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ABSTRACT

This essay introduces the theoretical concept of the Tetrahedron of Transnational Criminal Organizations (TCO) as a framework to understand and address the complexity of transnational organized crime. Drawing from the Fire Tetrahedron metaphor, the model highlights four key, interdependent domains that sustain these organizations: (1) illicit resources and markets, (2) a facilitating social environment, (3) human desires and motivations, and (4) adaptive complex criminal networks. By examining how these domains interact, the study shows why isolated interventions targeting one or two of the domains often fail to break the reinforcing cycles that empower TCOs. Historical examples, such as the Mérida Initiative and Sweden's drug liberalization policies in the 1960s, reveal the limitations of fragmented tackling strategies. The "war on drugs" emphasized cracking down on illicit resources while ignoring institutional and social factors. Similarly, Sweden's harm-reduction approach overlooked motivational and institutional aspects, leading to future setbacks. This study aims to lay the groundwork for a conceptual framework to help policymakers, researchers, and practitioners craft integrated strategies. Addressing all four domains of the TCO Tetrahedron offers a more effective way to combat transnational organized crime. Future research should explore complementary models, such as network theories and predictive analytics, to deepen our understanding of criminal dynamics and develop sustainable, impactful solutions.

Keywords: Transnational Criminal Organizations. TCO Tetrahedron. Illicit Resources and Markets. Integrated Strategies to Tackle Organized Crime.



RESUMO

Este ensaio apresenta o conceito teórico do Tetraedro das Organizações Criminosas Transnacionais (OCT) como uma estrutura para compreender e abordar a complexidade do crime organizado transnacional. Inspirado na metáfora do Tetraedro do Fogo, o modelo destaca quatro domínios-chaves e interdependentes que sustentam essas organizações: (1) recursos ilícitos e mercados, (2) um ambiente social facilitador, (3) desejos e motivações humanas e (4) redes criminosas complexas e adaptativas. Ao examinarmos como esses domínios interagem, demonstramos por que intervenções isoladas que visam um ou dois desses domínios frequentemente falham em romper os ciclos de reforço que fortalecem as OCTs. Exemplos históricos, como a Iniciativa Mérida e as políticas de liberalização de drogas na Suécia na década de 1960, revelam as limitações de estratégias fragmentadas. A "guerra às drogas" enfatizou o combate aos recursos ilícitos, ignorando fatores institucionais e sociais. De forma semelhante, a abordagem de redução de danos da Suécia negligenciou aspectos motivacionais e institucionais, resultando em retrocessos nos momentos seguintes. Este estudo busca, portanto, estabelecer as bases para um marco conceitual que ajude formuladores de políticas, pesquisadores e profissionais a desenvolver estratégias integradas. Abordar os quatro domínios do Tetraedro das OCTs oferece uma maneira mais eficaz de combater o crime organizado transnacional. Indicamos que pesquisas futuras devem explorar modelos complementares, como teorias de redes e análises preditivas, para aprofundar nossa compreensão das dinâmicas criminosas e desenvolver soluções sustentáveis e impactantes.

Palavras-chave: Organizações Criminosas Transnacionais. Tetraedro das OCT. Recursos e Mercados Ilícitos. Estratégias Integradas para o Enfrentamento ao Crime Organizado.

RESUMEN

Este ensaio presenta el concepto teórico del Tetraedro de las Organizaciones Criminales Transnacionales (OCT) como un marco para comprender y abordar la complejidad del crimen organizado transnacional. Inspirado en la metáfora del Tetraedro del Fuego, el modelo destaca cuatro dominios clave e interdependientes que sostienen estas organizaciones: (1) recursos ilícitos y mercados, (2) un entorno social facilitador, (3) deseos y motivaciones humanas y (4) redes criminales complejas y adaptativas. Al examinar cómo interactúan estos dominios, demostramos por qué las intervenciones aisladas que se enfocan en uno o dos de estos dominios suelen fallar en romper los ciclos de refuerzo que fortalecen a las OCT. Ejemplos históricos, como la Iniciativa Mérida y las políticas de liberalización de drogas en Suecia en la década de 1960, revelan las limitaciones de estrategias fragmentadas. La "guerra contra las drogas" puso énfasis en combatir los recursos ilícitos, ignorando factores institucionales y sociales. De manera similar, el enfoque de reducción de daños de Suecia descuidó aspectos motivacionales e institucionales, lo que resultó en retrocesos en los años posteriores. Este estudio busca, por lo tanto, sentar las bases para un marco conceptual que ayude a los formuladores de políticas, investigadores y profesionales a desarrollar estrategias integradas. Abordar los cuatro dominios del Tetraedro de las OCT ofrece una forma más eficaz de combatir el crimen organizado transnacional. Indicamos que futuras



