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Electric mobility in the Amazonas Military Police: future perspectives for financial and logistical efficiency.

Electric mobility in the Military Police of Amazonas: future perspectives for financial and logistical efficiency

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Summary

This study aims to analyze the future prospects of adopting electric and hybrid vehicles in the Amazonas Military Police (PMAM), considering their impacts on the institution's financial and logistical efficiency. The research, qualitative and exploratory in nature, is based on a bibliographic and documentary review, with an emphasis on studies on energy transition, engine efficiency, and sustainability policies. The results indicate that, although the immediate adoption of a fully electric fleet is unfeasible due to limitations in the regional energy infrastructure, hybrid vehicles represent an effective intermediate solution, reconciling performance, economy, and sustainability. It concludes that electric mobility, articulated with logistical and financial management, constitutes a strategic instrument to modernize public security, align the PMAM with the Sustainable Development Goals, and consolidate an efficient and environmentally responsible public management model.

Keywords: Electric mobility; Financial efficiency; Police logistics; Sustainability; Military Police of Amazonas.

Abstract

This study aims to analyze the future prospects of adopting electric and hybrid vehicles within the Military Police of the State of Amazonas (PMAM), considering their impacts on the institution's financial and logistical efficiency. The research, qualitative in nature and exploratory in scope, is based on bibliographical and documentary review, highlighting studies on energy transition, engine efficiency, and sustainability policies. The results indicate that, although the immediate adoption of a fully electric fleet is currently unfeasible due to the limitations of the regional energy infrastructure, hybrid vehicles represent an effective intermediate solution, combining performance, cost-efficiency, and environmental sustainability. It is concluded that electric mobility, when integrated with logistical and financial management, constitutes a strategic instrument for modernizing public security, aligning PMAM's operations with the United Nations Sustainable Development Goals, and consolidating a more efficient and environmentally responsible model of public administration.

Keywords: Electric mobility; financial efficiency; Police logistics; Sustainability; Amazon

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Military Police.

INTRODUCTION

Technological advancements and the growing demand for sustainable solutions have driven...
The adoption of electric vehicles in different sectors of society, including in public service and more
recently, within the security forces. In this context, the Military Police of the State of Amazonas
(PMAM), institution responsible for preserving public order in a territory of dimensions
Given its continental size and unique geographical characteristics, it faces significant challenges in this regard.
to logistical inefficiency and the high operational costs of their vehicles. The need to ensure the
The continuation of police activities with less financial and environmental impact has encouraged...
debate on the incorporation of new technologies that allow for a more [policing] model
Economical, sustainable, and modern.

Electric mobility presents itself as a strategic alternative to dependence on
Fossil fuels offer advantages from an economic, logistical, and environmental standpoint.
The use of electric vehicles, for example, can significantly reduce expenses.
fuel and maintenance costs are reduced, since electric motors have fewer components subject to high levels of fuel and maintenance.
They wear out and require less frequent maintenance, which contributes to the optimization of resources.
public (Wef, 2023; Onohara; Onohara, 2022). Furthermore, the use of electrical energy as a source
The motor system promotes a reduction in the emission of polluting gases, thus reducing the environmental impact of...
daily operations and aligning the institution with global sustainability goals.

This systematization is directly aligned with the goals of the Objectives of
Sustainable Development Goals (SDGs) proposed by the United Nations' 2030 Agenda
(UN), especially with SDGs 7 (Affordable and Clean Energy), 11 (Cities and Communities
Sustainable), 12 (Responsible Consumption and Production) and 13 (Climate Action). The implementation of an SGS[1]
in the Military Police of Amazonas, for example, can consolidate
Energy efficiency practices, emissions reduction and resource optimization, demonstrating the
institutional commitment to sustainability and environmental responsibility. In this way, the
SGS acts as an integrating instrument, aligning the principles of public management with the global agenda.
of sustainable development and contributing to the construction of more efficient and ethical policies
and environmentally responsible (UN, 2015; Barbieri; Silva, 2018).

In the specific case of the State of Amazonas, the application of this technology becomes particularly relevant.

[1] The Sustainability Management System (SMS) constitutes a structured set of practices, policies, and processes designed to promote a balance between economic development, environmental preservation, and social responsibility within public and private institutions.

