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The logistics at the Battle of Tannenberg: the high price of incompetence

La Logística en la Batalla de Tannenberg: el alto precio de la incompetencia

Abstract: The term Logistics is very broad, covering activities such as acquisition produtcs, transport, distribution and sustainment by the user. Logistics began to be studied scientifically, in the mid-nineteenth and early twentieth centuries, by authors such as Clausewitz and Jomini. The present work has the general objective of analyzing the logistical support to the German na Russian armies, and how they influenced the outcome of the Battle of Tannenberg, which took place during the Great War. The methodology used was process tracing, supported by na extensive bibliographic research. As a result, the inefficiency of Russian army logistics was found to have a major contribution to Germany's final victory at Tannenberg. In addition, they had implications for Logistics with new concepts, such as the Supply Chain, and its division into strategic, operational and tactical levels.

Keywords: logistics; Army; Tannenberg.

Resumen: El término Logística es muy amplio, abarcando actividades como la obtención de productos, transporte, la distribución y el uso final por parte del usuario. La Logística comenzó a ser estudiada científicamente a mediados del siglo XIX y principios del siglo XX, por autores como Clausewitz y Jomini. El presente trabajo tiene como objetivo general analizar el apoyo logístico a los ejércitos, alemán y ruso, y cómo estos influyeron en el desenlace de la Batalla de Tannenberg, ocurrida durante la Primera Guerra Mundial. La metodología utilizada fue el *process tracing* (rastreo de procesos), sustentada en una amplia investigación bibliográfica. Como resultado, resultó que la ineficiencia de la logística del ejército ruso contribuyó en gran medida a la victoria final de Alemania en Tannenberg. Además, tuvo implicaciones para la Logística con nuevos conceptos, como el *Suplly Chain* (Cadena de Suministro), y su división en niveles estratégico, operativo y táctico.

Palabras clave: logística; Ejército; Tannenberg.

Rodrigo Tavares Ferreira
Exército Brasileiro. Batalhão de Dobragem, Manutenção de Paraquedas e Suprimento pelo Ar (B DOMPSA)
Rio de Janeiro, RJ, Brasil.
rotafe@yahoo.com.br

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1 1 INTRODUCTION

The present work is a study on how the logistical support provided to armies in a battle can directly influence their success or defeat. The case studied was the Battle of Tannenberg, which took place in World War I (WW I) (1914-1918), involving the armies of the German and Russian empires.

Military logistics can be understood as an activity that enables the war effort of the armed forces, with the forecasting and provision of supplies and with the movement of necessary personnel and material on the battlefield (BRASIL, 2015A; SANTOS; OLIVEIRA, 2017).

The foundation of modern military logistics, based on technical and scientific studies, was initiated during the Napoleonic campaigns in the nineteenth century. Before the battles were fought by the French army, Napoleon Bonaparte ordered his commanders to make calculations of the necessary provisions, to establish bases from the reserves of supplies, and to extract resources from the occupied territories. In this way, the genius Corsican found that the greatest effectiveness of his army was linked to the availability of resources and means for his soldiers, leaving "in hand" the food, weapons, ammunition and uniforms necessary for combat (CREVELD, 2000; DEL RE, 1955).

The first author to document the importance of logistics for an army was the German Carl von Clausewitz. In his work *Vom Krieg*, he related a series of principles, rules, concepts, norms and teachings that constituted the doctrinal foundation of modern war. The author noted the responsibility of the government in the logistics of the armies with the construction of warehouses, the acquisition of food and the mobilization of means of transport for the armies, placing logistics as a national responsibility (DEL RE, 1955; VON CLAUSEWITZ, 1883).

In the same vein, Baron Antoine-Henri Jomini, in his work *Precis de l'art de la guerre*, argued that logistics encompassed all or almost all of the field of military activities in support of combat, such as the organization of marches and camps (DEL RE, 1955; JOMINI; MENDELL; CRAIGHILL, 2007).

Both authors in their works sought to demonstrate that the success or failure of armies came to depend on logistics, the efficiency of mobilizing national resources, and command-and-control over troop movement. In this sense, the Piedmont military campaigns (1859) and the Franco-Prussian War (1870-1871) demonstrated that the rapid availability of the belligerent countries' resources to their armies had the power to directly impact the outcome of military campaigns. The direct consequence of this was that logistics began to be seen in the strategic sense (CREVELD, 2000; DEL RE, 1955; KISSINGER, 2012; SONDHAUS, 2013).

In the year 1914, on the western front of the war, the German army was at the gates of Paris, pressing the French army to mount a desperate defense of its capital. To relieve this pressure, France cornered Russia, its ally, to open an eastern front against Germany, which would force the German state to fight on two fronts. This attitude can be seen in the words

of the French Ambassador to Russia, Maurice Paléologue, in an audience with Tsar Nicholas II: "I beg Your Majesty to order your armies to begin an immediate offensive; otherwise, the French army risks being crushed" (TUCHMAN, 1998, p. 238). Finally, the Russian Empire gave in to the French onslaughts and advanced with its armies on the German territory of East Prussia (MASSIE, 2014; TUCHMAN, 1998).

The invasion of the territory considered the "cradle of the Germanic race" (DURSCHMIED, 2003, p. 220) led to the reaction of the German Empire against the Russian that culminated in the Battle of Tannenberg, which took place in the period of August 25 and 29, 1914, having as contenders the first and second Russian armies and the eighth German Army MASSIE, 2014; TUCHMAN, 1998).

The result of this skirmish was a fragrant Russian defeat that sealed "the fate of Tsarist Russia as a war power" (DURSCHMIED, 2003, p. 232). In the same vein as this statement, General Guchkov, the Russian Minister of War, declared that after the Battle of Tannenberg he had "come to the firm conviction that the war was lost" (TUCHMAN, 1998, p. 357). Corroborating this assertion, it is noted that one of the indirect consequences of this Russian defeat occurred three years later, in 1917, with the signing of the Brest-Litovsk peace treaty, where Germany demanded from Russia "the annexation of the entire Baltic area, a slice of Belarus, a de facto protectorate over independent Ukraine and a huge indemnity" (KISSINGER, 2012, p. 233). Certifying the exhibits of the facts presented, German General Max Hoffmann described the victory at Tannenberg as "one of the great victories in history" (TUCHMAN, 1998, p. 355).

Based on the reflections presented the research problem arose: how did the logistical support of the German and Russian armies influence the outcome of the Battle of Tannenberg?

