

**SUPPLY CHAIN MANAGEMENT APPLIED TO CRIMINAL AGRICULTURE: A case study of cocaine seizures in Brazil.**

**GESTÃO DE CADEIA DE SUPRIMENTOS APLICADA À AGRICULTURA CRIMINAL: Um estudo de caso de apreensões de cocaína no Brasil.**

**GESTIÓN DE CADENA DE SUMINISTRO APLICADA A LOS CULTIVOS ILÍCITOS: Un estudio de caso de incautaciones de cocaína en Brasil.**

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**ABSTRACT**

Transnational criminal organizations such as those that operate in international drug trafficking function as multinationals, which is why it is possible to observe clear fundamentals of business management in their operations. Among them, those observing Supply Chain Management and Operations, common to legal business on a global scale, stand out. In this study, based on observations of 21 (twenty-one) large seizures of cocaine carried out by Brazilian security forces between 2017 and 2023, the application of such concepts is evident. The analyzed sample, select due to its homogeneous profile, contains import standards such as the size of the bales, the packaging technique, the type of textile fiber used in the bale packaging, the sewing pattern of the bales, the means of transport, the dynamics of logistic integration between the different stages of the supply chain. The complexity of the crime in question and the dynamics of supply chain management is a preponderant factor for its efficiency, maintenance of scale and mitigation of costs associated with losses resulting from seizures. It is also crucial for assessing the level of difficulty faced by security forces in combating international drug trafficking: the dependence on defense infrastructure, technology and intelligence is clear for defense, homeland security and police activities to be successful.

**Keywords:** Supply Chain Management; Criminal Agriculture; Cocaine Seizures; Brazil.

**RESUMO**

Organizações criminosas transnacionais como as que atuam no tráfico internacional de drogas funcionam como multinacionais, razão pela qual é possível observar em suas operações claros fundamentos de gestão empresarial. Dentre eles, destacam-se os relacionados à Gestão de Cadeia de Suprimentos e Operações, comuns aos negócios legais de escala global. Nesse estudo, a partir de observações de 21 (vinte e uma) grandes apreensões de cocaína realizadas pelas forças de segurança brasileira entre 2017 e 2023, evidencia-se a aplicação de tais conceitos. A amostra analisada, selecionada em razão do seu perfil homogêneo, contém padrões importantes tais como o do tamanho dos fardos, na técnica de acondicionamento, no tipo de fibra têxtil dos fardos, no padrão de costura dos fardos, no meio de transporte, na dinâmica de integração logística entre os distintos momentos da cadeia de suprimentos. A complexidade do delito em relevo e a dinâmica da gestão da cadeia de suprimentos é um fator preponderante para a sua eficiência, manutenção de escala de e mitigação de custos associados a perdas, decorrentes das apreensões. Ela também é determinante para a aferição do nível de dificuldade enfrentado pelas forças de segurança no combate ao tráfico internacional de drogas: fica clara a dependência de infraestrutura de defesa, de tecnologia e de inteligência para que a atividade policial e de defesa sejam bem-sucedidas.

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**Palavras-chaves:** Gestão de Cadeia de Suprimentos; Agricultura Criminal; Apreensões de Cocaína; Brasil.

## RESUMEN

Organizaciones criminales transnacionales, como las que operan en el tráfico internacional de drogas, funcionan como multinacionales, razón por la cual es posible observar en sus operaciones claros fundamentos de gestión empresarial. Entre ellos, se destacan los relacionados con la Gestión de la Cadena de Suministro y Operaciones, comunes a los negocios legales a escala global. En este estudio, a partir de observaciones de 21 (veintiuna) grandes incautaciones de cocaína realizadas por las fuerzas de seguridad brasileñas entre 2017 y 2023, se evidencia la aplicación de tales conceptos. La muestra analizada, seleccionada debido a su perfil homogéneo, contiene estándares importantes, como el tamaño de los fardos, la técnica de acondicionamiento, el tipo de fibra textil de los fardos, el patrón de costura de los fardos, el medio de transporte y la dinámica de integración logística entre los distintos momentos de la cadena de suministro. La complejidad del delito en cuestión y la dinámica de la gestión de la cadena de suministro son factores preponderantes para su eficiencia, mantenimiento de escala y mitigación de costos asociados a pérdidas derivadas de las incautaciones. También es determinante para evaluar el nivel de dificultad enfrentado por las fuerzas de seguridad en la lucha contra el tráfico internacional de drogas: queda clara la dependencia de la infraestructura de defensa, la tecnología y la inteligencia para que la actividad policial y de defensa sean exitosas.

**Palabras clave:** Gestión de la Cadena de Suministro; Cultivos ilícitos; Incautaciones de Cocaína; Brasil.

## 1 INTRODUCTION

Packing is an important part of the supply chain process, especially in international business. This concept is valid to legal business and to illegal business. Drug trafficking involves several processes from goods to leave the producing regions – located mainly in Central America, South America, North Africa, and East Asia - and reach the final consumer – located all around the world, especially in Europe and the United States. At each stage, the packing is different, due to the volumes to be transported. This adaptation is strategic when the subject is cocaine hydrochloride or base paste.

The sophistication of this criminal business is evidenced by the diversity of transport techniques, and concealment tactics - with the clear intention of circumventing the authorities - and bottling technologies - aimed at preserving an illicit product with extremely high added value to criminal organizations - in each of the links in the production chain: from the producer to the final users. In other words, the packages observed in research vary from plastic bags in barrels or sisal bales, to kraft paper wrappers with excessive use of adhesive tape (common in cocaine tablets or pieces) and Eppendorf-type tubes (common in sale to final drug users). The bottling demonstrates the level of professionalization of the criminal organizations that operate



in cocaine Agrocriminal Supply Chain (AGROCRIM), which, given the inherent risk in the illicit activity, relies on robust industrial techniques to preserve the integrity of its product, largely transported in extremely steep conditions, as in some submerged areas of ships, such as the sea chest.

In this paper, our proposal is to discuss the impact of packaging on cocaine hydrochloride or base paste logistics, focusing on case studies of seizures carried out by Paraguayan, Brazilian and European security forces. It's intended, as a general aim, to highlight the traceability of these apprehensions. The paper is divided in four parts. In the first, a brief theoretical review is presented. In the second part, the methodological procedures, essential for the case study, are presented. In the third part, data analysis and discussions are carried out. In the fourth and last part, the final considerations are presented.