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additional. The geographical and logistical peculiarities of the region, coupled with the difficulty of access to
The lack of fuel in remote areas and energy instability in inland municipalities make the search...
for innovative solutions that promote greater autonomy and efficiency in police activities.
Emerging technologies, such as fast charging and solar charging stations, are coming...
being improved and can contribute decisively to the viability of this transition.
(Onohara; Onohara, 2022). Thus, the implementation of electric or hybrid vehicles in the fleet
The PMAM's implementation represents an operational modernization, logistical and financial restructuring of the
corporation.

Even with such benefits, the adoption of this technology within the Military Police of
The Amazon project raises questions about its actual viability and efficiency in a regional context.
which presents considerable structural limitations. The central problem guiding this study may
It can be formulated as follows: the implementation of electric vehicles in the Military Police of Amazonas
This will effectively contribute to the corporation's financial and logistical efficiency, considering the...
What are the particular energy and territorial characteristics of the State of Amazonas? This question arises from the fact that...
that, although electric vehicles show promising performance and fuel economy, their full adoption is still a long way off.
This requires adequate charging infrastructure and significant investments, aspects that are still...
They are showing early signs in the region.

Given this problem, this article aims to evaluate the perspectives.
Future plans for the adoption of electric vehicles in the Amazonas Military Police, focusing on efficiency.
institutional financial and logistical support. To that end, the first specific objective is established.
to analyze the economic, environmental, and operational benefits and challenges arising from
Implementation of electric and hybrid vehicles in the PMAM (Military Police of Amazonas). As a second specific objective, it seeks-
to investigate how electric mobility can optimize the use of financial resources and
logistics of the institution, promoting greater sustainability and efficiency in operations of
visible policing.

The relevance of this research stems from the need to understand how...
The incorporation of electric mobility can transform the management of public resources and contribute to...
The modernization of police activities in the State of Amazonas. In addition to its economic character, the
This initiative is aligned with environmental principles and administrative efficiency, values that have
guiding contemporary public policies focused on sustainability and technological innovation.

2. METHODOLOGY

This research work is based on a qualitative approach, of a nature
theoretical-descriptive and exploratory in nature, whose objective is to understand, through the analysis of
Based on existing literature, the prospects for implementing electric mobility in the Military Police of

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The State of Amazonas and its implications for financial efficiency and institutional logistics. According to

According to Severino (2018), qualitative research seeks to interpret social and institutional phenomena from...

from understanding their meanings and contexts, allowing a critical look at the relationships between

Theory and practice. This research prioritizes the interpretation and reflection on data and arguments.

presented by authors and institutions that deal with the topic of electric mobility,

Sustainability, energy efficiency, and public management.

The methodology adopted is based on bibliographic and documentary research, as proposed.

Severino (2018), through the review of works, scientific articles, institutional reports and

official documents related to the theme of energy transition, logistics efficiency and

Environmental sustainability. This methodological strategy aims to gather and analyze different perspectives.

theoretical frameworks on the application of electric and hybrid vehicles in the public sector, especially in

police corporations, enabling a well-founded reflection on the benefits and challenges of

adoption of this technology in the Amazonian context. National sources were selected and

international publications published between 2004 and 2024, ensuring an up-to-date and diverse database of

data.

The theoretical framework focuses on Rational Choice Theory, which, according to Carvalho

(2013) proposes that institutional decisions should be understood as a result of evaluation.

A rational balance between costs, benefits, and available resources. This theoretical perspective is well-suited to the study.

of logistical and financial efficiency in public administration, as it allows for the evaluation of how decisions

Regarding the replacement of the traditional vehicle fleet with electric vehicles, they can maximize results and...

Reduce waste. Therefore, the analysis is conducted considering that strategic choices

The actions of the Military Police of Amazonas reflect economic aspects and institutional values of

Sustainability, efficiency, and modernization.

The data collection was based on the analysis of secondary sources, including reports.

official documents of the Military Police of Amazonas, government documents, relevant legislation and data.

Technical data on the energy performance of electric and hybrid vehicles. The interpretation of the data was

This was carried out in light of recent studies on electric mobility and sustainable management, such as those by Onohara.

and Onohara (2022), the World Economic Forum (WEF, 2023) and Naito (2024), who discuss the

The transition to clean energy matrices and its economic and operational impacts. The triangulation

Combining theoretical foundations with published empirical evidence allows for the consolidation of a comprehensive overview.

