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Restructuring the Amazonas Military Police force: proposing a formula for the ideal force size.

The restructuring of the Military Police force of Amazonas: proposition of the ideal force strength formula

Luiz Carlos Teles Da Silva Júnior - Bachelor of Laws from Faculdade Martha Falcão and specialist in Criminal Law from Uniasselvi, 3rd year Cadet PMAM, currently pursuing a Bachelor's degree in Public and Citizen Security at the State University of Amazonas, Manaus, Amazonas. Contact: lc.teles.jr@hotmail.com Lattes: http://lattes.cnpq.br/1160241902893682

Adriana Sales Gomes - Specialist in Strategic Management in Public Security (UEA), Public Management applied to Security (UEA), Military Law (UNINORTE), Bachelor in Public and Citizen Security (UEA) and Nursing (UFAM). Officer of the PMAM (Military Police of Amazonas), she served as Commander of the 27th CICOM, PROERD instructor, and 1st Commander of the Maria da Penha Patrol (PMAM). Currently a Lieutenant Colonel, Deputy Director of the Active Personnel Directorate (PMAM), responsible for Strategic Personnel Management of the PMAM and Instructor of Officer and Enlisted Personnel Training Courses (PMAM). Contact: pm.adrianasales@gmail.com Lattes: http://lattes.cnpq.br/8621829498826458

Denison Melo de Aguiar - Post-Doctorate UniSalento (Italy-2024), Doctor of Law. Doctor of Law from the Postgraduate Program in Law at the Federal University of Minas Gerais (PPGD/UFMG). Master of Environmental Law from the Postgraduate Program in Environmental Law at the State University of Amazonas (PPGDA/UEA).
Lawyer. Graduated in Law from the University of the Amazon (UNAMA/PA). Professor of higher education in the Law course at UEA. Professor at the Military Police Academy of Amazonas (APM-PMAM). Professor of higher education at the University Center for Higher Education of Amazonas (CIESA). Coordinator of the Clinic for Conflict Resolution Mechanisms (MArbiC/UEA). Coordinator of the LGBTI Law and Citizenship Clinic (CLGBTI/UEA). Coordinator of the Animal Law Clinic (YINUAKA-UEA). Editor-in-chief of the Equidade Magazine. Member of the research group Challenges of Access to Human Rights in the Amazonian Context of the Superior School of the Judiciary of Amazonas (ESMAM). Permanent professor of the Postgraduate Program in Public Security, Citizenship and Human Rights (PPGSP/UEA). Contact: denisonaguiarx@gmail.com http://lattes.cnpq.br/9956374214863816 - https://orcid.org/0000-0001-5903-4203

Kristorferson Almeida do Rêgo - 3rd year Cadet of the Military Police of Amazonas. Bachelor's degree in Public and Citizen Security from the State University of Amazonas – Contact: kr.asafe.noah.pedro@gmail.com .
Lattes: https://lattes.cnpq.br/4078604726881272 .

Willian Falcão Damasceno - Lutheran University Center of Manaus - CEULM/ULBRA - Bachelor of Laws and Specialist in Public Security Management 2019, Contact: falcaofalcao0210@gmail.com Lattes: https://lattes.cnpq.br/3409972935695294

Summary

This article develops and applies a formula for calculating the ideal police force size for the Military Police of the State of Amazonas (PMAM), considering the territorial, demographic, criminal, and operational peculiarities of the region. The research is characterized as applied, with a quantitative and qualitative approach, based exclusively on institutional documents, official reports, academic studies, and official databases. The methodology involved the analysis of population indicators, violent death rates, criminal dynamics, territoriality, seasonal events, and the strategic position of municipalities, culminating in the construction of a mathematical model based on three main variables: population, crime rate, and key city status. The results indicated that municipalities such as Manaus and Tabatinga require substantially larger police forces than they currently have, while cities such as Parintins and Manacapuru have increased needs due to the holding of large cultural events. The final projection revealed that the ideal state police force is between 10,400 and 15,000 officers, a value aligned with current legislation and the PMAM's 2023–2032 Strategic Plan. It is concluded that the proposed formula is technically feasible, operationally applicable, and institutionally coherent, constituting a relevant instrument to guide public tenders, the rational distribution of personnel, and the planning of permanent public security policies in Amazonas.

Keywords: Police force; Public security; Staffing calculation; Amazonas; Strategic management.

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Abstract

This article develops and applies a formula for calculating the ideal police force size of the Military Police of the State of Amazonas (PMAM), taking into account the region's territorial, demographic, criminal, and operational particularities. The research is characterized as applied, with a quantitative and qualitative approach, grounded exclusively in institutional documents, official reports, academic studies, and databases provided in the annexes. The methodology involved analyzing population indicators, violent death rates, criminal dynamics, territorial factors, seasonal events, and the strategic relevance of municipalities, culminating in the construction of a mathematical model based on three main variables: population, crime index, and key-city condition. The results indicated that municipalities such as Manaus and Tabatinga require substantially larger police forces than currently available, while cities like Parintins and Manacapuru demonstrate expanded needs due to major cultural events. The final projection revealed that the ideal statewide police force ranges between 10,400 and 15,000 officers, a value aligned with existing legislation and with PMAM's 2023–2032 Strategic Plan. It is concluded that the proposed formula is technically feasible, operationally applicable, and institutionally coherent, constituting a relevant tool for guiding public recruitment processes, rational personnel distribution, and long-term public security policy planning in the state of Amazonas.

Keywords: Police force; Public security; Staffing calculation; Amazon; Strategic management.

1. INTRODUCTION

The state of Amazonas faces unique public security challenges stemming from its vast territorial extension, low population density, strong dependence on river routes and It has direct borders with Venezuela, Colombia, and Peru, making it one of the main entry points. of drug and arms trafficking in Brazil. This context contributes to the maintenance of high rates of lethal violence and continuously puts pressure on the actions of the Military Police of the State of Amazonas (PMAM), especially in border municipalities and in locations that host large events, like the Parintins Festival.

Despite this complexity, the PMAM's (Military Police of Amazonas) personnel has a historical shortfall in relation to... to the quantity foreseen in state legislation and recent institutional goals. While Law No. 3.793/2012 (AMAZONAS, 2012) and the Strategic Plan 2023–2032 project an effective force of With around 15,000 military police officers, the current contingent is around 8,843 officers, even after... the incorporation of those who passed recent competitive exams, which highlights a significant gap between the The projected need and the actual availability of personnel. This discrepancy compromises the capacity. The corporation's response limits the full execution of its constitutional role of preserving the public order.