## 2 SUPPLY CHAIN MANAGEMENT CONCEPTS, PACKING AND COCAINE AGROCRIM PROCEDURES

### 2.1 Initial concepts

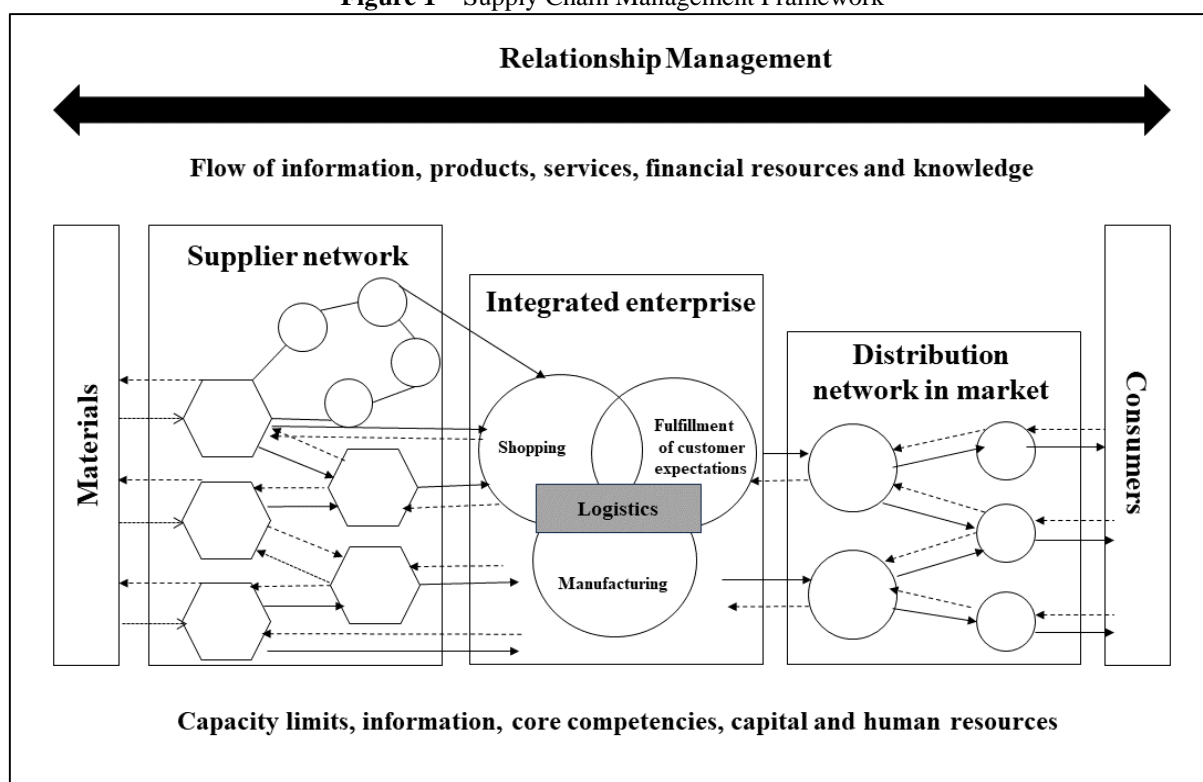
Transnational Organized Crime specializing in agrocriminal activities is a traditional example of a sustainable supply chain, as seen in the cases of *Erythroxylum coca*, *Cannabis Sativa*, *Cannabis Indica* and *Papaver somniferum*. Each of them has its own robust production chain, capable of connecting producers to final consumers on a global scale. Therefore, these are businesses totally dependent on distribution channels and logistical strategies (with extensive use of transportation modal structures) common to legal businesses. Supply Chain Management is conceptualized by Coughlan *et al* (2002, p.20) “as a set of interdependent organizations involved in a process of making one or more products or services available for use or consumption”. Mentzer *et al* (2001), define it as “[t]he systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of individuals companies and supply chain as a whole”. Von der Vorst *et al* (2007, p.7) conceptualize “Supply Chain as a sequence of (decision making and execution) processes and (material, information and money) flows that aim to meet final customer requirements, that take place within and between different stages along a continuum, from production to final consumption”.

This concept, in the view of Bowersox *et al*. (2007), is segmented into two perspectives:



that of the supply chain management itself and that of logistics. While supply chain is understood by them as “collaboration between companies to drive strategic positioning to improve operational efficiency”, logistics is defined by the same authors as “the work required to transport and position inventory throughout an entire supply chain” (Bowersox *et al*, 2007). This conceptual symbiosis can be better understood in the schematic model proposed by the authors (Figure 1). The most relevant contribution of this model is the understanding that the more synergistic the relationships between each of the actors inserted in the supply chain framework, the greater the value added to the product or service. The success of this synergy depends on the success of five critical streams: information, products, services, financial resources, and knowledge. And understanding the weaknesses, limitations related to capacity limits, information, core competencies, capital, and human resources.

**Figure 1 – Supply Chain Management Framework**



Source: Bowersox *et al*, 2007.

The specificity of the strengths and weaknesses of the supply chain is what will determine the relational cohesion between the actors, the capacity to support competition and the fulfillment of contracts, and the logistical efficiency and success in delivering quality products and services, with due added value, to final consumers. This flow (of information and products), according to Coughlan *et al* (2002, p. 27), is fostered by a set of members:

manufactures (or producers), intermediaries (wholesalers, retailers, and specialists) and end users (corporate customers and end consumers). This interlocution creates the specificity of the channel and its ability to add value to the product along the supply chain. The authors (p.27) also add that “often, a channel member can be considered the “channel captain” [...] an organization that has the greatest interest in channel efforts for a given product or service, and who acts as a leader in establishing and maintaining channel linkages”. The premise of such a structure is “reducing decision-making uncertainties” of the stakeholders (VON DER VORST *et al*, 2007, p. 12). Such arguments are valid for both licit and illicit business, the focus of this study.

Drug trafficking is anchored in two segments of narcotics: chemical-based drugs (synthetic drugs manufactured entirely in laboratories) and plant-based drugs (drugs whose raw material comes from plants). Both one and the other segment have a supply chain. In this study, the focus is on cocaine, which is an Agrocriminal Supply Chain (AGROCRIM), concept proposed by Freitas (2019, p.21):

Agrocriminal Supply Chain (AGROCRIM) is conceptualized as agricultural-based criminal activity structured based on governance brought by a criminal organization, be it national or transnational with coordinates both horizontally and vertically an expressive set of criminal offenses, forming an all dynamic, complex, sophisticated, economical, and organizationally sustainable, with a strong impact on the stability of National and Subnational States and civil society in one or more countries.

In Cocaine AGROCRIM, the role of criminal actors, and their size, their negotiating capacity, are essential for safeguarding the sophisticated model of governance that in Latin America alone, is made up of 125 (one hundred twenty-five) organizations - according to FREITAS (2022) - whose contractual arrangements are crucial for operational capacity to achieve global scale, using logistical efficiency competently and illicitly. These organizations are segmented in scientific study about governance mechanisms in agrocriminal organizations in Latin America in 12 (twelve) types of criminal organizations (FREITAS, 2022; p. 27-28): (1) mafia, (2) cartel, (3) multinational criminal company, (4) national criminal company, (5) regional criminal company, (6) crime syndicate, (7) faction, (8) criminal group, (9) paramilitary group, (10) neo-paramilitary group, (11) terrorist group, (12) militia. (Please, dear reader, see the updated governance structure in appendix 2 of the study until November 2023. With update, there are 155 (one hundred fifty-five) criminal organizations in the region).

Investigative works such as *The Infiltrator: my secret life behind the scenes of money laundering in the Medellin Cartel*, by Special Agent of United States Drug Enforcement Administration (DEA) Robert Mansur, publish in 2009; *Cocaine: The Caipira Route* (2018) and



*Cabeça Branca*: the hunt for the biggest drug trafficker in Brazil (2021), both by Brazilian investigative journalist Allan de Abreu, offer a dimension of the economic power and operational capacity of criminal organizations specialized in international drug trafficking. In the following excerpts, it is possible to observe the impact of this magnitude on the dynamics of business principles of supply chain management applied to crime:

Rudy Armbrrecht, one of the Medellín Cartel's top organizers, had worked closely with the entire cartel commission to prepare some of the most sensitive operations in the United States. If the organization needed to buy a set of planes or if they needed to check the viability of some global money laundering scheme, it was Rudy they called (MANZUR, 2009, p. x; our translation).