Criticism regarding the technical and financial feasibility of electric mobility in the context of the Military Police.

from the Amazon.

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3. THEORETICAL DISCUSSION

3.1 Electric Mobility

Electric mobility can be understood as a concept that represents the transition from transportation systems based on fossil fuels to propulsion systems powered by electricity, whether from renewable or non-renewable sources. This transformation is part of a movement A global search for sustainable and efficient solutions aimed at reducing greenhouse gas emissions. pollutants, the consumption of non-renewable fuels and the costs associated with urban transport and rural. According to Onohara and Onohara (2022), electric mobility consists of partial electrification. or the entire transportation system, involving motor vehicles that use electric motors. powered by rechargeable batteries, replacing traditional internal combustion engines. The central objective of this model is to promote energy efficiency and reduce environmental impacts. Reconfigure urban mobility and logistics policies.

Specialized literature indicates that electric mobility is not limited to replacement. Technological advancements in vehicles involve a structural change in the way they are produced, distributed, and consumed. energy. According to the World Economic Forum (WEF, 2023), the transition to energy systems Electric transportation is intrinsically linked to the reconfiguration of the global energy matrix, requiring Strengthening clean energy sources, such as solar, wind, and hydroelectric power, and developing... Adequate infrastructure for fast and efficient charging. In this sense, electric mobility takes on... a strategic role in consolidating a low-carbon economic model, aligned with the goals of climate neutrality and the Sustainable Development Goals (SDGs), especially those of number 7 (Affordable and Clean Energy), 11 (Sustainable Cities and Communities) and 13 (Action Against Global Climate Change.

From a technical point of view, electric vehicles have a mechanical architecture. simplified when compared to combustion-powered vehicles. According to Mepram (2023), the absence of complex systems, such as exhaust, transmission and components subject to Intense friction results in less mechanical wear and reduced maintenance costs. Furthermore, The energy efficiency of electric motors is superior, since the conversion of energy Electrical energy conversion to mechanical energy occurs more efficiently, reducing losses in the process. propulsion. This technical characteristic gives electric vehicles an efficiency rate that can achieve up to 90% of total energy consumption, contrasting with the average efficiency of 30%. 40% of combustion engines (Onohara; Onohara, 2022).

However, the consolidation of electric mobility faces structural challenges, especially in regions with limited energy infrastructure. Naito (2024) highlights that the transition to a matrix Sustainable electricity requires significant investments in distribution networks, clean generation, and... intelligent charging systems. In the case of the state of Amazonas, the energy shortage of

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Certain municipalities and the dependence on thermoelectric power plants hinder the full adoption of this. Technology. The widespread adoption of electric vehicles demands integrated planning between the energy, transport and public management sectors, in order to avoid overloading local systems and ensure The efficiency of the transition.

In addition to technological and energy aspects, electric mobility must also be analyzed from a social and environmental perspective. According to Clark and Beak (2023), the accelerated growth of The fleet of vehicles powered by fossil fuels in the Amazon increased by approximately 27% between The years 2021 and 2023 have contributed to an increase in air and noise pollution, as well as impacting... negatively impacts the quality of life in urban areas. In this context, electric mobility emerges. as a concrete alternative to reduce emissions and promote a cleaner urban environment and healthy. DETRAN-AM (2021) reinforces this perspective by showing that the state fleet is growing annually around 4%, which demonstrates the urgency of public policies aimed at the adoption of Less polluting technologies. From this perspective, electric mobility should be understood. as an instrument of institutional and social transformation, capable of aligning progress technological alignment with the environmental and economic efficiency goals proposed by the 2030 Agenda. United Nations (UN, 2015).

3.2 Application of Electric Mobility in the Military Context

The application of electric mobility in the military context represents one aspect of Technological advancement focused on sustainability and operational efficiency. In the case of the Military Police. of the State of Amazonas (PMAM), whose institutional mission is to preserve public order and the environment. environment (AMAZONAS, 2010), the introduction of electric or hybrid vehicles can contribute to Reducing logistics costs, modernizing the fleet, and mitigating environmental impacts. The energy transition in the public security sector reflects a broader movement of innovation and Sustainability in public administration, aligned with the goals of the Sustainable Development Goals. Sustainable Development Goals (SDGs), especially SDG 11, which seeks to promote sustainable cities and communities. sustainable (UN, 2015).