The shortage of personnel has a greater impact on municipalities located in international border areas, regions with the highest incidence of violent deaths, and cities that They host large-scale events, which result in a significant and temporary increase in the floating population. Under these conditions, the planning of visible policing comes to depend not only on the number absolute number of police officers available, but based on technical criteria capable of considering variables. Demographic, criminal, and regional factors influence the distribution of the contingent. It therefore becomes relevant

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to develop an objective model that helps the PMAM (Military Police of Amazonas) to determine its ideal personnel size in a more efficient way.
rational and aligned with the specificities of the Amazonian territory

Given this scenario, the overall objective of this research is to analyze the need for restructuring the personnel of the Military Police of the State of Amazonas and proposing a technical model for Defining the ideal staffing level, based on demographic, crime, and regional variables. Specifically, the aim is to: (i) describe population indicators and crime rates in The State of Amazonas, with attention to border municipalities and localities that host large events. events; (ii) examine the historical shortfall in the active personnel of the PMAM between 2011 and 2025, considering police entries and exits; and (iii) and finally, the central point of the article, which is to present and apply an ideal workforce formula, demonstrating its potential to guide planning.
institutional framework and the distribution of personnel.

The question guiding this study can be summarized as follows: how does the Police The Amazonas military can deduce an ideal number of personnel to perform its constitutional role of to efficiently restructure this workforce periodically, through public competitions and a Distribution based on technical criteria, in order to meet security demands in a given state. marked by strong demographic, criminal, and territorial heterogeneity? The hypothesis is that a periodic restructuring of the workforce, based on demographic, criminal, and regional analyses. At the state level, it is capable of increasing the effectiveness of public security in Amazonas, guaranteeing a A more adequate number of active police officers and a better response to critical incidents and events. large size.

To achieve these objectives, applied research of a specific nature was developed. Exploratory and descriptive, with a quantitative and qualitative approach, based on secondary data. Population indicators, statistics on violent deaths, and information on... were used. police personnel originating from agencies such as the Brazilian Institute of Geography and Statistics (IBGE), the Public Security Secretariat of the State of Amazonas and the PMAM itself, regarding primarily for the period from 2011 to 2025. These variables were integrated into a model. A specific mathematical formula — the Ideal Effective Strength Formula — designed to estimate police personnel. tailored to each municipality in Amazonas and to project the necessary state personnel for compliance. efficient performance of the corporation's constitutional functions.

Finally, this article is organized into three main sections, in addition to this introduction. The first This section presents the theoretical framework that underpins the research, discussing the relationship between dynamics. Demographics, crime, regional characteristics of Amazonas and their influence on demand. for policing, as well as aspects related to the management and replenishment of the police force. Military. The second section presents the developed model — the Ideal Strength Formula — detailing it. its conceptual foundations, the mathematical structure adopted, and the criteria used for application.

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to the municipalities of Amazonas. Finally, the third section analyzes the results obtained with the application.
of the model, comparing the ideal workforce to the actual workforce, discussing strategic implications for
public competitions, distribution of personnel, and institutional planning, in order to support
Permanent policies for restructuring the PMAM (Military Police of Amazonas) workforce.

2. Demographics, Crime, and Regional Peculiarities of Amazonas: Impacts on the Demand for Policing

Understanding the demographic and criminal dynamics of the State of Amazonas requires a
an integrated analysis of its territorial, population, and logistical characteristics that differentiate it.
Deeply distinct from the other federative units of the country. With the largest territorial extension among the
Brazilian states and distributed across 62 municipalities, many of them geographically isolated and
Relying exclusively on river or air access, the Amazon presents operational challenges.
uniquely complex for planning police activity, especially for the Police
Military.

From a demographic point of view, continuous population growth is observed: in 2010,
The state had 3,483,985 inhabitants; this number rose to 3,941,613 in 2022, and the estimate...
The official figure published by IBGE for 2024 was 4,281,209 inhabitants (IBGE, 2024). This increase
This represents an approximate rate of 1.03% per year and occurs unevenly, with strong concentration.
in the capital Manaus, which is home to more than 50% of the state's population (RIBEIRO, 2022a). This phenomenon,
It is described as urban macrocephaly, and it intensifies the demand for public safety.

> This is due to the population density that has occurred in the last decades of the current century, phenomena such as urban macrocephaly concentrated in the state capital have occurred, and the military police force has become apparently insufficient for the numerous criminal demands. (RIBEIRO, 2022, p.33.)

This population density, coupled with the growth of inland cities, increases the
Pressure on the operational capacity of the PMAM (Military Police of Amazonas), which needs to simultaneously deal with areas
densely populated and with remote, hard-to-reach locations.

Alongside demographic trends, crime rates in the state are high.
and directly related to the activities of criminal organizations. Border cities, such as
Tabatinga (72,283 inhabitants) and São Gabriel da Cachoeira (56,406 inhabitants) (IBGE, 2024) are among the most populous cities in Brazil.
among the most criticized due to its strategic location on the tri-border area with Colombia and Peru —
in the case of Tabatinga — and on the border with Venezuela — in the case of São Gabriel da Cachoeira. The
Data from the 2024 Municipal Violence Atlas indicates that Tabatinga recorded 95.9% in 2022.
violent deaths per 100,000 inhabitants, one of the highest rates in the country (CERQUEIRA; BUENO,
2024a), highlighting the impact of drug trafficking, arms trafficking, and conflicts between factions.

The presence of criminal organizations such as Comando Vermelho (CV) and Primeiro

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Comando da Capital (PCC) intensifies armed conflicts along the Solimões Route, a corridor.
Strategic for the flow of cocaine produced in Peru and Bolivia. Granja (2023) demonstrates
that violent deaths in Amazonas have increased from approximately 3,300 in 2011 to about
8,000 in 2018, revealing the strengthening and disputes between factions in the region. The FBSP (2023c)
It reinforces that this scenario directly affects the municipalities along the Solimões River and also impacts the
Security in the capital. In fact, Manaus was ranked as the 3rd most violent capital in Brazil in...
2022 (CERQUEIRA; BUENO, 2024a).