To answer this question, the general objective of this article is to analyze the logistical support provided to the German Eighth Army (8th Army) and the Northwest group of the Russian army, and how these influenced the outcome of the Battle of Tannenberg. For this purpose, the following specific objectives were listed:

1. Understanding the maneuvers of the armies at the Battle of Tannenberg;

2. Explain the logistics doctrine common to the main European armies in World War I;

3. Display physical characteristics of East Prussia and its influence on the logistical support of the German and Russian armies;

4. Present the logistical support of the 8th Army; and

5. Present the logistical support of the Northwest group of the Russian Army.

According to these objectives, it is perceived that the relevance of this work is in the lack of more in-depth historical studies on the importance of logistics for armies in their military campaigns.

The research methodology used was the *process tracing*, often used for security case studies, as well as for the explanation of a historical fact. *Process tracing* seeks to identify, understand, and chain together the critical events and their causes, demonstrating the factors that influenced or increased the likelihood for the outcome of the Battle of Tannenberg. The sources of evidence for the research were books, scientific articles and manuals (GODOY, 2006; MAHONEY, 2015; YIN, 2001).

2 MANEUVERS OF THE ARMIES AT THE BATTLE OF TANNENBERG

To understand what went right or wrong in the logistics of the German and Russian armies, and their weight in the outcome of the Battle of Tannenberg, it is imperative to know the compositions of the forces, their missions, the planned strategies, the maneuvers that were carried out and, finally, to evaluate the result. That said, this campaign was divided into three phases: The Russian offensive, the reorganization of the German army and the German counteroffensive.

The 8th Army was commanded by General Maximilian von Prittwitz, and its mission was the defense of East Prussia, it was composed of the I Corps (General Von François), XVII Corps (General Mackensen), XX Corps (General Scholtz), I Reserve Corps (General von Below), III Reserve Division (Von Morgen), I Cavalry Division and the Landwehr Division, had a total effective of approximately 135 thousand men. His soldiers were trained, disciplined and had solid knowledge of the terrain. In addition, the 8th Army had the possibility of receiving reinforcement from the German second and Third Army and the 8th Cavalry Division (DURSCHMIED, 2003; KEEGAN, 2003; MASSIE, 2014; SONDHAUS, 2013; TUCHMAN, 1998).

On the border with Germany, the Northwest group of the Russian army, commanded by General Yakov Jilinsky, who mobilized the 1st Army (General Pavel Rennenkampf) and 2nd Army (General Alexander Samsonov), with a total of 98 infantry divisions and 37 cavalry divisions, reinforced by 29 divisions, which made an effective with about 400,000 men. Due to a hasty mobilization the Russian army was poorly trained and poorly prepared, and to make matters worse, had no adequate knowledge of the terrain (DURSCHMIED, 2003; KEEGAN, 2003; MASSIE, 2014; SONDHAUS, 2013; TUCHMAN, 1998).

With the evidence presented, it can be seen that the numerical difference between the Germans and the Russians was enormous. For the offensive, the Russians detached 480 battalions against 130 Germans (HASTINGS, 2014; SONDHAUS, 2013; TUCHMAN, 1998).

2.1 The Russian offensive

The Northwest group of the Russian army had the mission of invading East Prussia with its 1st and 2nd Armies. The Russians had the knowledge of the fragile German defense, and decided to attack the positions of the 8th Army with their armies simultaneously, performing a pincer movement. The plan was for Rennenkampf's army to launch the attack and draw the bulk of the German forces to itself. After two days of fighting, with the Germans fully engaged in fighting with the 1st Army, Samsonov's 2nd Army would bypass them from the south of the Masurian lakes, surround them from the rear and deliver the decisive blow. This way, the Russian army hoped to destroy the German defense and open the door for a deeper invasion of German territory in the direction of Berlin (KEEGAN, 2003; MASSIE, 2014; SONDHAUS, 2013; TUCHMAN, 1998).

Thus, as planned, in August 12, a Cavalry Division of the Russian 1st Army, at the head of the main advance, invaded Prussia, taking the city of Marggrabowa, eight kilometers from the Russian border. General Rennenkampf, upon receiving reports of this attack, deduced that the Germans did not plan a strong defense to the East. Accordingly, the commander of the 1st Army on August 17 ordered the advance ahead of schedule into enemy territory, disregarding its incomplete supply service. This offensive was interrupted by the Tomingen Forest, having to the south the natural barrier of the Masurian lakes (TUCHMAN, 1998).

In southern Prussia, Samsonov could not keep up with the advance of the 1st Army, due to the poor condition of the sandy roads. To make matters worse, the Russian high command could not coordinate the actions of its two armies, as it did not have an established communication line due to the lack of wires (TUCHMAN, 1998).

Despite the numerical disadvantage, General von Prittwitz had difficulty maintaining the 8th Army defensive positions, according to orders issued by the high command of the German Army. Trying to exploit the surprise, the 8th Army attacked the Russian 1st Army, culminating in the Battle of Stallupönen. The Germans managed to inflict five thousand casualties on the Russians and capture three thousand prisoners, losing 1,200 men. After this clash, the Germans retreat to the city of Gumbinnen (MASSIE, 2014; SONDHAUS, 2013; TUCHMAN, 1998).

Two days later, on August 19, Rennenkampf's Army restarted its advance towards Gumbinnen. At this point, the 1st Army, which was less than 25 kilometers from the Russian border, began to resent the irregularity in the distribution of supplies, that did not reach its units (DURSCHMIED, 2003; TUCHMAN, 1998).

On August 20, in the Battle of Gumbinnen, the Russians took advantage of their numerical superiority and, with a good use of their artillery, managed to partially defeat the Germans, opening the way to the city of Königsberg. With this setback, General Von Prittwitz panicked, and gave orders for the 8th Army to retreat to the Vistula River, ceding East Prussia to the Russians (MASSIE, 2014; SONDHAUS, 2013; TUCHMAN, 1998).

After the battles of Stallupönen and Gumbinnen, the Russians believed that the Germans were on a desperate escape. That said, the Russian High Command insisted that General Samsonov continue the offensive "to meet the enemy retreating in front of General Rennenkampf and cut off their retreat to the Vistula" (TUCHMAN, 1998, p.341). Samsonov did not have at his disposal railway lines that would allow the rapid displacement of his troops, which moved along sandy roads, as well as the general had information that the enemy was not retreating, but reorganizing. Another fact was that Rennenkampf could not pursue his enemy to obtain a definitive victory, because his supply lines functioned precariously (TUCHMAN, 1998).