Police activity, by its very nature, demands constant mobility, rapid response, and Logistical efficiency. In Amazonas, these requirements become even more complex due to... territorial extension, geographical conditions, and the diversity of operational scenarios. According with the Military Police of the State of Amazonas (PMAM, 2022), there are approximately 400 patrol cars in This operation covers the entire state, acting continuously in visible policing. The large number of vehicles represents a high consumption of fossil fuels and, Consequently, high financial and environmental costs. The introduction of electric vehicles or Hybrid vehicles can substantially reduce these costs, since the cost per kilometer driven and the Maintenance costs for electric motors are significantly lower when compared to gasoline motors.

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combustion.

Electric and hybrid vehicles, when adapted to police work, offer advantages.
relevant operational aspects. According to Neocharge (2023), the incorporation of recovery systems of
Kinetic energy recovery (KERS) allows for the reuse of energy generated during braking.
transforming it back into electrical energy stored in batteries. This mechanism, in addition to
Increasing energy efficiency extends vehicle range during prolonged operations. Another
A key feature is the quiet operation of the electric motors, which promotes discretion.
in surveillance missions, night patrols, and tactical operations, optimizing communication between
the agents and reducing noise pollution.

The full implementation of electric mobility in a military context requires attention to...
regional and technical particularities of the State of Amazonas. As Naito (2024) points out, the
The local energy infrastructure still has structural limitations, with frequent power outages.
and the high cost of electricity, especially in municipalities that depend on thermal power plants. This scenario
This represents a significant obstacle to the deployment of a 100% electric fleet, making adoption difficult.
Hybrid vehicles offer a more viable transitional alternative. Hybrid models, which combine
Electric and combustion engines provide greater operational autonomy and independence.
energy-efficient, being especially suitable for regions where the electricity supply is
irregular.

It is observed that internal combustion engines operate according to the principle of machines.
Thermal forces, which convert heat into mechanical work, in this case, the energy required for the
The movement of vehicles. This conversion is based on the so-called Carnot cycle, considered the
Ideal theoretical model for the operation of a heat engine. As described
Nascimento, Braga and Fabris (2004), a heat engine needs a heat source, responsible
one provides the heat, and the other is a sink or cold source, where some of the thermal energy is dissipated.
Due to thermodynamic limitations, there is no heat engine capable of converting
entirely converts heat into useful work, which results in unavoidable energy losses.

The maximum theoretical yield of this process is defined by the formula = 1 ÿ $\frac{2}{1}$ in what

1 represents the temperature of the hot source and 2 the temperature of the cold source. This limitation is explained by...
Internal combustion engines have limited efficiency, since a large part of the energy generated by burning the
fuel is lost as dissipated heat. In light of this principle, it is understood that...
I know that electric vehicles have substantially higher energy efficiency when
compared to combustion-powered vehicles. While internal combustion engines convert only
Approximately 30% of the energy contained in the fuel can be converted into useful motion by electrical systems.
achieve yields of up to 90%, due to lower energy dissipation and the absence of processes.
combustion (Onohara; Onohara, 2022; Mepram, 2023).

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This difference in efficiency reduces energy consumption, directly impacting costs.
operational costs and emissions of polluting gases. However, the implementation of electric vehicles in
Large-scale operations face obstacles related to charging infrastructure and the time required for...
replenishment and regional energy availability are particularly critical factors in this context.
Amazonian region, where the energy supply is still unstable and, in some areas, rationed.
(Onohara; Onohara, 2022; Naito, 2024).

Given this reality, the adoption of hybrid vehicles emerges as an alternative to
A viable and strategic transition, capable of reconciling energy efficiency and operational autonomy.
Hybrid vehicles combine electric motors and internal combustion engines, allowing the use of...
Integrated or independent of both energy sources, depending on the travel conditions.
(Onohara; Onohara, 2022). These models are classified into three main categories: Full
Hybrid, in which both engines can operate together or autonomously; Mild Hybrid,
in which the electric motor only assists the combustion engine, without the ability to operate itself.
Independent; and Plug-in Hybrid, equipped with larger batteries that can be recharged via wall outlets.
electric vehicles, offering greater autonomy in electric mode (WEF, 2023; Mepram, 2023).