In addition to the border regions, cities like Coari, Tefé, and Itacoatiara are taking on a large role.
Operational relevance to drug trafficking and, consequently, to visible policing. How
FBSP study reinforces:

> In addition to Manaus and the other municipalities in the border area, the municipalities of Coari, Tefé, and Itacoatiara are extremely important to the factions. Control of the first two ensures fluidity on the route along the Solimões River. Itacoatiara, like Manaus, is a municipality that receives ships traveling abroad (FBSP, 2023c, p.13).

This logistical structure — where more than 70% of municipalities have exclusive access
Riverine traffic — increases police response time, hinders reinforcement of personnel, and limits police presence.
ostentatious, exacerbating the vulnerability in critical regions.

In addition to structural crime, Amazonas has a rich cultural calendar.
relevance, which generates specific impacts on the demand for policing. Events such as
The Parintins Festival, which attracts around 130,000 visitors, and Carnachoeira in Presidente Figueiredo.
approximately 100,000 people and the Manacapuru Cirandas Festival with about 60,000.
Participants cause sudden increases in the floating population and in the demands for security.
(AMAZONAS, 2023a). The logistics of these events require temporary reinforcements of policing,
Intensive use of resources and advance operational planning. Such requirements reinforce the
The importance of having a workforce capable of absorbing peak demand aligns with the understanding of
Azevedo and Fritola (2023), according to whom public safety depends directly on the capacity
Regarding the replacement and expansion of police personnel:

> It is important to emphasize that public safety cannot be achieved without the necessary resources, so the Military Police need to deploy a sufficient number of personnel and vehicles on the streets in order to act preventively to deter crime and generate a sense of security for the population. Similarly, they must act repressively when a crime occurs. (2023, p.4)

This set of factors — demographic, criminal, geographic, and cultural — demonstrates
that the Amazon region requires a differentiated policing structure, adapted to its peculiarities.
regional. The convergence between population growth, factional activity, sensitive borders and
Large-scale events reinforce the need for a robust police force, distributed in a way that...
strategic and continuously updated through regular public tenders and effective policies.
to reorganize the team.

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Thus, the integrated analysis of these elements shows that the demand for policing in The Amazon cannot be evaluated solely by population indicators, but must include variables. criminal and regional [laws] systematically — a central foundation for the development of the formula of effective ideal proposed in this study.

2.1. The need for restructuring the Amazonas Military Police (PMAM) force.

Restructuring the Amazonas Military Police force is a necessity. This is urgent given the significant accumulated deficit over the last two decades, exacerbated by... annual turnover of police officers. This situation stems, to a large extent, from the disorderly entry of classes over time and the absence of stable and regular replacement mechanisms, such as Regular, well-planned public competitions. This scenario highlights the need for Permanent mechanisms for staff replacement and expansion, capable of keeping up with demands. operational staff of the corporation.

The historical staff shortage is widely recognized in the literature and by the authorities themselves. corporation. State Law No. 2,591/2000 (AMAZONAS, 2000) set the PMAM's personnel at 10,000. military police officers, while Law No. 3,793/2012 (AMAZONAS, 2012) raised this provision to 15,000. However, as Ribeiro (2022a) points out, such legal parameters have never been reached. revealing “the discrepancy between the legislation and the operational reality of the corporation” (RIBEIRO, 2022a, p. 62). Even after the competition held in 2021, the active workforce remains around 8,843 police officers, highlighting the persistence of the shortfall. (AMAZONAS, 2024a).

> In the year 2000, State Law No. 2591 of 04/01/2000, established in its articles: “Art. 1º - The effective strength of the Military Police of Amazonas is fixed at 10,000 (ten thousand) military police officers”, however, years have passed and this number has never been a reality. Law No. 3793 of 27/08/2012 revoked Law No. 2591 and instituted the following regulation: “Art. 1.º The effective strength of the Military Police of Amazonas is fixed at 15,000 (fifteen thousand) Military Police Officers”, another utopia never achieved by this institution, given that, currently, it does not reach 9,000 men in the corporation (RIBEIRO a, 2022, p.62).

This number becomes even more critical when confronted with the downward trend. Continuous growth of the workforce over the years. In 2014, the active force consisted of 9,287 police officers. (AMAZONAS, 2024a). Since then, retirements, disability pensions, dismissals, Deaths and other departures caused a steady decline. Between 2015 and 2020, the balance The annual figure was negative, with outflows exceeding inflows. The largest proportional loss occurred between 2022. and 2023, when the corporation recorded a deficit of more than 400 police officers in a single year. (AMAZONAS, 2024a).

An average turnover rate of between 3% and 5% per year implies an approximate loss of 300 to 400 employees. police officers annually — a volume that, without frequent recruitment, prevents the natural replenishment of the force. effective. This scenario directly compromises the operational capacity of the PMAM, resulting in Reduced visible police presence, increased response time, and difficulty in providing coverage in high-risk areas.

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high, especially in isolated municipalities, border towns, or those strategically located for drug trafficking.

As Miranda (2018) points out, studies show that “during the period when the number of personnel was higher,

"Consequently, with more police officers on the streets, violent crime rates were falling."

highlighting the direct relationship between police force size and reduced violence.

Demographic and criminal analysis of the state reinforces the seriousness of the situation. Between 2009 and

In 2022, the absolute number of homicides in Amazonas grew by approximately 45% (IPEA, 2023). The Atlas

Data on violence in municipalities from 2024 shows that Tabatinga recorded 95.9 violent deaths per 100 inhabitants.

thousand inhabitants (CERQUEIRA; BUENO, 2024a) and places Amazonas as the state with the largest

homicide rate in the North region (43.5), highlighting municipalities such as Iranduba (98.1) and Coari

(83.6). Although this information is part of the criminal context of the state, it highlights the

Increasing pressure on a police force that, year after year, decreases in absolute numbers.

For the first time in recorded history, Amazonas had the highest homicide rate.

Estimated figures for the North region (43.5) and the second highest in Brazil. This rate was increased by municipalities in

Iranduba (98.1) and Coari (83.6), near the capital Manaus (55.7); and Tabatinga (95.9), in the southwest.

Amazonian region, in Alto Solimões. The Solimões River is strategic in the drug trafficking route, as it drains...

The drug is produced in Peru and Bolivia, and is disputed by local criminal factions and

international. (CERQUEIRA; BUENO, 2024a, p.22)

The shortage of police officers becomes even more critical given the geostrategic position of...

state. Border municipalities such as Tabatinga (triple border Brazil–Colombia–Peru) and São

Gabriel da Cachoeira (on the border with Venezuela) is listed as a route for the entry of weapons and drugs.

as indicated by Lanzellotte (2018) and the Atlas of Violence in Municipalities (CERQUEIRA;

(BUENO, 2024a). The fragility of borders intensifies the activities of criminal organizations such as

The Red Command (CV) and the First Command of the Capital (PCC), which are fighting for control of

riverine logistics of trafficking (MANSO; DIAS, 2018). These factors, despite being analyzed in

The greater depth discussed in the previous section reinforces the need for a workforce sized appropriately for...

to meet these operational pressures.

