack of radios with adequate coverage (A, C) Inadequate ballistic vests (A, B) Insufficient personal protective equipment and other equipment (B, C)
Exploration of constraints	Analyze how these constraints impact operations and troop performance	Poor communication between troops and command due to inadequate radios (C) Difficulty adapting to wearing vests during operations (A) Low troop morale due to the need for personal acquisition of equipment (B) Lack of equipment standardization, making coordination and external perception difficult (C)
Subordination and synchronization	Develop strategies to adjust processes to the constraints identified	Centralization of equipment storage (B) Standardization of materials between different battalions (C) Adherence to regulations TCA 168-2/2020 and TCA 125-1/2021 for standardization and centralized procurement (C)
Elevation of constraints	Implement solutions to overcome or increase the constraints identified	Investment in equipment of better quality and sufficient quantity (All) Implementation of regular training with the equipment used in operations (A) Use of new communication channels and more advanced ballistic vests (B)
Reassessment of constraints	Monitoring and adjusting the solutions implemented to ensure continued effectiveness.	Adjustments to the acquisition and distribution of new equipment as necessary (All) Continuous assessment of the impact of new regulations and standardizations on future operations (C)

**Source:** Prepared by the authors, 2024.

That said, the systematic application of TOC enables an integrated view of the management process, which favors continuous adaptation to changes in operational demands. By proactively identifying and resolving constraints, INFAER can significantly improve its readiness and effectiveness in GLO operations, ensuring that material resources are used optimally.

Furthermore, the implementation of the strategies advocated by the theory must be accompanied by rigorous monitoring and continuous analysis of the outcomes, so that this monitoring makes it possible to quickly identify new constraints that may arise and adjust actions as necessary.

It is therefore possible to establish a link between the inefficient supply chain and preparedness and deployment, particularly in relation to insufficient equipment for the INFAER Corps. In this sense, the last specific objective was achieved, which was to examine the relationship between the supply chain and the preparedness of troops in GLO operations.

## 5 FINAL CONSIDERATIONS

The general objective of this study was to analyze the impact of the supply chain on the preparedness and deployment of Air Force Infantry troops in Law and Order Assurance Operations.

Throughout the research, we sought to answer the following question: What is the impact of the supply chain on the preparedness and deployment of Air Force Infantry troops in Law and Order Assurance Operations? The methodology adopted included a combination of bibliographical and documentary research. Sources such as TCA 125-1 and TCA 168-2 were consulted, as well as the material control spreadsheet for all Security and Defense Units (SISCOMAT), managed by the Preparedness Command.

The theoretical review covered fundamental concepts of logistics, the supply chain, and the Theory of Constraints. Logistics was defined as a comprehensive process involving the planning, implementation, and control of the flow of goods, services, and information, which are essential to efficiently meet customer needs. This differs from the concept of the supply chain, which comprises the material and information exchanges in the logistics process, extending from the acquisition of raw materials to the delivery of finished products to the end user. The Theory of Constraints, proposed by Goldratt (1990), was used to identify and manage the main constraint limiting the organization's effectiveness.

In addition, in order to complement the bibliographic-documentary survey, field research was conducted to seek information on the materials supplied (quantity and quality) to specialists who worked directly on the Law and Order Assurance missions covered in the research.

The data collected revealed that the equipment used by the Air Force Infantry in GLO operations is essentially of a police nature, as described in TCA 125-1 (Brasil, 2021a), which sets out the Planning Factors for the Equipment Used by Infantry Units. The analysis of the materials used during operations, mentioned by the interviewees, confirmed the relevance of this equipment to the missions.

A comparison with Brazilian Army standards, such as EB70-CI-11.404 (Brazil, 2014) and EB70-MC-10.359 (Brasil, 2020d), showed that traffic control items, miscellaneous equipment and communication devices are quite similar, although with different specifications due to different supply chains.

The documentary analysis revealed that only 21% of the items needed for operations are supplied systemically, in accordance with TCA 168-2 (Brasil, 2020a), which deals with the Free



Distribution of Quartermaster Materials within the scope of the Aeronautics Provisions System, obliging Security and Defense Units to carry out material acquisitions in a non-systemic way. This method is often inefficient and slow, negatively impacting the preparedness and deployment of military personnel.

Analysis of the data from the SISCOMAT spreadsheet highlighted the shortage of materials in the Security and Defense Units, revealing a material sufficiency index of less than 60%, indicating the need for improvements in the supply chain.

Applying the principles of the Theory of Constraints, the main constraint identified was the inadequacy of the supply chain. Exploring this constraint revealed that strategies such as redistributing materials and adopting temporary alternatives are viable, but do not completely solve the problem. The interviews corroborated these conclusions, highlighting the lack of suitable radios, the lack of standardization of equipment and the insufficiency of critical equipment for the work.

According to Taliaferro *et al.* (2019), efficient management of material resources is essential to ensure that units can respond promptly in any operational scenario. In this sense, examining the insufficiency of equipment needed for the Air Force's police activities concludes that there is an impact on the preparedness and employment of troops in GLO operations.

The research's contributions to the FAB include the identification of specific bottlenecks in the supply chain and the proposal of improvement strategies based on the Theory of Constraints, which can be implemented to increase the efficiency of operations in which Air Force Infantry troops are employed.

For future research, we suggest investigating the influence of other types of material resources, such as armaments, operational vehicles, and ballistic protection in general, which were not the focus of this study, but are of relevance to the FAB.

Furthermore, studies that explore the integration of supply management technologies and the impact of centralized procurement policies on the operational efficiency of Security and Defense Units would be valuable in improving the preparedness of forces in complex operations such as GLO.

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