The operational advantages of hybrid vehicles are widely recognized. In traffic
In urban areas, the predominant use of electric motors considerably reduces fuel consumption and
greenhouse gas emissions, in addition to reducing noise pollution, making cities more
silent and sustainable (Onohara; Onohara, 2022; MEPRAM, 2023). Furthermore, many of these
Vehicles are equipped with a Kinetic Energy Recovery System (KERS), which converts the
Energy generated during braking is converted into electrical or mechanical energy, storing it in batteries or
in inertia flies for later use (Neocharge, 2023). This system increases range and
Energy efficiency, reducing energy waste and contributing to savings.
fuel.

These characteristics make the use of hybrid vehicles particularly suitable for this activity.
Military police officer, which requires performance, reliability, and autonomy in prolonged operations.
In the context of the State of Amazonas, policing takes place in urban and rural areas that are difficult to access.
Given access and precarious energy infrastructure, the use of hybrid vehicles offers a solution.
Practical and sustainable.

By enabling operation on both electricity and fuel.
Conventional vehicles ensure the continuity of operations even in restricted areas.
of electrical energy, preserving the efficiency and safety of missions (Onohara; Onohara, 2022;
(WEF, 2023). In this way, hybrid mobility represents a fundamental intermediate step.
towards a complete transition to an electric fleet, allowing the Amazonas Military Police to reconcile
Sustainability, performance, and economic efficiency.

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These unique characteristics allow for the widespread use of hybrid vehicles in this activity. military police force due to combining the perspectives of power, maneuverability, and economy of fuels that are essential in carrying out police and military activity in the State of Amazonas, In addition to not being dependent on a single energy source, namely electricity or fuel, which would help to the rural areas of the state where electricity is rationed.

From the perspective of institutional sustainability, the introduction of electric or hybrid vehicles The Military Police's role directly contributes to strengthening environmental governance practices. and for the construction of a modern and responsible institutional image. According to the Forum According to the World Economic Forum (WEF, 2023), the adoption of clean technologies by security forces reduces The environmental impacts improve management efficiency and the allocation of public resources. The gradual incorporation of this technology into police operations can therefore represent a Double win strategy: optimize operational performance while simultaneously aligning the corporation to the environmental commitments undertaken by the Brazilian State in agreements international.

Thus, electric mobility applied to the military context transcends the technical aspect and It takes on a strategic and institutional dimension (Neocharge, 2023). It is an instrument of administrative modernization, which contributes to the rational use of resources, logistical efficiency and environmental preservation. In the case of the Amazonas Military Police, this technological innovation reflects an opportunity to improve visible policing operations, reduce costs and strengthen the A commitment to sustainability without compromising the corporation's operational capacity.

3.3. Financial and logistical efficiency in the context of the Military Police

The term "logistics" originates from the Greek word *logistiké,* which means "related to calculation" or "to". "Reasoning," derived from the word logos, associated with logic and reason. Historically, logistics was born due to the military's need to supply troops on the move with food, weapons, and ammunition. Over time, it evolved into a concept of strategic management, defined as the process of planning, implementation and control of the efficient flow of goods, services and information from its From origin to end consumer. This modern view of logistics seeks to integrate efficiency and economy. throughout all stages of the process, ensuring agility and sustainability in operations. Mauricio *et al.,* (2021), highlight:

> Logistics costs account for 11.7% of Brazil's GDP, and logistics expenses represent 7.6% of net revenue, considering transportation, inventory, and warehousing costs. Measuring these costs and their impact on the company's and products' total costs is necessary. Furthermore, logistics costs can be defined as all costs incurred from the supply of raw materials to the delivery of the product to the consumer (Maurício *et al.,* 2021, p. 165).

According to Gomes and Thiesen (2022), military logistics is an essential activity, as it guarantees Maintaining the operational capacity of corporations, ensuring a continuous supply of

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Materials, equipment, and personnel. Thus, it is through logistics that police activities are carried out.