The shortage of personnel has direct consequences for public safety, not only increasing the risk of crime, but also increasing the risk of staff shortages.

Not only the vulnerability of critical areas, but also the overload on the military police officer. Scales

Extraordinary effects, increased physical and emotional strain, and reduced productivity are all consequences.

common in corporations that operate with chronic deficits, causing effects of burnout syndrome.

in the military (CURY, 2022). The strategic planning of the PMAM (2023–2032) recognizes the

The insufficiency is projected, and the goal is to have 15,000 police officers by 2032, a number that is in line with the...

current legislation is essential to meet the needs of the state (PMAM, 2023).

Thus, adopting a technical model for workforce sizing contributes to

To align the operational reality of the PMAM (Military Police of Amazonas) with legal goals and strategic planning.

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institutional. The need to align staffing levels with the instruments of

National and state public security planning is in line with the debate on the II

National Public Security and Social Defense Plan 2021–2030 (SANTOS; AGUIAR, 2022)

Thus, given the historical shortfall in personnel, the significant annual turnover, and

population growth, the intensification of crime rates, and the territorial peculiarities of

In this state, it becomes essential to adopt a technical model that allows for determining the ideal workforce size.

for each municipality and for Amazonas as a whole. This need is supported by

specialized literature, which emphasizes the importance of objective criteria to guide the allocation of

police force. In this sense, Paixão (2023) emphasizes that:

> It is fundamental to recognize that the actions of individuals are at the heart of police work. Therefore, the distribution of military police personnel should be guided by demographic factors, crime rates, and local characteristics. Thus, by proposing these criteria, the aim is to achieve an equitable and effective distribution of military police personnel. (PAIXÃO, 2023, p.7)
>
> The relevance of this technical criterion increases when considering temporary and seasonal demands—such as the Parintins Festival, Carnachoeira, and the Cirandas Festival, among others—which require the deployment of police officers from various battalions, temporarily leaving other areas of the state uncovered, including the capital Manaus. Such situations reveal that simply comparing the resident population to the available personnel is insufficient; it is necessary to incorporate logistical elements, specific types of crime, and regional peculiarities for a more precise and efficient distribution.
>
> Thus, it is evident that the restructuring of the PMAM (Military Police of Amazonas) force should be guided not only by numerical replacement, but by a distribution model that considers the operational weight of each region. Human action is the central element of police activity, and therefore, its allocation must seek balance, rationality, and a real capacity to respond to the diverse demands of the Amazonian territory.
>
> Based on these fundamentals, the next section presents the Ideal Staffing Formula, developed in this study as an objective tool to guide public tenders, operational distribution, and strategic planning, offering a transparent mathematical method aligned with the specific needs of public security in Amazonas.

2.2. Ideal Staffing Formula: Fundamentals and Structure

Determining the appropriate police force size for each territory is widely discussed in

literature on public safety and constitutes one of the main management challenges for the Military Police.

In Brazil, determining the required personnel size should consider not only population criteria, but also...

also variables related to crime dynamics, regional particularities and relevance

strategic of certain municipalities. In this context, this study proposes a calculation model.

the ideal effective number based on three key variables: population, violent death rate, and condition.

of a key city, seeking to translate these elements into objective criteria applicable to planning.

PMAM operational unit.

In addition to this proposal, another relevant theoretical foundation refers to the use of models.

weighted for the distribution of personnel. The Military Police of the State of São Paulo, in turn,

uses parameters that combine resident population (72%), floating population (10%), and indices of

crime (11%) and municipal peculiarities (7%), as systematized by Paixão (2023).

This experience reveals that hybrid models, based on weights and multiple variables, tend to...

to produce more balanced allocations, avoiding structural distortions and increasing the efficiency of

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policing actions.

> The distribution of military police personnel in the state of São Paulo is carried out based on rigorous and detailed criteria, aiming at the equitable and efficient allocation of resources. The main criteria include the resident population (72% of the personnel), the commuter population (10% of the personnel), the crime rate (11% of the personnel), and local peculiarities (7% of the personnel). (PAIXÃO, 2023, p.28)

The Ideal Staffing Formula proposal is inspired by this methodological reference, however.
It incorporates adjustments necessary to the Amazonian reality, marked by characteristics that do not exist in...
other states. In Amazonas, factors such as geographic isolation, large territorial extensions,
dependence on river transport, vulnerability of international borders and occurrence of
Large-scale tourism events make calculations based solely on population unfeasible, or
crime. For this reason, the variable "key city" is included, which encompasses municipalities with...
geostrategic relevance for public safety — such as border cities, localities situated
on the Solimões River route used for drug trafficking, or municipalities that receive flows
exceptional population outbreaks during specific periods.

It is worth highlighting that, unlike population and crime variables, which are defined
Based on objective statistical data, the variable "key city" has a predominantly managerial character.
Its definition can be adjusted according to strategic priorities, security policies, or projects.
specific aspects of territorial strengthening. It is, therefore, the only component of the model subject to...
to administrative discretion.

Thus, the construction of the theoretical model considers that the population indicates the basic dimension.
of police demand; the violent death rate expresses the direct criminal pressure on the
corporation; and the status of key city translates into logistical, geopolitical and cultural elements that
These factors influence operational needs. By combining these variables in a weighted manner, a...
An instrument that allows for a more precise estimation of the workforce needed for specific requirements.
from each municipality in Amazonas.

The following section presents the mathematical structure of the formula and demonstrates how these...
The fundamentals materialize in the calculation of the ideal workforce for the state.

3. MODEL: FORMULA, CALCULATION AND PRACTICAL APPLICATION

Defining the ideal police force size in the state of Amazonas requires a technical model.
capable of integrating demographic, criminal, and territorial variables in a systematic way, reflecting the
heterogeneity of the state and its operational demands. Faced with the increasing complexity of
public safety scenario — influenced both by the actions of criminal organizations and
Due to geographical and logistical factors, it became essential to develop an instrument.
A mathematical formula that allows for an objective and replicable estimation of the appropriate police force size.
for each municipality. This chapter presents the proposed model, its conceptual structure, and the

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parameters that form the basis for calculating the ideal workforce.