On both farms, Luciano [Tio Patinhas] maintained laboratories to refine drugs and multiply their quantity – each 300 kilos turned into 1 ton of good quality cocaine [...]. Days later, the drug ended up being shipped to São Paulo and Europe, again escorted by strong armed surveillance. Each of these trips generated a profit of BRL 5 million, estimates the Federal Police. (ABREU, 2018, p. 42; our translation).

In October 2017, the gang took three tons of cocaine from Venezuela to Suriname, in flights of 300 kilos each of the drug in Cessna 210 planes. Through the DEA, Brazilian agents Tiago Conceição and Rodrigo Carvalho called the Surinamese police [...]. Three days later, on February 28, Surinamese police found a semi-submersible 20 meters long and 7 meters wide on the Saramacca River, west of Paramaribo and close the Tabiti River, with the capacity to transport up to 7 tons of cocaine to the Africa or the Iberian Peninsula, manufactured by a Colombian group. (ABREU, 2021, p.156-157; our translation).

The operational capacity and dynamics of Cocaine AGROCRIM constitute an important challenge for security forces in five relevant spheres: intelligence, investigation, repression, homeland security and defense (FRANÇA, 2018; GRECO, 2020), because it is not uncommon for a coalition of transnational criminal organizations, such as those seen in Latin America context, involving Colombian cartels (for example, the Gulf Cartel and the Cali Cartel), Mexican Cartels (the Sinaloa Cartel and the Jalisco New Generation Cartel), Brazilian Cartel (First Command of the Capital) or great criminal groups (Rotela Family, Mota Family, Mara Salvatrucha), European Mafias ('Ndrangheta, Calabrian Mafia, Albanian Mafia), to count on the support of paramilitary organizations (FARC, National Liberation Army, *Ejército del Pueblo Paraguayo*), terrorists groups (Al-Qaeda, Hezbollah, Boko Haram), and specialized groups of hitmen (Black Eagles) (NEUMANN, 2018; FREITAS, 2021).

In the Brazilian case, for example, the difficulty level is increased due to its land border, which is continental. The country borders all major *Erythroxylum coca* producing countries: Colombia, Peru, Bolivia (and more recently, Venezuela). Policia Federal data point out that only 10% of all narcotics that enter the national territory are seizures. This fragility was measured by Freitas (2020). The author found in the data analysis a preference of the Brazilian



Federal Police to concentrate their actions in ports and airports, which, in the author's view, contributes to inefficiencies in the federal repression model of drug trafficking, which, according to the study, can be corrected with the institutional coalition model.

## 2.2 Characterization of Cocaine Agrocrim

*Erythroxylum coca* shrub is native to the Andes Region, which reaches between 2 and meters in height, commonly found at altitudes of 200 to 300m above sea level, in regions of slopes, which offer mild temperatures between 18°C and 22°C (64,4°F and 71,6°F). It is a plant that demands specific edaphoclimatic conditions, found in countries such as Colombia, Peru and Bolivia, the biggest producers (GOOTENBERG, 2008). The harvesting of coca leaves (the commercial product) commonly begins in the bush's second year of life (the plant's life cycle varies between 25 and 40 years) and is quarterly, with productivity that varies between 800kg and 2,500kg per hectare. The main destinations of the leaves, which have more than 14 alkaloids, are consumption in *natura* (as part of cultural patterns of Andean ancestral people, in form of teas or chewing or *chaccar*), pharmaceutical industry and the illegal production of base pasta and coca hydrochloride, which fosters one of the most profitable criminal businesses in the world (GOOTENBERG, 2008; SOCIEDAD ESPAÑOLA DE PRODUCTOS HUMICOS, 2010; MATTEUCCI & MORELLO, 2022). A study carried out by the United Nations Office on Drug and Crime (UNODCS) in 2006 in partnership with the Colombian Government indicates that, on average, between 4 and 5 leaf harvests are carried out per year.

Los ciclos productivos dependen de factores como la aspersión aérea, factores climáticos, biológicos, agrológicos y las variedades sembradas (por ejemplo, la variedad "cuarentena" tiene ciclos cortos y puede alcanzar cosechas cada cuarenta días). De acuerdo con el reporte de los cultivadores, un lote de coca se cosecha varias veces durante el año y varía de una región a otra. En ocasiones, el agricultor define el momento de la cosecha por las circunstancias del mercado y favorabilidad en precios y no por la madurez del cultivo.

Se observaron cuatro períodos bien definidos: 45 días, 60-70 días, 75-90 días y 120 días. En los 463 lotes de coca en los que se realizó la prueba de rendimiento, el número promedio de cosechas al año fue de 4,5 que equivale a una cosecha cada 81 días (UNODCS, 2006, p.18).

Illegal production is supported by enticing traditional family producers. This enticement is commonly carried out either by transnational criminal organizations or paramilitary groups, which lead producers to move from licit activities (coffee production, for example) to the production of raw material for the narcotic, which requires at least 350 kg of dry leaves for each kilogram of base paste. Matteucci and Morello (2022), point out that 60 (sixty) tons of dry leaves are needed to produce 01 (one) ton of cocaine hydrochloride. According to the agronomic



report of the *Sociedad Española de Productos Húmicos* (2010), the annual production per hectare of a coca producing region can vary between 800 and 2,500kg/hectare. Everything will depend on the quality of the cultural treatments, the edaphoclimatic conditions, the fertilization techniques and the *Erythroxylum coca* varieties used. As explained by Wainwright (2017) in the bestseller *Narconomics: how to run a drug cartel*, right now, 350kg of dry leaves cost about \$ 350.00 (three hundred and fifty dollars).

Although there is deliberate participation of producers in production for cultural (or economic) reasons, normally the production conditions are commonly inhumane and are often the product of regional histories of systematized violence, institutional corruption, and serial homicides. The regions of production are a constant target of criminal organizations and paramilitary groups (FREITAS, 2019, 2021; CUESTA, 2022). This is, in itself, a huge public safety challenge for National and Subnational States, as coca crops are difficult to locate (they are usually hidden by the forest) and require the use of technologies such as drones and satellites for their location, and are difficult to eradicate (given that the alternatives are spraying glyphosate by area, which causes severe damage to the environment, and the use of specialized personnel, such as the military who pull the bushes manually). It is worth mentioning that production aimed at drug trafficking (on an industrial scale) causes severe impacts on the environment (both in production and in the mitigation carried out by the authorities), which is a problem arising (UNODCS, 2006; MATTEUCCI AND MORELLO, 2022).

The base paste, according to Araújo (2006), is produced by macerating the leaves, a process that is sophisticated with the use of different types of solvents and acids. From there, treatment with other solvents and hydrochloric acid is carried out, which generates cocaine hydrochloride. Matteucci and Morello (2022) explain in their study that “[...] to process 60 (sixty) tons of dried leaves, the following are used: 8,900 liters of kerosene; 5000 liters of sulfuric acid; 2.5kg of calcium carbonate; 0.5 tons of carbide; 2.5 tons toilet paper; 1000 liters of acetone; 1000 liters of toluene”. At this stage, still at the Andean producer level, both the base paste and the cocaine hydrochloride are pressed into molds (like bricks), weighing approximately 1 kg. These molds may or may not have high or low embossed details, which mark the piece directly. After compression, they are protected by a set of packing: plastic, adhesive tape, kraft paper. This format, apparently very common in seizures carried out by security forces, aims to increase the efficiency of the use of space. Right now, once this has been converted into a kilo of cocaine, it can be sold in Colombia, for example, for \$800.00 (eight hundred dollars) (WAINWRIGHT, 2017).