Faced with the setbacks, the High Command of the German Army decided to replace the commander of the 8th Army in the region, removing General von Prittwitz and summoning from retirement, General Paul von Hindenburg, who appointed as his Chief of Staff General Erich Ludendorff. These two generals and the Colonel Max Hoffmann, Deputy Chief of Staff of the 8th Army, caused a change in the course of the fight in East Prussia (SONDHAUS, 2013; TUCHMAN, 1998).

2.2 The reorganization of the German army

Colonel Hoffmann knew that retreat was not the best course to take. He had a plan to stop the Russian advance. Hoffmann's plan was to leave, to the north, a detachment of the 8th Army as a covering force to observe and distract the Russian 1st Army and, taking advantage of the excellent German railway network, transfer two Army Corps from **Hindenburg** to the south to meet Samsonov's vulnerable Army, dealing him the fatal blow. This way, the Germans could throw all their strength, at a time, against each Russian army (HASTINGS, 2014; TUCHMAN, 1998).

In order for this plan to be carried out, the Germans carried out reconnaissance missions, including using a Fokker aircraft, occurring for the first time in wartime operations. With this, the German Command discovered that Rennenkampf's Army stopped to rest and re-equip, and that there was a huge gap between the Russian armies, due to the Masurian lakes. In addition, the Germans intercepted two Russian radio messages, which revealed that the orders issued to Rennenkampf would not threaten a small force of the 8th Army, to the north, and that Samsonov should pursue the Germans, who the Russian High Command believed were defeated (DURSCHMIED, 2003; TUCHMAN, 1998).

Moreover, the luck factor contributed to the bold plan. Hoffmann had a personal knowledge of a private quarrel between Rennenkampf and Samsonov, which occurred during Russo-Japanese War (1904-1905). Thus, he inferred that Rennenkampf would not be in a hurry to help Samsonov (TUCHMAN, 1998).

Hindenburg supported Hoffman's plan, and on August 24, the Eighth Army made the decision to throw almost all of its soldiers against Samsonov, leaving only two cavalry divisions to face Rennenkampf. On August 25, the Germans completed the transport of their troops to the South. Now Samsonov's army would face an army similar in size and superior

in artillery (DURSCHMIED, 2003 GILBERT, 2017; MASSIE, 2014; SONDHAUS, 2013; TUCHMAN, 1998).

Accordingly, the Corps of Generals Mackensen and Below would attack Samsonov's right wing. In the center, The XX Corps of General Scholtz, supported by the Landwehr Division and the third Reserve Division of General Von Morgen, were to support the main attack of Mackensen and Below. On the German Right, General Von François would envelop and attack the Russian left wing (TUCHMAN, 1998).

Figure 1 – The Russian offensive and the reorganization of the 8th Army

Source: Hastings (2014, p. 261).

2.3 The German counteroffensive at Tannenberg

On August 26, the Russians entered Rastenburg, located in Central Prussia. On August 27, fighting resumed next to the Masurian lakes near the villages of Frögenau and Tannenberg. The German Eighth Army attacked the Russian Second Army, managing to outflank its right wing, which led to a disorderly retreat of the enemies. On the extreme Russian left, heavy bombardment from German artillery fell on their positions, causing them to abandon their posts, fracturing Samsonov's Army. The pincer maneuver initially planned by the Russian army was undone with the defeat of the Second Army (GILBERT, 2017; TUCHMAN, 1998).

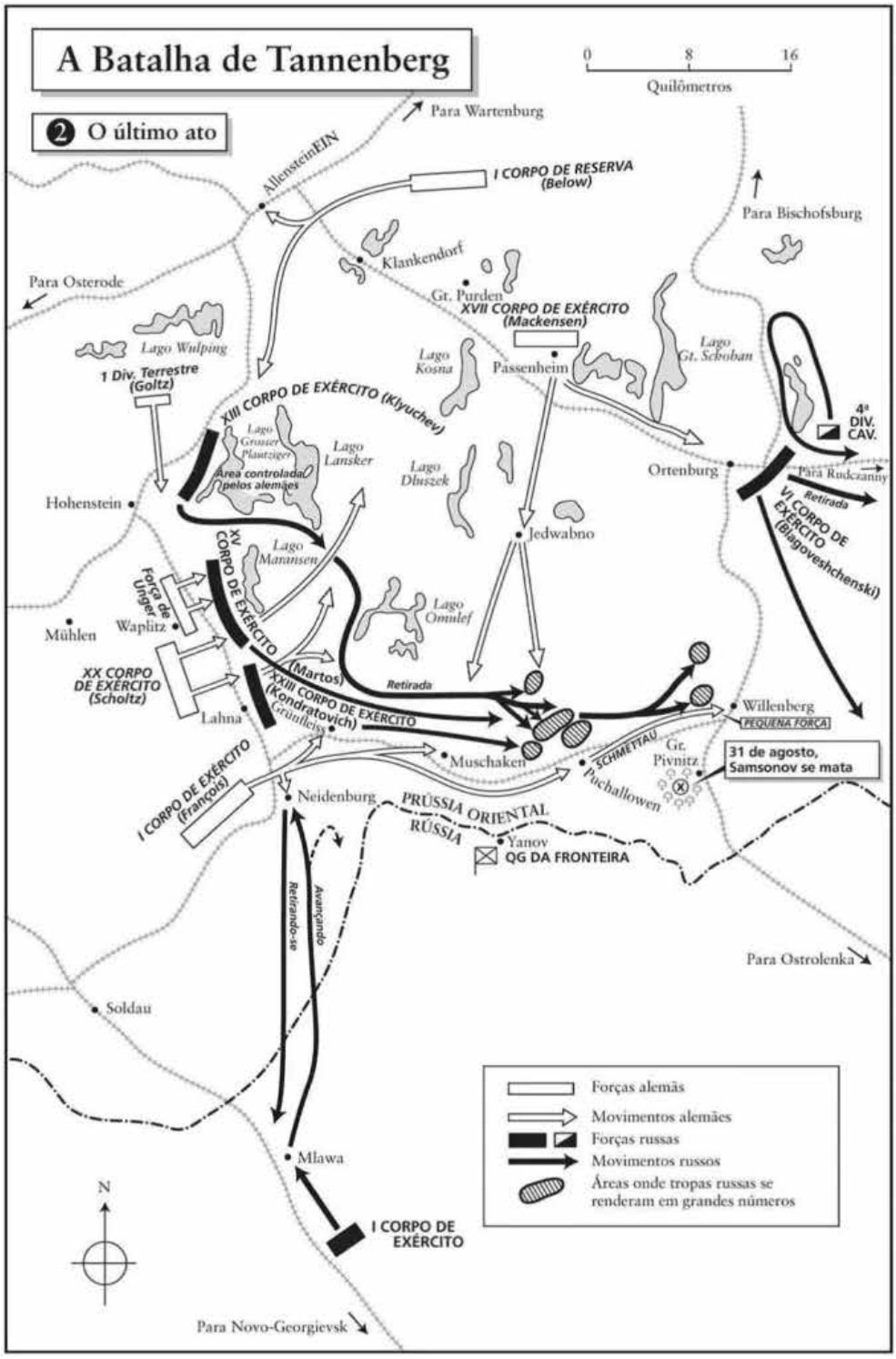
On August 29, Hindenburg's forces surrounded Samsonov's Army from three sides, and the Russian troops, exhausted, did their best. On the same day, general Samsonov committed suicide, for fear of confronting the Tsar. On August 30, the 2nd army disintegrated and capitulated (HEBERLEIN, 2021; MASSIE, 2014; SONDHAUS, 2013).