The model proposed in this study, called the Ideal Staffing Formula, is based on...
specialized literature and methodologies already applied by other Brazilian police corporations —
Notably, the Military Police of the State of São Paulo uses weighted criteria of population, crime, and local peculiarities
to distribute its personnel (PAIXÃO, 2023). From this
For reference, the model organizes three central dimensions for calculating the ideal staffing level: (a) population,
(b) violent death rate and (c) key city status, a variable that includes municipalities of
international border, locations situated on the Solimões Route, or cities that host events of
large size.

Based on these three dimensions, a weight matrix was constructed that makes it possible
to compare the municipalities of Amazonas in a standardized way. These weights feed into a formula of
weighted average, the resulting score of which is converted into police personnel per 100,000 inhabitants.
In this way, a model is obtained that is capable of systematically integrating structural variables.
criminal and regional, constituting a robust mathematical tool to support planning.

Strategic planning and the distribution of personnel within the PMAM (Military Police of Amazonas).

3.1 Rationale for the model

The construction of the proposed model is based on the premise that the distribution of personnel
Police presence should reflect not only the population size of municipalities, but also their level of
Lethal violence and its strategic characteristics. As Paixão (2023) points out, efficient allocation
The number of officers depends on objective criteria that reflect the real demand for policing, avoiding
Disproportionate distributions or distributions that are disconnected from local needs.

In the context of the Amazon, this requirement becomes even more evident due to its...
regional particularities, among which the following stand out: (i) vast areas that are difficult to access; (ii) municipalities
located on vulnerable international borders; (iii) locations that host events capable of
(iv) temporarily expand the population; (v) strong population concentration in the capital; and (v) action
of criminal factions along the main river trafficking routes. These factors highlight the
The inadequacy of models based exclusively on population indicators.

Thus, the Ideal Staffing Formula is based on three independent variables and
complementary: (a) population, which represents the ordinary demand for policing; (b) index of
violent deaths per 100,000 inhabitants, a widely recognized indicator as a measure of pressure.
criminal; and (c) key city, a qualitative variable that identifies municipalities with a strategic function.
expanded, such as borders, the Solimões route, or venues for major events.

The choice of these variables is supported by national studies that demonstrate that...
The relationship between population dynamics, crime patterns, and territorial factors in determining...
need for police reinforcement (MANSO; DIAS, 2018; CERQUEIRA; BUENO, 2024). A

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The experience of the Military Police of the State of São Paulo reinforces this perspective by employing distribution models based on multiple criteria (PAIXÃO, 2023).

Thus, the theoretical and empirical basis of the model indicates that the ideal police force does not It should not derive exclusively from parameters fixed by law, but from a dynamic formula, capable of To capture the unique characteristics of each municipality and systematically guide planning. strategic of the PMAM.

3.2. Operational concepts of the formula

Applying the Ideal Staffing Formula requires understanding five elements. Fundamentals: scoring, base, standardized population index (SPI), base value, and ideal effective value. These concepts structure the calculation process and allow for standardized comparisons between... municipalities of different sizes and crime profiles, adjusting the result to the demographic dimension of each locality through the IPP.

3.2.1. Scoring

The score corresponds to the result obtained by the weighted sum of the three variables. Key metrics of the model: population, violent death rate, and key city status. Each The variable is assigned a weight (P) (from 0 to 4), multiplied by a value (V), which expresses its relevance. proportional. Thus, the formula:

Score = *(Ppop x Vpop) + (Pcrime x Vcrime) + (Pcidade x Vcidade)*

Generating a standardized number that synthesizes the relative policing demand of each municipality located in the state of Amazonas.

3.2.2. Base

Base is a fixed numerical value used as a conversion parameter, functioning as a kind of benchmark that guides strategic decision-making. From From this value, the decision-maker can allocate larger or smaller proportions, according to the objectives of model and the weights defined for each variable.

In this study, a base of 100 is adopted because it is an intuitive and easily applicable benchmark. Practical and aligned with demographic metrics widely used in the field of public safety.

3.2.3. Base Value

The base value is the result of multiplying the municipality's score by the adopted base. Thus, it expresses the number of police officers needed per 100,000 inhabitants, according to the demographic, criminal and strategic characteristics of that municipality.

Base Value = *Score x Base*

This value allows for the comparison of municipalities with different profiles using the same scale.

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proportional.

3.2.4. Ideal Effective

The ideal number of officers is the final estimated number for each municipality. It results from...

multiplication of the standardized population index (Municipality population ÷ 100,000) by the value

base:

$$\text{Ideal Effective} = \left(\frac{\text{here}}{100{,}000} \right) x \text{ Base Value}$$

This is therefore an estimate of the police contingent needed to meet the demand.

adequately addressing local public safety demands, while simultaneously considering factors

population, criminal and regional factors.

3.2.5. Standardized Population Index

The standardized population index is obtained by dividing the total population of the municipality by

100,000, in order to express how many "units" of 100,000 inhabitants exist in that locality.

Like this, if a municipality it has 120,000 inhabitants, the index it will be:

$$\text{Standardized population index} = \left(\frac{120{,}000}{100{,}000} \right) x\ 1.2$$

3.3. Weight table and mathematical structure of the model.

The Ideal Staffing Formula proposed in this study uses three main variables —

population, violent death rate, and key city status — transformed into values

weighted values that allow for a standardized comparison of the municipalities of Amazonas. The assignment

The weighting of these variables is based on the operational relevance of each variable, with the final result being converted.

in police personnel per 100,000 inhabitants.

The mathematical structure of the model seeks to transform population, crime, and data.

Territorial variables are standardized in a given score. For this purpose, each variable is classified into levels (0 to 4).

associated with previously adjusted values. The general formula is as follows:

Score = (Ppop × Vpop) + (Pcrime × Vcrime) + (Pcidade × Vcidade)
Where:

i. Ppop = population weight
ii. Pcrime = weight of the violent death index
iii. Pcity = weight of the key city condition
iv. VPOP, Vcrime, Vcidade = values assigned to each variable to adjust its relative relevance.