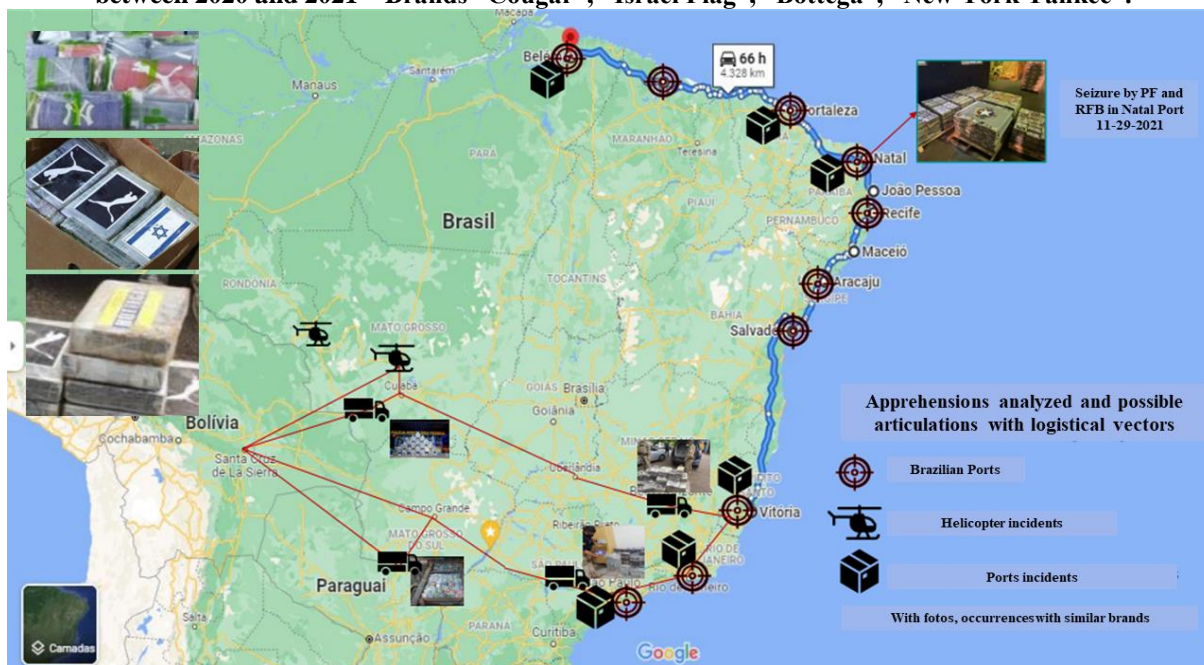
The transport of cocaine hydrochloride and base paste from the laboratories located in





the jungle to be made available to wholesalers can be carried out on foot or using aircraft, commonly helicopters (walking is more common in Colombia, while traveling by helicopters in Bolivia and Peru). At this point, the kilo of cocaine reaches \$2,200.00 (two thousand and two hundred dollars) (WAINWRIGHT, 2017). The intention at this first moment, it seems, is the concentration of volume at secret strategic points maintained by transnational criminal organizations such as cartels and paramilitary groups. It is important to highlight that means of air transport is eventually used to transport the narcotic from its origin to port regions, such as those in Brazil, to later be illegally introduced into other modes of transport, such as maritime transport. From that moment on, these organizations prepare loads for what we will be referred to export here. Some relevant precautions are taken at this stage: (i) reinforcement of the packaging of each piece, with the application of marks on them (copies or impressions of brands of drinks, perfumes, clothes, cartoons) and more layers of plastic and adhesive tape and (iii) preparation of bales, protected with plastic polyethylene film and packed either in sisal bales or bags or polyester travel bags. This preparation, as can be inferred from the analysis of seizures carried out by the security forces, is directly associated with the logistical scheme of drug trafficking.

**Figure 2 – Example of cocaine seizures carried out in Brazil and their possible logistical interlocation, between 2020 and 2021 – Brands “Cougar”, “Israel Flag”, “Bottega”, “New York Yankee”.**



Source: Elaborated by the author.

In Figure 2, an illustrative example of the logistical scheme based on my notes of drug trafficking can be seen. It contains the analysis of cocaine seizures carried out by the Brazilian security forces (Federal Highway Police of Brazil, Federal Police of Brazil, Federal Revenue

of Brazil), labeled with the brands “Cougar”, “Israel Flag”, “Bottega”, “New York Yankee”. Due to the pattern of the marks, it is observed that they appear in seizures carried out in the Brazilian states of Mato Grosso (Nobres and Rondonópolis cities), Mato Grosso do Sul (Ponta Porã and Campo Grande), São Paulo (Arujá), Minas Gerais (Belo Horizonte), Rio Grande do Norte (Natal), Rio de Janeiro (Resende), in the period between 2020 and 2021. It is inferred from the volume of seized cargo (possibly originally from Bolivia) that the focus was on exporting cocaine using the Brazilian port infrastructure.

The traffickers, in this phase, provide for the contamination of the loads, through violation of containers. In addition to this traditional criminal technique, other subterfuges are used, such as hiding narcotics in licit cargoes before they (or containers) are sealed (a more sophisticated perspective of criminal export activity), corruption of ship crews, with narcotics cargo on the high seas (the cargo is taken inside the ships) and the most complex and dangerous of all, the inclusion of drugs in sea chest (an operation carried out by professional divers co-opted by organized crime). In addition to the maritime environment, the air environment is also used. In this modality in addition to mules (co-opted people who carry narcotics in their bodies and in their luggage), there are schemes identified by the authorities, involving corruption of airport agents and teams of aviation companies (and official government aviation teams, such as head of state and government). The objective, whether by sea or air, is to allow cocaine to reach the other side of the ocean.

When illicit cargo arrives at destinations located in the African, European, Asian, and Oceanic continents, it is managed by large criminal organizations (*Ndrangheta*, *Albanian Mafia*, *Russian Mafia*, for example) and terrorist groups (*Boko Haram* and *Al Qaeda*) and/or paramilitaries groups (*Wagner Group*, *Al-Shabaab*) (NEWMANN, 2018; FREITAS, 2021). When it reaches an important market, such as the United States, as Wainwright (2017) explains, a kilo of pure cocaine costs \$14,500.00 (fourteen thousand and five hundred dollars). These groups are responsible for distributing cocaine to regional wholesalers (located in strategic regions, such as the Iberian Peninsula, for example), which are responsible for distributing into other local wholesalers, who supply local retailers. At this point, the kilo already costs \$19,500.00 (nine thousand and five hundred dollars), according to Wainwright (2017), it may still reach \$78,000 (seventh eight thousand dollars) at the final distribution points. At that time, these local dealers split the drug into small containers such as Eppendorf-type tubes, which are sold to users and drugs addicts. A gram of pure cocaine can be marketed in some countries for up to \$180.00 (one hundred eighty dollars).

When reaching the consumer market, the problem is no longer just one of public safety,

so it has also become a public health and social assistance problem, tripling, in some countries, the public expenditure of National and Subnational States with the pain caused by drug trafficking. Dramatic examples of these impacts can be observed in analysis of cases such as the Bronx of Bogotá (Colombia) and *Cracolândia*, in São Paulo city. Other problems associated with this criminal business are the overload of the judicial system and the penitentiary system, which have severe impacts on the efficiency and quality of the public services and on the increase in public spending, especially with custodians.