The toll of the defeat at Tannenberg to Russia was dire: 92,000 to 95,000 of its soldiers were imprisoned; between 300 and 500 artillery pieces were captured, out of a total of 600 guns that belonged to the 2nd Army; and thousands of horses were captured. To transport all captured prisoners, animals and materials, the Germans used more than 60 trains. It is estimated that more than 30,000 Russian soldiers were among the dead and missing. On the other hand, the Germans suffered between 12 and 20 thousand casualties, out of a total of 135 thousand that were employed in the action (GILBERT, 2017; HASTINGS, 2014; MASSIE, 2014; SONDHAUS, 2013; TUCHMAN, 1998).

After this resounding victory over the 2nd Army, the Germans turned to the north with the aim of defeating the army of the General Rennenkampf, and expel them definitively from East Prussia. The German 8th Army, now reinforced by troops from the Western Front, attacked and defeated the Russians in an offensive, which lasted from September 4 to 14, being known as the First Battle of the Masurian Lakes (HEBERLEIN, 2021; MASSIE, 2014; SONDHAUS, 2013; TUCHMAN, 1998).

In short, the consequences of the defeat at Tannenberg were: "the Russian Second Army had ceased to exist, General Samsonov was dead, and of his five Corps Commanders, two were captured and three dismissed for incompetence" (TUCHMAN, 1998, p. 356). In addition, the blame for the defeat "fell on General Jilinsky, who was replaced, and on Rennenkampf, who was discharged from the army" (MASSIE, 2014, p.309).

Figure 2 – The German counteroffensive at Tannenberg



Source: Hastings (2014, p. 261).

3 THE LOGISTICS DOCTRINE COMMON TO THE MAIN EUROPEAN ARMIES IN WORLD WAR I

From the middle of the nineteenth century to the beginning of the twentieth century, European countries had a huge technological development and a gigantic production of material channeling these resources to armies in combat zones. For this purpose, military logistics was divided into three distinct levels: the strategic, the operational and the tactical. In an incipient way, the armies established a *Supply Chain* that interconnected these levels, maintaining a continuous flow of provisions (BALLOU, 2006; BOWERSOX; CLOSS, 2011; DEL RE, 1955; GOLDONI, 2012; SILVA; MUSETTI, 2003).

The strategic level was focused on the national effort in the war, where countries mobilized their personal and material resources, developed their infrastructures and obtained the necessary supplies for their armies, with: the acquisition of defense equipment produced by national industry, the establishment of trade agreements between allied countries with the importation of articles that were not produced and/or lived at the expense of dominated territories with confiscation of raw materials and industrialized products (DEL RE, 1955; SILVA; MUSETTI, 2003).

At the operational level, it was the logistical support for military campaigns. Here, the armies established their bases, located far from the combat zone, where main supply stocks, field hospitals, workshops and mobilized personnel were concentrated. In these places, the distribution of supplies and adequate support to the Army Corps were organized and planned (DEL RE, 1955; KING; BIGGS; CRINER, 2001).

At the tactical level, logistical support was provided directly to the units of the armies that were in combat, with the distribution of various materials, with the arrival of personnel to replenish the units and with the evacuations of the wounded (DEL RE, 1955; KRESS, 2002).

This division by levels, in military logistics, affirmed the principle of continuous replenishment of supplies that was adopted by European armies, incipiently, since the Napoleonic wars and was perfected in the Franco-Prussian War (1870-1871), being the object of study in the *Fort Leavenworth* by the United States Army (FERREIRA; BARROS, 2020; JOMINI; MENDELL; CRAIGHILL, 2007; KING; BIGGS, 2001).

In this principle, the armies received in their bases the supplies, coming from the strategic level. Subsequently, the supplies were moved to a warehouse-station located in an intermediate zone. Finally, the provisions were transported to the Replenishment Station, reaching the front line. However, in order for the continuous replenishment of supplies to work correctly, it was necessary to move logistics facilities to areas closer to the combat zones, whenever the armies advanced their positions (DEL RE, 1955; JOMINI; MENDELL; CRAIGHILL, 2007; KING; BIGGS, 2001).

It was very complex to maintain the flow of supply between the rear and the *front*, for this it was necessary to possess an efficient transport system. To this end, the armies studied the conditions of the terrain in the area of operations, the distances that would be traveled, the quantities of personnel and material that would be transported, the means of transport available and, finally, prepared the convoys that would distribute the food, ammunition, armaments, ambulances, animals, luggage, equipment, uniforms, beef cattle, medicines and ammunition necessary for the troops in combat (CREVELD, 2000; DEL RE, 1955; JOMINI; MENDELL; CRAIGHILL 2007; KING; BIGGS; CRINER, 2001).