Table 1. Weights assigned to the POPULATION variable

WEIGHT P Population 0 1		VALUE
	-	-
	Population up to 50,000 inhabitants.	0.4
2	From 50,001 to 100,000 inhabitants.	0.8
3	From 100,001 to 500,000 inhabitants.	1.2
4	Over 500,000 inhabitants.	1.6

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Table 2. Weights assigned to the variable VIOLENT DEATH RATE		
WEIGHT P Criminal Index VALUE		
0	-	-
1	Up to 20 deaths per 100,000 inhabitants.	0.4
2	From 21 to 40 deaths per 100 thousand inhabitants.	0.8
3	From 41 to 60 deaths per 100 thousand inhabitants.	1.2
4	Above 60 deaths per 100,000 inhabitants.	1.6

Table 3. Weights assigned to the KEY CITY variable		
WEIGHT P Key City 0 1		**VALUE**
	Up to 20,000 visitors and other cities.	0
	Between 20,000 and 60,000 visitors.	0.2
2	More than 60,000 to 100,000 visitors, as well as Manaus.	0.4
3	Over 100,000 visitors.	0.6
4	Border cities (international).	0.8

This matrix allows all municipalities in Amazonas to be classified according to criteria. homogeneous, providing a consistent numerical basis for calculating the ideal workforce. The section The following details the practical application of these weights and demonstrates the operational interpretation of resulting score.

3.4. APPLICATION OF THE IDEAL STAFFING FORMULA.

Applying the formula requires defining the values assigned to each variable beforehand. For In this study, the following values (V) were adopted:

Table 4. Values related to each variable.		
Vpop = 0.4 Vcrime = 0.4		relative value of the population;
Vcity = 0.2		relative value of the violent death rate;
		relative value of key city status

These parameters reflect the proportional importance assigned to each dimension. Thus, According to the defined criteria, a municipality's final score can vary between **0.8** (minimum). possible) and **4.0** (maximum possible), serving as the basis for conversion into police personnel per 100,000 inhabitants.

3.4.1. Manacapuru-AM.

Example of Calculation:

Table 5. Classification of variables for Manacapuru-AM			
CITY	**MANACAPURU**	**WEIGHT**	**VALUE**
Population	110,691 Inhabitants	3	1.2
Crime rate: 27.5 deaths per 100,000 inhabitants (2022)		2	0.8

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Key city	60,000 visitors - Cirandas Festival	2	0.4
Score	3 Variables added together (Demographics + Crime + Key City)	-	2.4

Applying the values to the formula:

Score = *(P x Vpop) + (P x Vcrime) + (P x Vcidade)*

Score = *(3 x 0.4) + (2 x 0.4) + (2 x 0.2)*

Score = *1.2 + 0.8 + 0.4*

Score = *2.4*

The score obtained is then multiplied by the base, which serves as a parameter.
conversion method intended to estimate the ideal number of police officers for the municipality of Manacapuru.
In this case, a base of 100 is adopted; thus, a score of 2.4 results in a Base Value of 240.
as demonstrated in the calculation below.

Score x Base = *2.4 x 100 = 240*
Base Value = *240* (Number of police officers per 100,000 inhabitants)

Next, the Base Value is adjusted to the actual population of the municipality by calculating the
Standardized Population Index (SPI). The SPI for Manacapuru is obtained by dividing the
The total population of the municipality is calculated using the parameter of 100,000 inhabitants, resulting in an *IPP of 1.10691* .
Next, this index is applied to the base value of 240, so that *1.10691 × 240 ÿ 2661.*
indicating an ideal effective force of approximately 266 police officers for the municipality of Manacapuru-AM.

IPP = ($\frac{110,691}{100,000}$) = *1.10691*
1.10691 x 240 = approximately 266 police officers
266 = Ideal Effective Number of Manacapuru-AM

Therefore, note that by using the Ideal Staffing Calculation we arrive at the ideal staffing level.
for the city of Manacapuru-AM, according to this study, which is approximately 266
Police officers rounded up because within the formula we find the following number: 265.6584.

3.4.2. Manaus.

The application of the same procedure used in the calculation for Manacapuru - AM
This allows us to estimate the ideal police force size for the capital city of Manaus. Considering the weights assigned to the three
The model variables—population, violent death rate, and key city status—are obtained-
if the following structure:

Example of Calculation:

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Table 6. Classification of variables for Manaus

CITY	MANAUS	WEIGHT	VALUE
Population	2,279,686 inhabitants (2024)	4	1.6
Crime Index	55.7 deaths per 100,000 inhabitants (2022) 3		1.2
Key City	Capital (intermediate weight)	2	0.4
Score	3 Variables added together (Demographic + Crime + Key City) **score**	-	3.2

is calculated by weighted average:

Score = *(4 x 0.4) + (3 x 0.4) + (2 x 0.2)*

Score = *1.6 + 1.2 + 0.4*

Score = *3.2*

Score x Base = *3.2 x 100 = 320*

Base Value = *320* (Number of police officers per 100,000 inhabitants)

For the final calculation of the ideal workforce, the standardized population index is multiplied by the base value:

$$\left(\frac{2{,}279{,}686}{100{,}000} \right) = 22.79686$$

22.79686 x 320 = approximately 7,295 police officers

7,295 = Ideal Effective Personnel for Manaus

Thus, according to the parameters adopted in this study, the estimated ideal effective number for the The city of Manaus has approximately 7,295 military police officers.

The comparison between Manacapuru and Manaus highlights the capabilities of the Effective Formula. Ideal of adequately differentiating distinct municipal realities. Manacapuru, with size average population, moderate crime rate, and strategic relevance associated with seasonal events, It achieves a score of 2.4 and an estimated ideal force of 266 police officers. Manaus, however, faces demographic pressure. and criminological is significantly superior, obtaining a score of 3.2 and an ideal effective force of 7,295 police officers. The difference between the results demonstrates that the model responds proportionally to the variables. structural, criminal and territorial, validating its usefulness as a technical instrument for Staffing levels in the heterogeneous context of the State of Amazonas.

3.4.3. Expanded application in 10 cities in Amazonas.

It is worth noting that, with regard to the Key City variable, the state index may be built from the same references used for the municipalities, with the sole exception of this variable, for which the intermediate weight used in the capital Manaus is adopted throughout the state. (0.4). In this arrangement, the Key City variable is standardized with a weight of 0.4 for all municipalities, which allows us to estimate a reference state force of around 12,000 police officers or, Alternatively, the sum of the ideal effective population calculated for each of the 62 municipalities can be obtained, which

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currently this would result in approximately 10,478

With the purpose of illustrating the practical application of the formula and the operationalization of these As shown below, a table illustrates the calculation of the ideal workforce in 10 municipalities. Selected from the State of Amazonas.