In general lines, the Cocaine Supply Chain Management, an AGROCRIM, has similarities with supply chains commonly found in Agro-industrial supply chains (VAN DER VORST ET AL, 2007; FREITAS, 2011; 2019), such as coffee, soy, corn, and sugar agribusiness. The difference, as already exposed, is that the former is a criminal activity, subject to the penal normative apparatus. Even so, given the illegality, it is observed that even in the face of the seizures made by the security forces, throughout all stages of the supply chain, the profits obtained from the successes are more than enough to cover the failures. Therefore, it is possible to observe, that as explained by Bowersox et al (2007), there is value generation due to the synergy of the criminal actors that act along the supply chain.

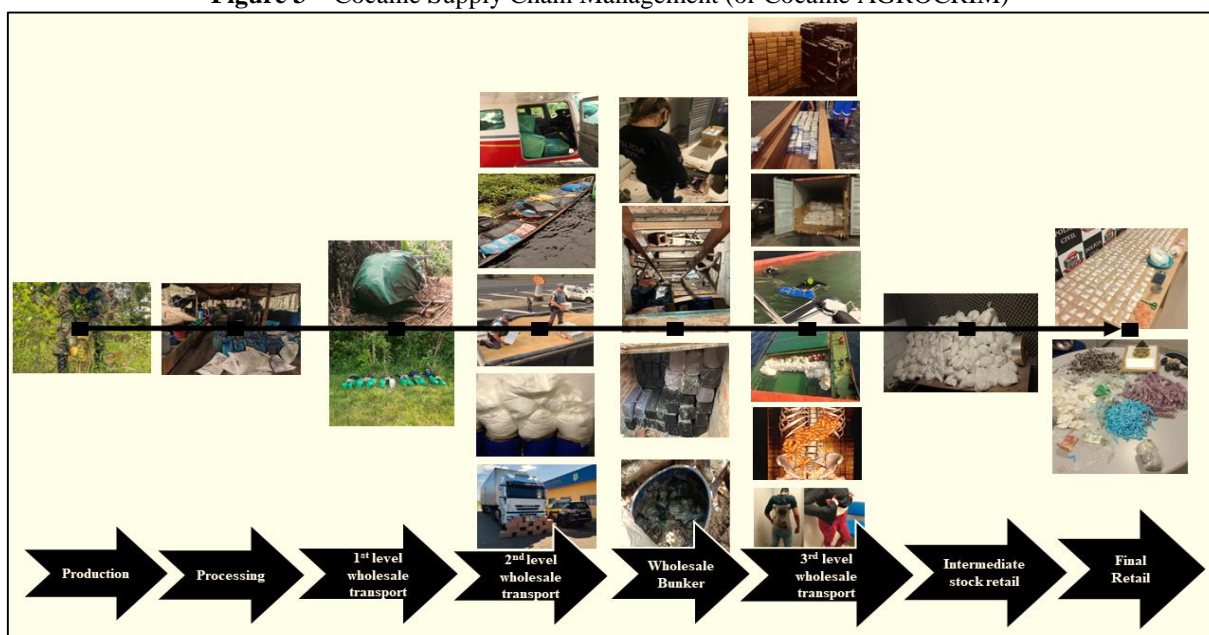
Understanding the supply chain management and the basic logistical service (BOWERSOX et al., 2007) related to global drug trafficking, especially cocaine, is a preponderant factor for the success of specialized police operations. As can be seen in Figure 3, the Cocaine Supply Chain Management (or Cocaine AGROCRIM) has 8 (eight) very well-defined stages. These stages are: **(1) production, (2) processing, (3) first level wholesale transport, (4) second level wholesale transport, (5) wholesale bunker, (6) third level wholesale transport, (7) intermediate stock retail, (8) final retail.** In the production stage, are the producers, commonly enticed by criminal organizations in rural areas. These farmers are responsible for planting, harvesting and first processing coca leaves (such as the production of base paste). The processing stage is also realized in rural areas. At this moment, realized the conversion of base pasta in coca hydrochloride and the first filling of the product and the use of packages that allow the transport of cocaine happens, as already explained. Then, the first level of wholesale drug dealer transport is carried out, commonly accomplished either on foot, using trails in the jungle, or includes aircraft, such as helicopters.

Cargo, after arriving at secret points defined by criminal organizations, can be transported in what we are calling here the second level of wholesale drug dealer transport, which can also use aircraft (airplanes and helicopters), boats, trucks (with and without cargo contamination), barrels and containers. Whether on the first or second level, the wholesalers'

purpose is to reach a bunker, where the narcotics are stored. The bunker is essential for marketing strategies of the criminal organizations, whether for the so-called internal or external markets, as they are vectors for the distribution and organization of the logistical services that will be used. Once the location of wholesale bunkers is decided, the third level of wholesale transport is observed. This level involves contamination of licit cargo, mixing narcotics with licit cargo, illegally boarding cargo, or passenger aircraft and commercial or passenger ships, use of ship sea chest area, use of mules (which ingest the narcotic or tie them to their bodies). This level allows the cocaine to reach other wholesale drug dealers at their final destinations, who sell the drug to large retail drug dealers who store the product in intermediate bunkers. These retailers supply smaller retail drug dealers, who are responsible for supplying end users. Finally, the cocaine reaches its destination, the nose of the user, whose addiction sustains one of the biggest criminal businesses in the world.

According to Bowersox et al (2007), while the supply chain demands collaboration between *collaborators* (networks of criminal actors), *business extension* (transnational criminal organizations) and *integrated services providers* (corrupt agents and specialized criminals, such as divers), integrated logistical services consider *cost minimization*, as explicit by the tendency of European and Asian criminal organizations to seek the consolidation of integrated supply channels: by established direct relationship with the producing regions), *product availability* (in addition to the expansion of planted areas, one can observe the adoption of agronomic procedures, such as fertilization, to reduce the waiting time for the production of coca leaves, which generates up to four harvests per year), *operational performance* (capillarization of logistical vectors, using different modes of transportations and routes), *speed* (there are investments in own logistical means, such as fleets of planes, ships and submarines), *consistency* (supply is independent of environmental conditions, as delays are punishable by death), *resilience* (ability to adapt to situations related to seizures of cargo and arrests of criminal actors), *time recovery* (ability to replace loads and preserve areas, even with the promotion of wars between criminal organizations) and *service reliability* (quality of cocaine, associated with the purity of the narcotic, financial guarantee of loads, including those seized by security forces, guarantee of delivery of products to criminal customers). This conceptual framework is essential for added value to products and services, including criminal products, as cocaine (Figure 3).

**Figure 3 – Cocaine Supply Chain Management (or Cocaine AGROCRIM)**



Source: Elaborated by the author.

### 3 METHODOLOGICAL PROCEDURES

For the analysis of the impact of packing on the Cocaine Supply Chain Management, this study is dedicated to performing a qualitative analysis of some seizures made in two operations carried out by the Brazilian security forces: the Ostium Operation and the Horus Operation. The collected data come from news published in the national press, which dealt with seizures of aircraft (and eventually, due to the similarity of the packaging, bunkers, and trucks) carried out by Brazilian Air Force (FAB) and the Federal Police of Brazil (DPF) (and other regional and local security forces), in the period between 2017 and 2022, in Brazilian Border Region (more specifically in Brazilian Midwest Region), according to Table 1.