About the modes of transport, since the Franco-Prussian War (1870-1871), the railway had become the most important means of transport for the armies, due to its speed, for having a large load capacity and for covering great distances in Europe, which had a railway network of approximately 322,000 kilometers. Despite these advantages presented, the train had strict itineraries and operating limits, not ensuring that the necessary personnel and supplies reached all locations. Therefore, in order to complete the transport to the front line, it was essential to board supplies and personnel in carts. In this way, the carts – with its low speed, limited carrying capacity and dependent on horses and mules for its displacement – became the most used means of Transport for logistical support. Subsequently, trucks and automobiles were incorporated into army convoys, which increased the demands for gasoline, oils and lubricants (CREVELD, 2000; DEL RE, 1955; KEEGAN, 2003; KING; BIGGS; CRINER, 2001; MACMILLIAN, 2013).

The trains were assembled on an intermodal system, that is, juxtaposing more than one mode of transport, using railways, wagons and motor vehicles to bring all the necessary personnel and supplies to the front line (DEL RE, 1955; KING; BIGGS; CRINER, 2001).

In WW I, the strength of the armies was enormous and, in order to maintain their combat power, the prevailing logistic doctrine provided that the most important supplies were food, for men and animals, and ammunition, especially artillery ammunition. With this, the armies had a minimal reserve of these supplies, but their emergency provisions were not scientifically calculated. Consequently, in the event of an interruption in the supply flow, the units would have to withstand until they were supplied again, which could take many days. Anticipating this problem, commanders, when possible, overloaded their means of transport with food, to the detriment of their unit's ammunition allocations (CREVELD, 2000; DEL RE, 1955; MURRAY, 1997).

Figure 3 shows the logistic doctrine in force in the armies of Europe, during the WW I:

Figure 3 – The logistics doctrine of the European armies in WW I

Source: based on Del Re (1955); Jomini, Mendell, Craighill (2007); Silva and Musetti (2003); United States, (2000).

For the perfect functioning of military logistics, connecting its three levels shown in Figure 3, its planning and preparation should comply with the conditions mentioned below:

Table 1 – Constraints on logistics

Constraints	Comments
Determination of needs	Minimum forecast of materials, services and human resources
Availability of resources	Leveraging local resources for army employment
Determination of restrictive factors	Survey and study whether the road network is compatible with means of transport
Availability of critical items	Forecasting an emergency reserve of critical items
Connection with supported elements	Ensure logistical support with supplies from the upper level for the supported elements
Continuity of support	Ensure support to the front line until the end of the operation
Aspect closed support	Shortest distance, measured by transport systems, to the front line

Source: prepared based on Brasil (2019); Del Re (1955); Jomini, Mendell and Craighill (2007); King, Biggs and Criner (2001).

4 THE PHYSICAL CHARACTERISTICS OF EAST PRUSSIA AND ITS INFLUENCE ON THE LOGISTICAL SUPPORT OF THE GERMAN AND RUSSIAN ARMIES

The physical aspects of a region with its main cities, its terrain, soil, vegetation, hydrography and its infrastructure, reflects in the movement of troops, in communication between the armies and in the organization of logistical support (BRASIL, 2017, 2019). Therefore, it becomes relevant to know the physical characteristics of East Prussia.

East Prussia was a territory located in the far east of the German Empire on the border with Russia, about 300 km long, 150 km deep and washed to the north by the Baltic Sea. Currently, this region is divided between Lithuania, Poland and Russia (BERGALLI, 1940; KIFFER, 2011).

Major German cities in the region were located to the North, such as Königsberg, which had fortifications of the German army, Gumbinnen, Marienburg and Insterburg, 60 km from the Russian border. In this region, there were farms that produced cereals and dairy products. However, the South was deserted and abandoned, inhabited by a few miserable peasants (KIFFER, 2011; TUCHMAN, 1998).

The predominant relief in the region was composed of large flat spaces with sandy and clayey soil. The South was dusty and mosquito-infested, making it hostile and with few resources to feed men and animals. In the North, there were swamps and dense forests, such as the Tomingen Forest. In this region there is a gorge, about 48 kilometers wide, near the town of Insterburg. The terrain was a restrictive factor for the movement of troops (DURSCHMIED, 2003; KIFFER, 2011; TUCHMAN, 1998).

The local hydrography has numerous watercourses, the most relevant of which are the Vistula rivers and the Angerapp, and numerous lakes, especially the Masurian lakes, near the border with Russia, which formed a 75 km wide barrier between North and South Prussia (BERGALLI, 1940; DURSCHMIED, 2003; KIFFER, 2011; KEEGAN, 2003).

The systems of railway branches in the German countryside were excellent, they "crossed out" the entire area and connected major cities. Thus, the Germans could move their troops quickly throughout the territory, which gave them great mobility to meet the enemy's advance in any area (DURSCHMIED, 2003; KIFFER, 2011; KEEGAN, 2003; TUCHMAN, 1998).

In Russia, there were not enough railway lines connecting its main regions to Prussia, and the gauges of its railways "had been deliberately built with a larger gauge than the German ones" (TUCHMAN, 1998, p. 68), as a preventive protection against an alleged German offensive on Russian territory. In addition, its gigantic territory made it difficult to establish communication lines, and consequently, the coordination of the movements of any troops (DURSCHMIED, 2003; MASSIE, 2014; KEEGAN, 2003; KIFFER, 2011; TUCHMAN, 1998).

The roads, north of Prussia, were long and rectilinear, but as they approached the Russian border they narrowed, allowing only cart traffic. In the South, the roads were sandy, insufficient and could not withstand heavy traffic, becoming an obstacle to the traffic of men and animals (DURSCHMIED, 2003 KIFFER, 2011; TUCHMAN, 1998).

It is partially concluded that the physical characteristics of East Prussia facilitated defensive operations, influencing the logistical support to combat units, as shown in Table 2 below:

Table 2 – Physical Characteristics and their influence on logistical support

Physical characteristics	Influence on logistical support	
	German army	Russian army
City	Königsberg Insterburg had the possibility for logistical support to dispose of critical items for the army.	There were no major Russian cities nearby. There was no facility for logistical support disposing of critical items for the army.
Terrain	Restrictive factor to the movement of logistics units.	Restrictive factor to the movement of logistics units.
Hydrography	Restrictive factor to the movement of logistics units.	Restrictive factor to the movement of logistics units.
Railway	Compatible railway - ease to connect logistics units with combatant units.	Incompatible railway – restrictive factor to the movement of logistics units. The Russian gauge was wider.
Highway	Compatible road - ease to link logistics units with combatant units.	Incompatible road - restrictive factor to the movement of logistics units.