They make things possible and sustainable over time.

The Military Police of the State of Amazonas (PMAM), responsible for policing

ostentatious and for the preservation of public order, it operates in a territory of continental proportions and

Complex geographical features, which require highly efficient logistical planning.

Law No. 3,514/2010 defines that it is the institution's responsibility to "preserve public order and the environment in

The State of Amazonas through an excellent visible policing" (AMAZONAS, 2010, p.

2) Such a mission requires technical expertise and effective and sustainable resource management.

Gomes and Thiesen (2022, p. 34) state that:

> Logistics in the Military Police is a conditio sine qua non activity for the proper execution of police operations, as it is through logistics that the coordination and control of supplies, equipment, vehicles, and personnel are carried out. It is a process dynamic, which connects institutional strategy to operational execution (Gomes and Thiesen, 2022, p. 34).

This understanding demonstrates that military logistics is not limited to the transportation of resources.

It integrates all operations, acting as the link between organizational efficiency and effectiveness.

public security actions. In the case of the PMAM (Military Police of Amazonas), the logistical complexity is accentuated by...

need for constant travel in hard-to-reach areas due to lack of infrastructure.

Road transport is dependent on river transport. Therefore, efficient logistics management becomes...

indispensable to ensure that operational units, even in the most remote regions,

maintain full functionality.

In addition, financial efficiency is another essential component of management.

Modern public administration, especially in contexts of budgetary constraints, implies the rational use of public resources.

of the available resources and the balance between the cost and benefit of institutional actions. As observed

Stutz (2010, p. 3):

> The economic problem is, in essence, the challenge of satisfying unlimited wants with limited resources. This is the basis of all rational choices involving the efficient distribution of scarce resources. In the public sector, this translates into the need to accomplish more with less (Stutz, 2010, p. 3).

Financial efficiency in the Amazonas Military Police should focus on the intelligent use of resources allocated to fleet maintenance, equipment acquisition, and personnel training. The introduction of new technologies, such as electric and hybrid vehicles, is an alternative that simultaneously addresses cost reduction and environmental sustainability.

The relationship between logistics and finance is one of interdependence: the efficiency of one is directly linked to the rationalization of the other. According to Gomes and Thiesen (2022), logistics represents the bridge between strategic planning and operational execution, and is therefore the instrument that enables the achievement of institutional results. This synergy is essential for meeting the efficiency goals established by public administration, especially in security institutions, where the ability to respond quickly and the reduction of operational costs are determining factors.

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The Amazonian context presents particular challenges. Long distances, river transport, and limited infrastructure demand creative and integrated solutions. The PMAM (Amazon Military Police) has sought partnerships with municipal and state governments and private companies to optimize the supply and movement of resources (Gomes; Thiesen, 2022). These collaborations reinforce the need for a systemic vision, in which logistical and financial efficiency go hand in hand for the sake of institutional sustainability.

As Stutz (2010, p. 5) aptly summarizes:

> True efficiency lies in reducing expenses, in the ability to maintain or improve the quality of services provided, even in the face of budgetary constraints. Efficiency, in its broadest sense, is producing more value with the same or fewer resources (Stutz, 2010, p. 5).

Therefore, financial and logistical efficiency within the context of the Amazonas Military Police should be understood as a continuous process of planning, innovation, and sustainability. The use of clean technologies and integrated resource management can transform how the corporation manages its operations, reducing costs, expanding response capacity, and strengthening its commitment to environmental responsibility. Thus, the logistical and financial modernization of the PMAM is a technical requirement, a strategic imperative for the efficiency of public service, and the consolidation of management aligned with the principles of economy, effectiveness, and sustainability (Maurício *et al.,* 2021).

4. Electric Mobility with Financial and Logistical Efficiency for the Military Police of Amazonas (PMAM)

The relationship between electric mobility, financial efficiency, and logistics in the context of policing. The Amazonas State Military Police (PMAM) involves a multidimensional analysis that considers Economic, structural, operational, and environmental aspects. The implementation of electric vehicles. or hybrid models represent a paradigm shift in how the institution manages its resources, planning their operations and ensuring the sustainability of their activities.