**Table 1 – Characterizations of aircrafts interceptions – FAB and DPF – 2017 at 2022 – Brazilian Border Region**

Date	Location	Interception description	Seizures
October 16, 2017	Tangará da Serra	Plane captured in Mato Grosso. Force landing in Tangará da Serra city.	Airplane, 420kg of cocaine, pilot, and co-pilot.
March 8, 2018	Barra do Bugres	Plane captured in Mato Grosso. Force landing in Nova Fernandópolis city, district of Barra do Bugres city.	Airplane, 500kg of cocaine, pilot.
April 27, 2018	Corumbá	Plane captured in Mato Grosso do Sul. Force landing in Corumbá city.	Airplane, 500 of cocaine base pasta. Pilot not located.

Source: Elaborated by the author

**Table 1 – Characterizations of aircrafts interceptions – FAB and DPF – 2017 at 2022 – Brazilian Border Region****(to be continue)**

<b>Date</b>	<b>Location</b>	<b>Interception description</b>	<b>Seizures</b>
June 20, 2018	Cáceres	Plane captured in Mato Grosso. Force landing in Cáceres city. The operation had the support of the Special Border Group (GEFRON) and the Mato Grosso Military Police (PMMT)	Airplane, 420kg of cocaine, 2 guns (uninformed caliber), 2 pilots (one of them shot).
July 19, 2020	Cuiabá	Plane captured on the border between Mato Grosso and Mato Grosso do Sul. Force landing on a farm localized on this border. The operation had the support of the Special Border Group (GEFRON), the Mato Grosso Military Police (PMMT) and the Civil and Judiciary Police of Mato Grosso (PJEMT).	Airplane, 420kg of cocaine, pilot, and crew members.
August 02, 2020	Rondonópolis	Plane captured in Mato Grosso. Force landing in Rondonópolis city. The operation had the support of the Special Border Group (GEFRON), the Mato Grosso Military Police (PMMT) and the Civil and Judiciary Police of Mato Grosso (PJEMT).	Airplane, 487 kg of cocaine, pilot.
November 11, 2020	Tucumã	Truck seized by Pará Military Policie (PMPA), in Tucumã city.	Truck, 800kg of cocaine, driver
July 31, 2021	Cáceres	Plane captured in Mato Grosso, between Machadinho d'Oeste (Rondônia State) and Colniza Cities (Mato Grosso State). Force landing in Cáceres city. The operation had the support of the Special Border Group (GEFRON).	Airplane, 324kg of cocaine. The pilot fled.
August 01, 2021	Poconé	Helicopter captured in Mato Grosso. The aircraft crashed.	Helicopter, 278,51kg of cocaine.
August 08, 2021	Coronel Sapucaia	Plane captured in Mato Grosso do Sul. Force landing in Coronel Sapucaia city. The operation had the support of the Special Operation Battalion of Mato Grosso do Sul's Military Police (BOPE).	Airplane, 442,7 kg of cocaine, rifles. The pilot fled.
March 20, 2022	Campo Grande	Plane captured in Mato Grosso do Sul. Force landing in Campo Grande city.	Airplane, 465kg of cocaine, pilot.
April 22, 2022	Salto	Truck seized by municipal guard of Salto city, São Paulo State.	Truck, 1,4 tons of cocaine, driver
July 3, 2022	Jales	Plane captured in Mato Grosso do Sul. Force landing between Jales and Pontalinda cities, in São Paulo State.	Airplane, 660 kg of cocaine, pilot.
July 21, 2022	Vila Bela da Santíssima Trindade	Bunker captured in Mato Grosso, specifically in rural area. Bunker captured in Mato Grosso, specifically in the jungle. The operation had the support of the Special Border Group (GEFRON).	970kg of cocaine, two suspects were arrested.
February 27, 2023	Sinop	Plane captured in Mato Grosso. Force landing in Sinop city. The operation had the support of the Special Border Group (GEFRON).	Airplane, 462 kg of cocaine, pilot.
February 27, 2023	Poconé	Bunker captured in Mato Grosso, specifically in jungle. The operation had the support of the Special Border Group (GEFRON).	1,7 tons of cocaine.
March 02, 2023	Alta Floresta	Plane captured in Mato Grosso. Force landing in Alta Floresta city.	Airplane, 400kg of cocaine. The pilot fled.
April 23, 2023	Salvador	Bunker captured in Bahia, specifically in a Salvador neighborhood. The operation had the support of the Bahia Military Police (PMBA)	1 ton of cocaine, several suspects were arrested.

**Source:** Elaborated by the author

**Table 1 – Characterizations of aircrafts interceptions – FAB and DPF – 2017 at 2022 – Brazilian Border Region**

Date	Location	Interception description	Seizures
April 23,2023	Brasnorte	Bunker captured in Mato Grosso, specifically in rural area. Bunker captured in Mato Grosso, specifically in jungle. The operation had the support of the Special Border Group (GEFRON).	492,8 ton of cocaine
May 13, 2023	Vila Bela da Santíssima Trindade	Bunker captured in Mato Grosso, specifically in rural area. Bunker captured in Mato Grosso, specifically in jungle. The operation had the support of the Special Border Group (GEFRON).	500kg of cocaine
June 03, 2023	Comodoro	Bunker captured in Mato Grosso, specifically in rural area. The operation had the support Civil and Judiciary Police of Mato Grosso (PJEMT).	550kg of cocaine.

**Source:** Elaborated by the author

For the selection of seizures listed in the table, the following similarities of the packages were considered: (1) bales, (2) type of bale fiber, (3) bale colors, (4) bale stitching, (5) bale size, (6) bale tying. As explained, in addition to seizures carried out due to the capture of packages, seizures of cocaine load in bunkers and trucks were considered. The selection criterion was similar packaging. The data, after being organized in a table, were treated with two Microsoft software: Microsoft Excel and Microsoft Power BI. Canva was also used to process the photographic images collected at official bases, such as those of the DPF, FAB and Brazilian Civil and Military Police.

## 4 DATA ANALYSIS AND DISCUSSION

### 4.1 Characteristics of seized loads

The analysis of the 21 (twenty-one) apprehensions (TABLE 1) that make up the homogeneous sample show a series of intriguing standards that can be segmented into: (a) *standard of the size of the load*, (b) *standard of the packaging technique*, (c) *standard of the external packing*, (d) *standardized means of transport*, (e) *logistical integration standard*, with evidence which indicates similarities of 3 (three) modes associates with supply chains strategy.

Regarding the standard of the packages, taking as parameter the photographic analysis and the information disclosed by the authorities of the seizure carried out on March 20, 2022, in Campo Grande (Mato Grosso do Sul), there is approximate amount of 30 (thirty) per pack. This base seizure seized 465 (four hundred sixteen-five) kilos of cocaine, which were divided into 15(fifteen) bags. With the use of a ruler, it is observed that the package measures are also standardized, which shows an extreme concern with the criminal charge, however valuable: (a) packing of the piece of cocaine itself: polypropylene film, kraft paper, adhesive tape and brand



printed on paper, also adhesive; (b) packaging it in a cardboard box, which is packed in some plastic packaging (or wrapped with kraft paper) and more adhesive tape; (c) packaging in raffia bags (Figure 4).