Source: prepared on the basis of Brasil, (2019); (2003); Kiffer, (2011); Keegan (2003); and Tuchman (1998).

5 THE LOGISTICAL SUPPORT OF THE GERMAN 8TH ARMY

The logistical support of the 8th Army was mounted on a transport system that had at its disposal the existing railway branches in East Prussia, which together with the carts, established the regular flow of supplies leaving Konigsberg, its main garrison, for the troops at Gumbinnen, Marienburg and Tannenberg, obeying the doctrinal principle of continuous replenishment (DEL RE, 1955; DURSCHMIED, 2003 KING; BIGGS; CRINER, 2001; SONDHAUS, 2013; TUCHMAN, 1998).

Therefore, the 8th Army soldiers moved by trains with all their equipment, armaments, ammunition and horses, as well as the reinforcement troops from the Western Front, constituting a decisive factor in stopping the advance of the Russians and for their defeat (DURSCHMIED, 2003; SONDHAUS, 2013; TUCHMAN, 1998).

For the food of their troops, each German regiment had its field kitchen, consisting of kitchen wagons pulled by four horses. This device allowed the preparation of food, even with the army on the move (TUCHMAN, 1998). In addition, each soldier had a reserve ration, containing ground coffee, a flask of whiskey, two cans of meat, two cans of vegetables, and two packets of stale bread, "a type of unleavened bread" (TUCHMAN, 1998, p. 199).

In 1914, Germany already stood out worldwide as a major producer of armaments, ammunition and chemicals, thanks to companies such as Krupp, Skoda, Bayer and BASF. This year, the German army had in its stock more than 8,000 pieces of heavy artillery, in 1870, its stock was 1,585 pieces. In addition, each German infantryman was provided with 2,000 to 3,000 rounds of ammunition per rifle (Blaine, 2010; CREVELD, 2000; GOLDONI, 2012; KEEGAN, 2003; LE COUTEUR; BURRESON, 2006; TUCHMAN, 1998).

In summary, it can be seen that the 8th Army had an efficient transport system that effectively linked their base to various regions of Prussia, allowing the rapid movement of troops and provisions, and their soldiers had availability of critical items such as food, armaments and ammunition.

6 THE LOGISTICAL SUPPORT IN THE NORTH-WEST GROUP OF THE RUSSIAN ARMY

The main Russian base was located in the city of Baranovichi distant around 420 kilometers of Innerburg, and about 510 kilometers from Königsberg, that is, the Russian 1st and 2nd armies had a very extensive supply line and, with its lines of communications not established, it was difficult to coordinate their logistical support (DURSCHMIED, 2003; MASSIE, 2014; MACMILLIAN, 2013; KIFFER, 2011; KEEGAN, 2003; TUCHMAN, 1998).

The armies had a very limited transport system, mainly, due to the difference in the size of the gauge of the Russian and German Railways. As a result, the Russians were unable to use their wagons, restricting the distribution of supplies and the movement of troops. To use the German Railways, the Russians had to change the size of the gauge or capture the German trains. Thus, the two cavalry corps of General Rennenkampf who, in addition to

their reconnaissance mission, had orders to prevent the withdrawal of German railway wagons (DURSCHMIED, 2003; KEEGAN, 2003; MACMILLIAN, 2013; TUCHMAN, 1998).

With the lack of trains, the transport of supplies of the Russian army began to depend heavily on its wagons, which was a hindrance, due to its low speed and small carrying capacity. Another problem for this type of transport were the totally unsuitable sandy roads for the heavy traffic of more than 400,000 men, with their equipment, added to the fleeing German population. Soon, the roads turned into quagmires (KIFFER, 2011; KEEGAN, 2003; MASSIE, 2014; TUCHMAN, 1998). As reported by a commander of an artillery unit of Samsonov's Army:

> This wretched sand, it is hell for men and for cannons. The horses are already out of strength and my men have to push the artillery pieces with their arms. Every hundred meters something breaks. We should be happy if we can do twenty kilometers a day (DURSCHMIED, 2003, p. 220).

Consequently, when the armies received the orders to advance into hostile territory and moved away from their bases, their distribution columns of provisions collapsed, transgressing the principle of continuous replenishment of supplies. In this way, the lack of provisions began to be felt by the army just 25 kilometers from the Russian border. From August 17 to 19, supply levels dropped desperately, everything was insufficient, food for men and horses, ammunition, rifles, boots and medicines (DURSCHMIED, 2003; MACMILLIAN, 2013; TUCHMAN, 1998).

The soldiers consumed a huge amount of food, mainly bread and tea. As the rations did not arrive, the feeding of the Russians became miserable. In some units, soldiers went up to 72 hours without any food. The hungry and exhausted men did not advance in the direction of the enemy, they spent a good part of their time searching for food, killing the cattle and chickens they found (DURSCHMIED, 2003 TUCHMAN, 1998). In a short time, "the elite cavalry of the Cossacks was nothing more than a band of looters and arsonists" (DURSCHMIED, 2003, p. 219).

The reserves of rifles, machine guns, heavy weaponry and Army ammunition was insufficient, due to an incipient war industry. Thus, the Russian infantry began the campaign with 850 rounds per gun, less than half as many as the Germans had with their 2,000 to 3,000 rounds. With a few days of fighting, the shells began to run out and the solution found by the Russian High Command was to share its little ammunition of one Corps with another (Blaine, 2010; GOLDONI, 2012; MASSIE, 2014; TUCHMAN, 1998).

Russian troops did not have enough boots, causing soldiers to walk slowly and with their feet wrapped in rags, and to compound the problem, there were no bandages for the wounded (DURSCHMIED, 2003; TUCHMAN, 1998).

The deficiency of logistics in the Russian army can be depicted in the words of Colonel Sergei Michailovich Glagolev:

> Look at these starving peasants, most of them have never handled a rifle. It's impossible to call this an army. The Germans move their units by train, their troops, rested, can be quickly mobilized no matter where. We drag on without boots and our soldiers are tired before the battle begins (DURSCHMIED, 2003, p. 217).

Briefly, it can be noted that the Northwest group of the Russian army had no operational link between its base and its troops, its means of transport were limited and its soldiers did not have access to critical supplies such as food, armaments, ammunition and uniforms.

7 CONCLUSION

In WW I, military logistics was concerned with supplying men with food, animals, equipment and ammunition, and transporting everything necessary for the fulfillment of the army's mission.