In this sense, it is clear that the implementation of a 100% electric fleet in the context of PMAM depends not only on internal or external financial contributions, but also on infrastructure. Ample and stable energy. For an electrical matrix model to be able to support the voltage generated by at least 400 vehicles in continuous operation, it is necessary that the cities of the State of Amazonas has the technical capacity to carry out recharges efficiently, without compromise residential and industrial supply (PMAM, 2021).

However, the state's energy matrix still has deficiencies, with high costs. Frequent power outages and a heavy reliance on thermal power plants are factors that compromise the economy. the sustainability potential of the full electricity transition. As Naito (2024) points out, the The predominance of energy from fossil fuels makes a change unfeasible in the short term. an effective structural solution in the Amazonian energy matrix, which would require large investments in Infrastructure and renewable energy sources.

Given this scenario, the adoption of a 100% electric fleet by the PMAM (Military Police of Amazonas) proves to be a... perspective to be achieved, due to the lack of adequate infrastructure and the inability

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Energy available on the so-called "Amazonian power line". The *plug-in* hybrid vehicle model emerges as a more viable, sustainable and strategic alternative, as it offers operational flexibility, both with both electric and combustion engines. Furthermore, when the State has the means to... With better energy infrastructure conditions, such vehicles can be fully integrated into The electrical grid, since its batteries are rechargeable via conventional outlets, which guarantees its technological longevity (Onohara; Onohara, 2022).

The cost-benefit ratio of adopting hybrid vehicles is widely tangible and positive. The cost per kilometer driven is lower than that of vehicles powered by fossil fuels, thanks to... The efficiency of the electrical conversion reduces energy waste compared to motors. Thermal engines. In addition to fuel savings, the total maintenance cost is considerably lower. due to the simplicity of electrical systems and the smaller number of components subject to wear and tear (Onohara; Onohara, 2022, p. 87). As the authors point out, “cost reduction is not It limits energy consumption, but also covers extending the lifespan of components. "Reducing mechanical interventions and increasing operational reliability."

These advantages are corroborated by experiences in other regions of the country. Study conducted by the Porto Alegre Municipal Government (2022) demonstrated that the replacement of buses Replacing combustion engine vehicles with electric models would result in savings of R$ 3.7 billion by 2050. considering only the cost of fuel. When the benefits related to reduction are added... Considering both pollution and the positive impacts on public health, the amount saved could reach... R$9 billion. This data reinforces that electric mobility is an environmental strategy, as a policy. public financial efficiency and sustainable economic management.

The adoption of a hybrid fleet by the PMAM (Military Police of Amazonas) would bring immediate logistical and tactical benefits. Because they are quieter, hybrid vehicles are advantageous for carrying out surveillance operations and night patrols, allowing for clearer communication between police officers and facilitating the Execution of encirclement and interception actions. The absence of noises characteristic of engines a Combustion makes approaches more discreet and effective, increasing the element of surprise in operations. (Onohara; Onohara, 2022). In addition, the presence of kinetic energy recovery systems (KERS) allows the energy generated during braking to be converted into reusable electrical energy. extending range and reducing fuel consumption (Neocharge, 2023).

From a logistical point of view, electric and hybrid mobility also simplifies the... Fleet and supply management. According to Gomes and Thiesen (2022), logistics is the link. fundamental between the strategic planning and operational execution of security forces, being directly affected by transportation, maintenance, and supply costs. The replacement The gradual replacement of conventional vehicles with hybrid models would allow for greater predictability. budgetary and operational efficiency, reducing dependence on fossil fuels and

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Vulnerability in the face of oil price fluctuations.

Gomes and Thiesen (2022, p. 37) reinforce this idea:

> Logistics is the fundamental link between institutional strategy and operational action. Its efficiency is directly linked to the rationalization of resources and the technological adaptation capacity of corporations. The introduction of new technologies, when well planned, reduces costs and increases the effectiveness of actions (Gomes, Thiesen, 2022, p. 37).

The adoption of sustainable mobility technologies also opens up fundraising opportunities. of financial resources from national and international organizations focused on sustainability and Technological innovation. As highlighted by the World Economic Forum (WEF, 2023):

> Governments and institutions that incorporate clean technologies into their operations strengthen their ability to attract foreign investment and participate in climate finance programs. Sustainability, in this context, ceases to be a cost and becomes a driver of institutional competitiveness (WEF, 2023, p. 52).