**Figure 4 – Cocaine Packaging Process – Research Note**



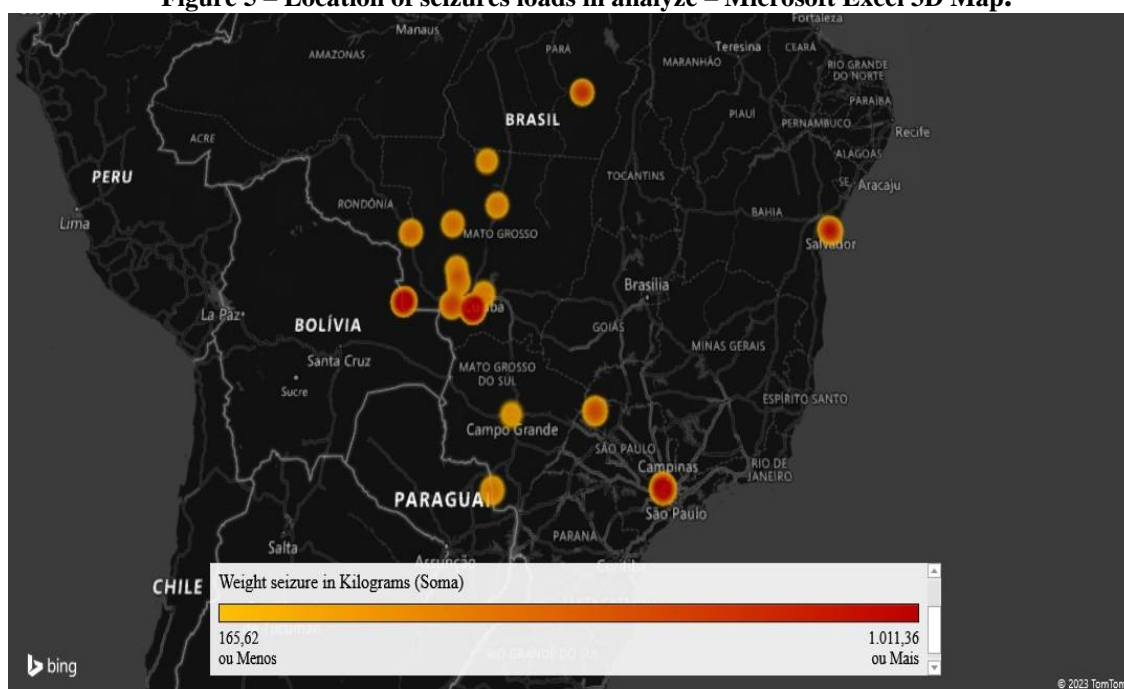
**Source:** Elaborated by the author.

All apprehensions evaluated (demonstrated in map in Figure 5) were packed in raffia bags, with the same pattern of packaging format, fiber type, colors (green, light green and light blue), tying and sewing, which allows inferring that the origin of all loads was the same. In the appendix, it is possible to observe these similarities in figures organized by the author, in the chronological order of the observations, detailed in Table 1.

The harmonized characteristics of the seized loads shows a sophisticated logistical arrangement, with the application of business knowledge with a view to clearly preserving the integrity of the goods, in this case, cocaine hydrochloride. This is an observable feature in business activity aimed at wholesale. In the case of the study, it appears that the seized quantities have standardized bales (approximately 30 (thirty) kilos each) and minimum transported volumes. Isolating the modes of air transport (helicopter and plane), the lower limit is situated at 278,50kg and the upper limit at 1,700kg. This condition is better observed in Table 2.



Figure 5 – Location of seizures loads in analyze – Microsoft Excel 3D Map.



Source: Elaborated by the author.

Then, still considering the sample, the use of bunkers and trucks is verified. From the study, it is not possible to assess whether the loads were destined for the domestic or foreign markets. Among the sample, the only seizure that indicates there would possibly be a destination for export, is the seizure carried out on April 23, 2023 in Salvador, which is a coastal Brazilian port city.

#### 4.2 Sample convergence points for attention

The captures carried out by the Brazilian authorities (DPF, FAB, Civil and Military Police), sampled in this study, were concentrated in three of the eight supply chain phases of the cocaine agrocriminal chain: (a) 1<sup>st</sup> level wholesale transport, (b) 2<sup>nd</sup> level wholesale transport and (c) wholesale bunker. Except in the case of trucks and bunkers, which required police intelligence activity, the other seizures (helicopters and planes) required defense technology and infrastructure (homeland security).

Table 2 - Characteristics of seized carried out by the Brazilian authorities – 2017 at 2023 – Sampling in analysis

Location	State	Weight seizure	Year	Interception	Bale type?	Bale Fibre Type	Bale Green Color	Bale Light Blue Color	Bale Light Green Color	Bale stitching	Bale Size	Bale tying
Tangará da Serra	Mato Grosso	420,00	2017	Plane	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Barra do Bugres	Mato Grosso	500,00	2018	Plane	Yes	Raffia	NO	YES	NO	Industrial Stitching	Identical	Identical
Corumbá	Mato Grosso do Sul	500,00	2018	Plane	Yes	Raffia	YES	YES	YES	Industrial Stitching	Identical	Identical
Cáceres	Mato Grosso	420,00	2018	Plane	Yes	Raffia	NO	YES	NO	Industrial Stitching	Identical	Identical
Cuiabá	Mato Grosso	420,00	2020	Plane	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Rondonópolis	Mato Grosso	428,00	2020	Plane	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Tucumã	Pará	800,00	2020	Truck	Yes	Raffia	YES	YES	NO	Industrial Stitching	Identical	Identical
Cáceres	Mato Grosso	324,00	2021	Plane	Yes	Raffia	YES	YES	NO	Industrial Stitching	Identical	Identical
Poconé	Mato Grosso	278,50	2021	Helicopter	Yes	Raffia	NO	YES	NO	Industrial Stitching	Identical	Identical
Coronel Sapucaia	Mato Grosso do Sul	442,70	2021	Plane	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Campo Grande	Mato Grosso do Sul	324,00	2022	Plane	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Salto	São Paulo	1400,00	2022	Truck	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Jales	São Paulo	660,00	2022	Plane	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Vila Bela da Santíssima Trindade	Mato Grosso	970,00	2023	Bunker	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Sinop	Mato Grosso	462,00	2023	Plane	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Poconé	Mato Grosso	1700,00	2023	Bunker	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Alta Floresta	Mato Grosso	400,00	2023	Plane	Yes	Raffia	NO	YES	NO	Industrial Stitching	Identical	Identical
Salvador	Bahia	1000,00	2023	Bunker	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Brasnorte	Mato Grosso	492,80	2023	Bunker	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical
Vila Bela da Santíssima Trindade	Mato Grosso	500,00	2023	Bunker	Yes	Raffia	YES	NO	YES	Industrial Stitching	Identical	Identical
Comodoro	Mato Grosso	550,00	2023	Bunker	Yes	Raffia	YES	NO	NO	Industrial Stitching	Identical	Identical

Source: Elaborated by the author



The seizures in the study demonstrate the ability of transnational organized crime to create sophisticated patterns of invasion of Brazilian territory to achieve its commercial objectives. They also show the ability to co-opt professional who are experts in their areas (such as airplane and helicopter pilots), who demand specialized training, that poses a herculean challenge for the Brazilian security forces, since in addition to cocaine, these traffickers also bring weapons for restrict use (Figure 6).

**Figure 6 – Example of the presence of arms trafficking in the context of drug trafficking**



**Source:** Elaborated by the author.

An example in this regard is the seizure carried out in Coronel Sapucaia city, Mato Grosso do Sul, on August 8, 2021. In this operation, an airplane, 442,7kg of cocaine and weapons (03 rifles Colt M4 Trooper 5.56mm 16' and 01 rifle Ruger SR 7.62mm). As you can see in Figure 7, two of the rifles had a Punisher (Marvel Comics character) decal. This same marking can be observed in two other seizures carried out by the Brazilian police: one was carried out on August 7, 2022, in Ourinhos, State of São Paulo (Military Road Police of São Paulo) and another, on June 25, 2023, in Cascavel, State of Paraná (Federal Highway Police of Brazil). Weapons commonly end up supplying criminal organization operations in Brazilian territory and, as a rule, are used in violent crimes against property, as in the case of crimes of the Domain of Cities modality.