In summary, in the Battle of Tannenberg, it was verified that factors such as the command of the troops, communication, the mobilized effective, the physical characteristics of East Prussia and the availability of critical items interfered in the logistical support and, consequently, in the outcome of the operations conducted by both armies, according to Table 3:

Table 3 – Factors affecting army maneuvers and logistical support

Factors	Implications for logistical support	
	The regularity of the German war machine	**The faults in the Russian army**
Command	United for the defence of Prussia.	Disunited by personal issues.
Communication	Established, including with the use of a reconnaissance aircraft.	There was no established line of communication. The Russian High Command did not have accurate information about the enemy and could not coordinate actions of the two armies.
Mobilized effective	Small effective. Trained, disciplined troops with knowledge of the terrain.	Numerical superiority of the Russian force. Troop poorly trained, poorly prepared and without knowledge of the terrain.
Physical characteristics of East Prussia	Ease of defensive operations.	Very extensive front line. Difficulty for offensive operation.
Availability of means and critical items	Compatible railway and highway – possibility to quickly move around the territory.	Incompatible rail and highway – restrictive factor to the movement of logistics units.

Source: prepared on the basis of Brasil (2019); Durschmied (2002); Keegan (2003); Kiffer (2011) and Tuchman (1998).

According to the arguments put forward, it can be concluded that Hoffmann's plan, which culminated in the counteroffensive of the 8th Army, was possible only thanks to effective logistical support, because: the German army was able to perfectly connect the strategic level of logistics with the operational and tactical, creating a continuous flow of supplies, where the German war industry produced sufficient armaments and ammunition to soldiers; the doctrine of continuous replenishment was obeyed, due to the assertive functioning of the intermodal transport system, bringing the necessary troops and provisions to the front line; and the soldiers had enough ammunition and food, preserving the combat power of the army.

On the other hand, the offensive of the armies of Rennenkampf and Samsonov was unsuccessful due to inefficient logistical support, because: the main base of the North-Western group of the Russian army was very far from the front line, between 400 and 500 kilometers; the transport system was very limited, the Russians could not use their trains and depended on carts, which restricted the distribution of provisions and troops movement, with that the distribution columns of supplies collapsed; a continuous flow of supplies was not established, transgressing the principle of continuous replenishment; the Russian war industry did not produce the rifles, the machine guns, the heavy weapons and ammunition in sufficient quantities; the soldiers, who were hungry and exhausted, had no desire to fight the enemy, spending a good part of their time in search of food.

In addition, the incompetence of the Northwest group of the Russian Army in organizing its logistics cost the army of the Empire a very high price: 92,000 to 95,000 soldiers imprisoned, 300 to 500 artillery pieces captured, incalculable wounded and dead, General Samsonov was dead, General Rennenkampf was dismissed and General Jilinsky was replaced from the command of the Northwest Group. The most serious of all this was that the Russian Second Army ceased to exist, ending the reputation of Tsarist Russia as a war power.

Through the literature review, it was possible to prove the division of logistics into three distinct levels, strategic, operational and tactical. In addition, the importance of establishing the *Supply Chain* interconnecting these three levels, to maintain the continuous flow of supplies to the armies. These lessons learned in World War I had profound reflections in the field of military logistics, enduring to the present day, *a posteriori*, its concepts were gradually absorbed into business logistics.

Finally, it can be stated that adequate logistical support to the combat troops of the German army and sufferable logistical support to the Russian front line contributed decisively to the great German victory at the Battle of Tannenberg.

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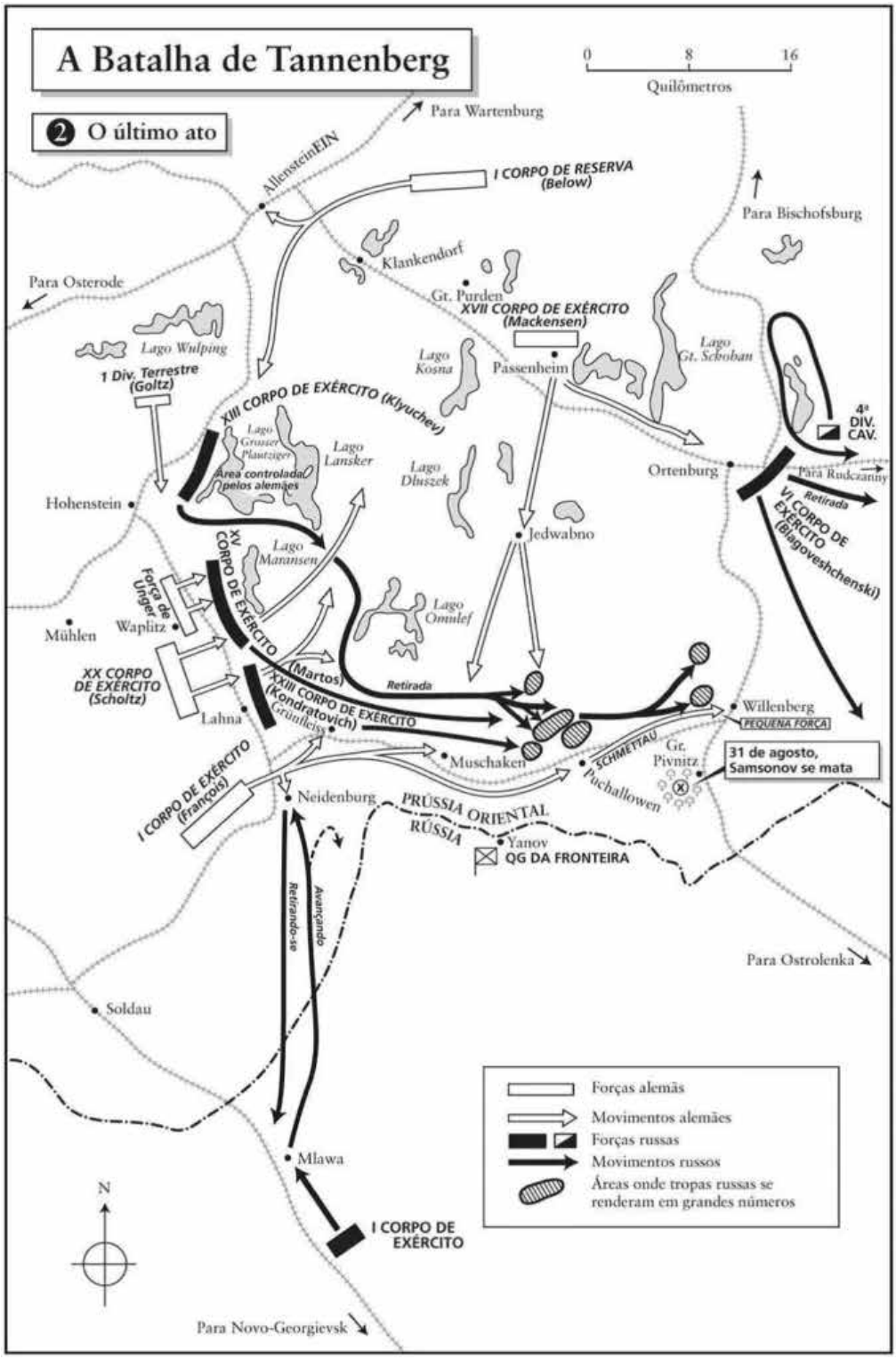
Figura 1 – La ofensiva rusa y la reorganización del 8º Ex Ale