Table 7: Application of the Ideal Staffing Formula in 10 municipalities.

	AMAZON		4,281,209	35.9	state	2.4	240	12,000
QUANT.	**CITIES**	**CENSUS The POP. (2022)**	**ESTIMATIVA POP. (2024)**	**INDEX CRIMINAL (2020)**	**CIDA OF CHAV AND**	**POINTS TO THE**	**VALOR BASE**	**EFETI GRANDMOTHER IDEAL**
1	Alvarães	15,866	16,670	15,314	8.3		0.8	80	13
2	Watchtower of North	15,892			8.4	border the	1.6	160	25
3	Barcelos	18,834	18,626		35.2	border the	2	200	38
4	Coari	70,616	73,820		62.7	20 thousand	2.4	240	177
5	Itacoatiara	103.598		112,520	26.3	30 thousand	2.4	240	270
6	Manacapuru	101.883		110,691	27.4	60 thousand	2.4	240	265
7	Manaus	2.063.689		2,279,686	45.0	capital	3.2	320	7.295
8	Parintins	96,372	101,956	51,795	16.6	130,000	2.2	220	224
9	São Gabriel da Cachoeira	56,406			24.1	border the	2.4	240	136
10	Tabatinga	66,764	72,283		63.8	border the	3.2	320	231

Source: IBGE, Brazilian Institute of Geography and Statistics. Population estimates published in the Official Gazette: Tables - 2024. Population estimates for Municipalities and Federative Units, with a reference date of July 1, 2024.

IPEA, Institute for Applied Economic Research. SANTOS, Maria Paula; HOFF DA CUNHA, Victória, Technical Managers - Amazonas. DYNAMICS OF VIOLENCE: STATE OF AMAZONAS.

The practical application of the Ideal Staffing Formula, demonstrated through calculations. The studies, conducted for ten representative municipalities in the state, show how population variables, Criminal and strategic factors translate into differing estimates of policing needs.

The preliminary results presented in Table 7 not only illustrate the operationalization of model, but they also reveal patterns that reflect territorial heterogeneity and distinct operational pressures faced by the Military Police of Amazonas. From this stage onwards, it becomes It is possible to move on to a critical analysis of the findings, examining their implications for the institutional planning, staff distribution, and public policy formulation, according to discussed in the next section.

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4. DISCUSSION OF THE RESULTS AND IMPLICATIONS OF THE MODEL

Applying the Ideal Staffing Formula allowed us to identify consistent patterns among Territorial demand, criminal pressure, and the need for personnel reinforce the need for methodological adequacy. from the model to the specificities of the State of Amazonas. The estimates generated highlight differences. significant differences exist between small municipalities, strategic locations, and the capital, demonstrating that Criteria based solely on population data would be insufficient to guide the distribution of resources. Humans in public safety.

4.1. Formula performance and identified patterns.

The results obtained reveal that municipalities with low population density and Low rates of violence, such as in Alvarães and Atalaia do Norte, presented ideal effective numbers. proportionally modest. On the other hand, locations with geostrategic relevance — such as Tabatinga, São Gabriel da Cachoeira, and Coari exhibited higher scores, reflecting their Location in border areas, drug trafficking routes, or high incidence of violence. lethal.

The cases of Manacapuru and Manaus clearly illustrate the sensitivity of the model. Manacapuru, influenced by the temporary population flow resulting from major events, It presented an ideal force of 266 police officers. Manaus, on the other hand, achieved the highest score among the municipalities. resulting in an estimated 7,295 police officers, consistent with its high population density and Its rate of violent deaths is above the state average. The analysis of the ten municipalities presented Table 7 confirms that the formula adequately differentiates between distinct operational realities.

4.2. Discrepancies between the ideal and actual number of police officers in the Amazon.

When comparing the calculated ideal workforce with the actual workforce currently available, it is found that- without significant discrepancies. Although the state has approximately 8,843 police officers, the total The ideal municipal police force number is close to 10,400, indicating a structural deficit in order. of 1,500 servers.

More relevant, however, is the unequal distribution of this deficit. Strategic municipalities They exhibit critical deficiencies: Tabatinga operates with a deficit of approximately 60.6% in relation to its workforce. ideal; Coari, with approximately 69.5%; São Gabriel da Cachoeira, with 89.7%; Manacapuru, with approximately 36.5%; and Atalaia do Norte, with 76%. These gaps compromise the response capacity, prevention and action in sensitive areas, such as the tri-border region, the Solimões River axis, and zones of high crime rate.

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Table 8: Comparison of Actual vs. Ideal Staffing

Municipality	Actual Effective	Ideal Effective	Deficit	Deficit (%)
Tabatinga	91	231	-140	60.6%
Manacapuru	169	266	-97	36.5%
Coari	54	177	-123	69.5%
São Gabriel da Cachoeira	14	136	-122	89.7%
Atalaia do Norte	25	06	-19	76.0%

Source: Amazonas Government Transparency Portal, Available at: https://www.transparencia.am.gov.br/pessoal/

These data highlight particularly severe deficits in São Gabriel da Cachoeira, Coari and Tabatinga — municipalities with critical characteristics, whether due to their geostrategic position of international border (Tabatinga, São Gabriel, Atalaia) or location on trafficking routes along the axis Solimões River, in addition to persistent criminal pressure (Manacapuru and Coari).

This scenario demonstrates that the problem with PMAM is not only quantitative, but also distributive. Even increasing the total workforce would be insufficient without technical mechanisms. Permanent redistribution and monitoring processes.

4.3. Strategic implications for workforce planning and management.

The discrepancies identified reveal direct impacts on police performance. Deficits Severe situations increase workload, reduce visible presence, and lengthen response time. and weaken operations in high-risk areas. The literature consistently indicates that greater Police presence is associated with a reduction in violent crime, which reinforces the need for... reconstruction of the framework (MIRANDA, 2018).