Returning to the analysis of the packages that make up the sample, it appears that in addition to the packaging pattern, there are other important standards to be highlighted, such as (1) the industrial sewing of the bales (Figure 7) and (2) the pattern of tying these bales (Figure 8).

Figure 7 – Industrial sewing of the bag seizures



Source: Elaborated by the author.

These two pieces of evidence reinforce the idea that all the cargo seized on different dates by the Brazilian authorities came from the same place. An extremely instigating homogeneity (worthy of the work of Agatha Christie).

Figure 8 – Pattern of tying the bag seizures



Source: Elaborated by the author.

## 5 FINAL CONSIDERATIONS

Criminal Supply Chain Management is a crucial paradigm for homeland security and public security policies, particularly to National countries in strategic regions to Drug Trafficking, as producing countries (Colombia, Peru, Bolivia, for example) and countries that function as logistical warehouses – or hubs – for international criminal trade and, and at the same time, relevant consumers markets (Brazil, Argentina, Chile, and Ecuador, for example). The government challenges, in general, touch seven public service systems: the Defense System, the Homeland Security System, the Public Security System, the Justice System, the Prison System, the Social Assistance System and the Health System. All these systems, in view

of the visible impact of drug trafficking activity, put increasing and constant pressure on the public budgets of National and Subnational States.

Apart from all notorious impacts, it is necessary to consider that there are impacts on the generation of the National and Subnational Gross Domestic Product (GDP), due to the clear disuse of people of economically working age, in the face of the disgraceful chemical dependence (as Brazilian society is currently witnessing the scourge of crack addicts in the capital of the States of São Paulo, a lucrative business maintained by the First Command of Capital Brazilian Cartel; the United States deals with a national tragedy caused by Fentanyl, a synthetic drug produced by Mexican cartels).

The present study showed a small fraction of the dynamics of the organized crime business through the analysis of seizures, that is, the losses of organized crime, which demonstrates the complexity of mitigation of the supply chain associated with drug trafficking and related crimes. The pattern of the sample is frightening, because it shows a strong and, at the same time, the high level of difficulty of the authorities in curbing this complex crime. In addition to being organized in the broadest sense by the quality and refinement of the use of logistics fundamentals (carefully designed packaging and selection of high-performance means of transport), and to demonstrating a strong scale of a well-designed and efficient supply chain (in case of cocaine, the object of this study), there was an association with other serious crimes, such as international weapons trafficking and enticing people to perpetrate crimes.

In the Brazilian case, arms trafficking encourages very serious crimes, such as the seizure of territories (as in the case of Rio de Janeiro) that have robust paramilitary groups in action (militia), violent crimes against property (such as the Dominion of Cities and correlates, such as robbing banks and armored cars), wars between rival criminal organizations and clashes with security forces. Integration strategies of security forces such as Vigia, Horus, Unified Public Security System (SUSP) itself show successes, as these strategies impact criminal activity in all links of the supply chain. The same can be said when it comes to mechanisms for international cooperation, intelligence, and the fight against money laundering. But the research shows that there are segments still to be considered in the strategy, such as, for example, the regulation of products and services that can be used by drug trafficking.

It is surprising to observe how inputs used by legal industries to bottle their products are also used by organized crime. In this study, the use of (a) polypropylene film, (b) kraft paper, (c) adhesive tape, (d) standardized cardboard boxes and (e) raffia bags, with standardized colors, was clearly verified. As these are products that are easily found in stores specializing in packaging and school supplies, supermarkets, there is a diplomatic challenge there, which

requires some type of regulation at the World Trade Organization (WTO), which facilitates the traceability of the companies responsible to produce such inputs and, based on sales tax records, facilitate the investigations carried out by the security forces. An alternative could be a global bank of DNA samples from these inputs that could be maintained by either the WTO or The International Criminal Police Organization (INTERPOL).

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## APPENDIX I - Collection of patterns of cocaine seizures carried out by Brazilian authorities between 2017 and 2023

Artigos

Figure A – Top to bottom, left to right: seizure in Tangará da Serra on October 16, 2017; seizure in Barra do Bugres on March 8, 2018; seizure in Corumbá on April 27, 2018; seizure in Cáceres on June 20, 2018.



**Source:** elaborated by the author, based on the Federal Police, Brazilian Air Force, Brazilian Army, Special Border Group of the State of Mato Grosso, Military Police of Mato Grosso, Military Police of Mato Grosso do Sul, Civil Police of Mato Grosso, Military Police of São Paulo, Civil Police of São Paulo, Municipal Guard of Salto.



Figure B – Top to bottom, left to right: seizure in Cuiabá (more specifically between Mato Grosso and Mato Grosso do Sul) on July 19, 2020; seizure in Rondonópolis on August 02, 2020; seizure in Tucumã in November 11, 2020; seizure in Cáceres on July 31, 2021.



**Source:** elaborated by the author, based on the Federal Police, Brazilian Air Force, Brazilian Army, Special Border Group of the State of Mato Grosso, Military Police of Mato Grosso, Military Police of Mato Grosso do Sul, Civil Police of Mato Grosso, Military Police of São Paulo, Civil Police of São Paulo, Municipal Guard of Salto.

Figure C – Top to bottom, left to right: seizure in Poconé on August 01, 2021; seizure in Coronel Sapucaia on August 08, 2021; seizure in Campo Grande on March 20, 2022.



**Source:** elaborated by the author, based on the Federal Police, Brazilian Air Force, Brazilian Army, Special Border Group of the State of Mato Grosso, Military Police of Mato Grosso, Military Police of Mato Grosso do Sul, Civil Police of Mato Grosso, Military Police of São Paulo, Civil Police of São Paulo, Municipal Guard of Salto.

Figure D – Top to bottom, left to right: seizure in Salto on April 22,2022; seizure in Jales on July 3, 2022; seizure in Vila Bela da Santíssima Trindade on July 21, 2022; seizure in Sinop on February 27, 2023; seizure in Poconé on February 27, 2023.



**Source:** elaborated by the author, based on the Federal Police, Brazilian Air Force, Brazilian Army, Special Border Group of the State of Mato Grosso, Military Police of Mato Grosso, Military Police of Mato Grosso do Sul, Civil Police of Mato Grosso, Military Police of São Paulo, Civil Police of São Paulo, Municipal Guard of Salto.

**Figure E – Top to bottom, left to right: seizure in Alta Floresta on March 02, 2023; seizure in Salvador on April 23,2023; seizure in Brasnorte on April 23,2023; seizure in Vila Bela da Santíssima Trindade on May 13, 2023; seizure in Comodoro on June 03, 2023**



**Source:** elaborated by the author, based on the Federal Police, Brazilian Air Force, Brazilian Army, Special Border Group of the State of Mato Grosso, Military Police of Mato Grosso, Military Police of Mato Grosso do Sul, Civil Police of Mato Grosso, Military Police of São Paulo, Civil Police of São Paulo, Municipal Guard of Salto

APPENDIX II – Governance mechanisms of agrocriminal organizations in Latin American – graphic scheme updated until November 2023

Artigos