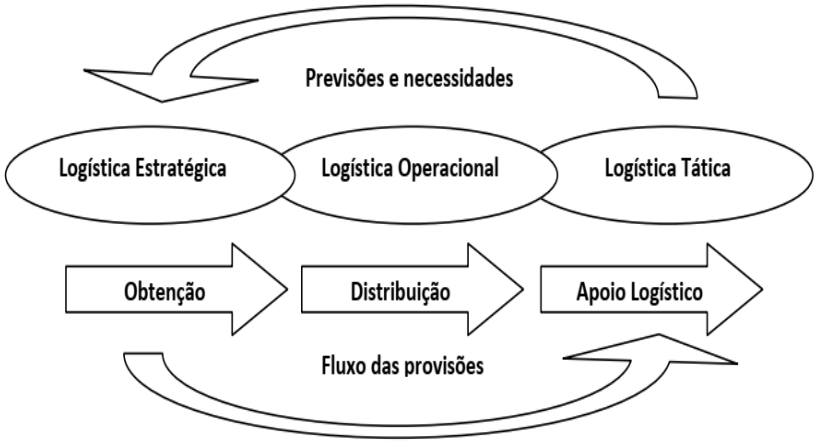
Fuente: Hastings (2014, p. 261).

Figura 2 – La contraofensiva alemana en Tannenberg



Fuente: Hastings (2014, p. 261).

Figura 3 – La Doctrina Logística de los Ejércitos Europeos en la Primera Guerra Mundial



Fuente: Elaborado en base a Del Re (1955); Jomini, Mendell, Craighill (2007); Silva y Musetti (2003); United States, (2000).

Para el perfecto funcionamiento de la logística militar, conectando sus tres niveles que se muestran en la Figura 3, su planificación y preparación debe cumplir con las condiciones que se mencionan a continuación:

Tabla 1 – Condicionantes de la logística

Condicionantes	Observaciones
Determinación de necesidades	Previsión mínima de materiales, servicios y recursos humanos
Disponibilidad de recursos	Aprovechar los recursos locales para el empleo en el ejército
Determinacción de factores restrictivos	Establecer y estudiar si la red viaria es compatible con los medios de transporte
Disponibilidad de artículos críticos	Predicción de una reserva de emergencia de artículos críticos
Conexión con elementos apoyados	Asegurar el apoyo logístico con suministros del escalón superior
Continuidad del apoyo	Garantizar el apoyo a la primera línea hasta el final de la operación
Aspecto apoyo cerrado	Distancia más corta, medida por los sistemas de transporte, a la línea del frente

Fuente: Elaborado a partir de Brasil (2019); Del Re (1955); Jomini, Mendell y Craighill (2007); King, Biggs y Criner (2001).

Tabla 2 – Características físicas y su influencia en el apoyo logístico

Características físicas	Influencia en el apoyo logístico	
	Ejército alemán	Ejército ruso
Ciudades	Königsberg e Insterburg tenían la posibilidad de apoyo logístico para desplegar elementos críticos para el ejército.	No había cerca ciudades rusas importantes. No había medios para que el apoyo logístico desplegara artículos críticos para el ejército.
Relieve	Factor restrictivo al movimiento de unidades logísticas.	Factor restrictivo al movimiento de unidades logísticas.
Hidrografía	Factor restrictivo al movimiento de unidades logísticas.	Factor restrictivo al movimiento de unidades logísticas.
Ferrocarriles	Red ferroviaria compatible – fácil conexión de unidades logísticas con unidades de combate.	Red ferroviaria incompatible – factor restrictivo al movimiento de unidades logísticas. El ancho de vía ruso era más ancho.
Carreteras	Red ferroviaria compatible – fácil conexión de unidades logísticas con unidades de combate.	Red ferroviaria incompatible – factor restrictivo al movimiento de unidades logísticas.

Fuente: Elaborado en base a Brasil, (2019); Durschmied (2003); Kiffer, (2011); Keegan (2003); y Tuchman (1998).

Tabla 3 – Factores que afectaron las maniobras de los ejércitos y apoyo logístico

Factores	Implicaciones para el apoyo logístico	
	La regularidad de la máquina de guerra alemana	Los desajustes en el ejército ruso
Comando	Unido por la defensa de Prusia.	Desunido por problemas personales.
Comunicación	Establecida, incluso con el uso de un avión de reconocimiento.	No se estableció ninguna línea de comunicación. El Alto Mando ruso no tenía informaciones precisas sobre el enemigo y no pudo coordinar las acciones de los dos ejércitos.
Personal movilizado	Pequeño efectivo. Tropas entrenadas, disciplinadas y con conocimiento del terreno.	Superioridad numérica de la fuerza rusa. Tropas mal entrenadas, mal preparadas y sin conocimiento del terreno.

Características físicas de Prusia Oriental	Facilidad para llevar a cabo operaciones defensivas.	Primera linea muy extensa. Dificultad para la operación ofensiva.
Disponibilidad de medios y elementos críticos	Red ferroviaria y vial compatibles – capacidad de moverse rápidamente por el territorio.	Rede ferroviaria y vial incompatibles – factor restrictivo al movimiento de unidades logísticas.

Fuente: Elaborado en base a Brasil (2019); Durschmied (2002); Keegan (2003); Kiffer (2011) y Tuchman (1998).