The proposed model also has direct implications for public procurement policy. and personnel management. Annual turnover, estimated at approximately 3% to 5% based on data The public information available on the PMAM website necessitates the regular completion of processes. selective measures, under penalty of exacerbating the staffing deficits already identified, especially in municipalities in the interior. Considering the growth and replacement projections, it is observed that The need for annual recruitment of between 860 and 1,040 new police officers is necessary for the state to approach the effective as stipulated by law and, simultaneously, reduce internal asymmetries in the distribution of contingent. In this scenario, the adoption of biennial cycle competitions, with calls divided into periods. In subsequent years, this establishes a more operationally appropriate strategy, in line with Practices adopted in federative units such as Minas Gerais. (PMMG, 2024)

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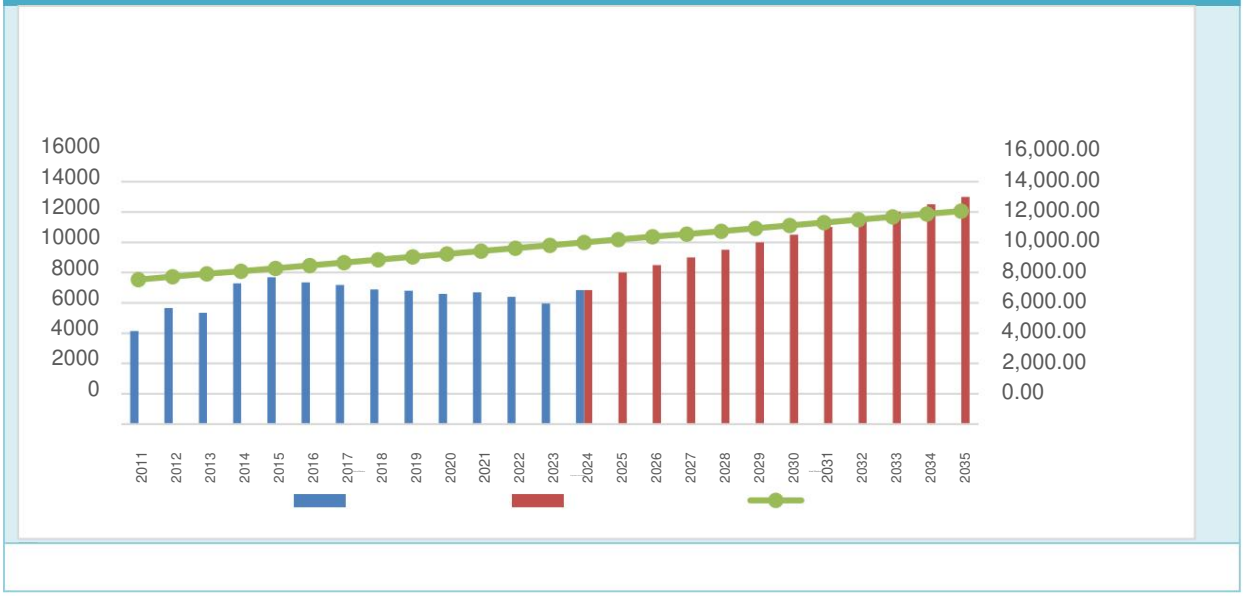
Table 9: Active Personnel Chart



Thus, exam planning, combined with the proposed mathematical model, provides a an integrated strategy to rebuild and expand the PMAM's personnel in a rational, transparent and... guided by technical criteria.

In the case of the Military Police, the importance of periodic recruitment exams has been widely recognized. recognized by literature. Azevedo and Fritola (2023), analyzing the reality of Paraná, highlight that the absence of continuous replenishment generates a series of negative effects, such as overload of work, reduced visible presence, delays or inability to respond to incidents, Increased crime and damage to public trust. According to the authors:

> The hiring of more military police officers, regardless of the state where it occurs, certainly It generates expenses and is costly for the federated entity, but, on the other hand, it must be considered that... The government's failure to carry out this hiring process could lead to, among other things... Other factors: excessive workload for existing staff; loss of institutional credibility; reduction police presence on the streets; delays in responding to incidents; no Responding to incidents; increased crime rates; insecurity for the population; Prevalence of impunity; discouragement of business investment. (AZEVEDO; FRITOLA, 2023, p.8)

Finally, the model requires continuous monitoring. The definition of adjustable weights (Vpop, Vcrime, Vcidade) allows for periodic reviews based on demographic, criminal, or other changes. Territorial. Pilot municipalities can be used for longitudinal monitoring. enabling precise adjustments to the formula and strengthening evidence-based management.

FINAL CONSIDERATIONS

The analysis developed in this study demonstrated that the Military Police of the State of The Amazonas Military Police (PMAM) faces a structural problem of insufficient personnel, resulting from several factors.

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accumulated over decades, such as the absence of regular recruitment processes and high turnover. annual population growth and increased crime, especially in the regions of border and in municipalities located on strategic trafficking routes. Added to this, the dynamics territorial boundaries of the state — marked by great distances, logistical difficulties and cultural events of large scale — requires a much more complex workforce distribution model than that one based solely on population indicators.

In this context, the Ideal Staffing Formula, proposed and applied in this work, proved to be... a technically feasible and operationally applicable instrument. When considering simultaneously three fundamental variables — population, violent death rate, and key city status — The model made it possible to transform demographic, criminal, and regional data into objective parameters. for determining the police force size. The results showed that municipalities such as Manaus, Tabatinga, Coari, São Gabriel da Cachoeira, and Parintins have demands. significantly higher than those currently served, highlighting the urgency of a restructuring. structural framework of the PMAM.

The projections obtained indicate that the ideal number of state personnel is between 10,400 and 15,000. police officers, a value aligned with current legal provisions and the guidelines established by the Planning. Strategic plan for the corporation 2023–2032. However, in order to reach this level, it becomes... It is essential to hold public competitions in two-year cycles, with validity periods. reduced to a maximum of six months and annual call-ups, similar to the model adopted in Minas Gerais (PMMG, 2024), in order to ensure the continuous replenishment of natural losses and to avoid new cycles of lag. This policy of periodic entry not only stabilizes the workforce of work, as well as allowing for staff rejuvenation and continuing education, increasing the operational efficiency of the institution.

The study also demonstrated that workforce restructuring, when accompanied by continuous monitoring and evaluation of indicators such as crime, response time and Performance at large events makes it possible to improve police action and adjust the formula accordingly. the social and territorial changes in the state. Thus, management becomes evidence-based, and not through isolated or contingent decisions.

It can be concluded, therefore, that the proposal presented in this article provides a solid technical basis. to support strategic decisions related to staff allocation, public recruitment processes, Operational planning and formulation of permanent public security policies in Amazonas. By integrating quantitative data and qualitative analyses, the Ideal Staffing Formula represents a methodological and institutional advancement, capable of contributing significantly to strengthening

from the PMAM (Military Police of Amazonas) and for the improvement of public safety in the state.

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