Therefore, the transition to hybrid vehicles would bring direct resource savings to the PMAM would increase its institutional visibility, strengthening its image as a corporation. Innovative and committed to environmental sustainability and efficiency in public management. This Modernization could even be partially funded by parliamentary amendments or by international funds aimed at projects that combine public safety and environmental protection, two issues of increasing relevance on the global agenda (Porto Alegre, 2022; WEF, 2023).

The adoption of a hybrid fleet, therefore, represents a strategic opportunity for Integration between financial efficiency, logistical efficiency, and institutional sustainability. The initial investment tends to be offset by significant reductions in fuel costs and maintenance, as well as lasting operational and environmental gains.

Stutz (2010, p. 4) summarizes: “Economic efficiency, when guided by Sustainability generates a virtuous cycle of growth and rationality. The initial investment in Innovation tends to translate into continuous productivity gains and future cost reductions. It is observed that electric and hybrid mobility can transform police resource management. The military of Amazonas, making it more rational, economical and sustainable.

5. FINAL CONSIDERATIONS

An analysis of electric mobility in the context of the Military Police of the State of The Amazonas Military Police (PMAM) highlights that fleet modernization and energy transition constitute a A promising, yet challenging path for the institution. The progressive replacement of vehicles. The replacement of combustion-powered vehicles with electric or hybrid vehicles reflects a technological innovation, a a public management strategy guided by financial efficiency and environmental sustainability. for logistical efficiency. The adoption of these technologies, however, requires short-term planning, long-term investments in energy infrastructure and an integrated institutional policy that

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Consider the territorial and socioeconomic specificities of the State of Amazonas.

It has been empirically observed that electric vehicles, although more efficient from a business perspective, From an energy and environmental perspective, they still face obstacles related to the local electrical infrastructure. characterized by high costs, unstable supply, and a strong dependence on thermal power plants (Naito, 2024). Such limitations make the implementation of a 100% electric fleet unfeasible in the short term. making plug-in hybrid models the most viable alternative. These vehicles combine performance, Autonomy and sustainability, being able to operate on both electricity and fuel. conventional, which makes them ideal for the geographical and logistical conditions of the Amazon.

From a financial and logistical standpoint, it has been found that electric and hybrid mobility... This can lead to significant reductions in the operational costs of the PMAM (Military Police of Amazonas). Savings can occur. mainly due to the reduction in the consumption of fossil fuels and the need for maintenance. and the mechanical complexity of the vehicles. This reduction in expenses, combined with the increased durability of the Equipment allows for the redirection of resources to priority areas of the corporation. contributing to the improvement of visible policing activities and personnel management.

From an operational standpoint, the use of hybrid vehicles offers tactical advantages. evident features, such as silent operation, which facilitates surveillance and patrolling operations. Nighttime, and the presence of regenerative systems, such as KERS, which recover some of the energy. during braking, increasing range and energy efficiency. These factors, combined with Reducing noise and pollutants contributes to improving the quality of life in cities. and for the construction of an environmentally responsible public safety model.

In addition to the economic and logistical benefits, electric mobility applied to PMAM has Strategic potential for attracting external funding. Projects focused on sustainability and... Energy efficiency measures are in line with the United Nations' 2030 Agenda. particularly with the Sustainable Development Goals (SDGs). In this way, initiatives that integrate public safety and sustainability can attract national funding and internationally, strengthening the institutional capacity of the PMAM and positioning it as a benchmark in Green innovation in the Brazilian public sector.

The adoption of electric and hybrid mobility represents a smart management policy, which It combines cost reduction, operational improvement, and environmental responsibility. This Integration reflects a cultural and structural shift within military corporations, in which the Technological innovation is now understood as a tool for improving efficiency. institutional.

In this sense, it is concluded that the gradual implementation of electric and hybrid mobility in The Military Police of Amazonas is technically feasible and strategically necessary, provided that... accompanied by public policies that ensure investments in infrastructure and training.

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Technical and budgetary sustainability. Thus, electric mobility, when linked to management financial and logistical aspects are consolidating themselves as a driver of innovation and public responsibility, aligned to the environmental, economic and social challenges of the 21st century.

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