investigaciones deberían explorar modelos complementarios, como teorías de redes y análisis predictivos, para profundizar nuestra comprensión de las dinámicas criminales y desarrollar soluciones sostenibles y de impacto.

Palabras clave: Organizaciones Criminales Transnacionales. Tetraedro de las OCT. Recursos y Mercados Ilícitos. Estrategias Integradas para Enfrentar el Crimen Organizado.

1 INTRODUCTION

Combating transnational criminal organizations (TCO) stands as one of the most critical global security challenges of the 21st century, as highlighted by various studies (Bouchard, 2020b; Perret; Otero, 2020; Roth, 2012). These organizations, known for their complexity, adaptability, and resilience, transcend traditional geographic and political boundaries, exploiting institutional, social, and economic vulnerabilities on an unprecedented scale. This makes their containment increasingly challenging.

Over the past decade, research on organized crime and the organizations that sustain it has grown significantly. A simple search on Google Scholar for "organized crime" and "criminal organizations" reveals over 50,000 publications globally between 2014 and 2024. Including equivalent terms in other languages, such as Spanish, French, or Portuguese, would likely yield even higher numbers.

Despite this surge in academic output, operational progress in addressing TCO has lagged. The sheer volume of publications overwhelms practical application. For instance, reading two articles daily would require approximately 68 years to cover the 50,000 works, assuming no interruptions. Beyond reading, critical comprehension, synthesis, and practical application demand even more time and intellectual effort, underscoring the gap between academic knowledge and actionable solutions.

Without tools to organize, integrate, and translate academic findings into practical strategies, this vast body of knowledge remains underutilized. Traditional strategies, often fragmented, fail to account for the dynamic and interconnected factors sustaining TCO. As Buneci (2021) noted, TCOs adapt rapidly, reconfiguring their structures and operations in response to countermeasures, highlighting the need for innovative approaches.



To address this complexity, this study proposes the **TCO Tetrahedron**, inspired by the Fire Tetrahedron, as a practical framework for understanding and combating TCO. Just as combustion relies on four elements — fuel, oxygen, ignition temperature, and chain reaction (Denti; Dallago; Steffens, 2022) — the TCO Tetrahedron identifies four domains driving organized crime: (1) illicit resources and markets (fuel), (2) a facilitating social environment (oxygen), (3) human desires and motivations (ignition temperature), and (4) adaptive complex criminal networks (chain reaction).

For clarity, the term “criminal organizations” is used here to describe a heterogeneous set of actors involved in diverse illegal activities. The definition of organized crime remains contested, as discussed by Paoli and Vander Beken (2014), emphasizing the need for adaptable strategies that address the nuances and complexities of transnational illicit activities.

The goal of this study is to introduce the TCO Tetrahedron as a dynamic, integrated framework for understanding TCO activities and designing comprehensive countermeasures. By examining the interactions and interdependencies among these domains, the study seeks to provide an initial conceptual foundation for policymakers, researchers, and practitioners. This framework not only acknowledges the complexity of TCO but also has the potential to guide the creation of effective, sustainable strategies, diagnostics, and protocols to combat transnational organized crime in the near future.

2 UNDERSTANDING THE DOMAINS SUSTAINING TRANSNATIONAL CRIMINAL ORGANIZATIONS: A FIRE TETRAHEDRON METAPHOR

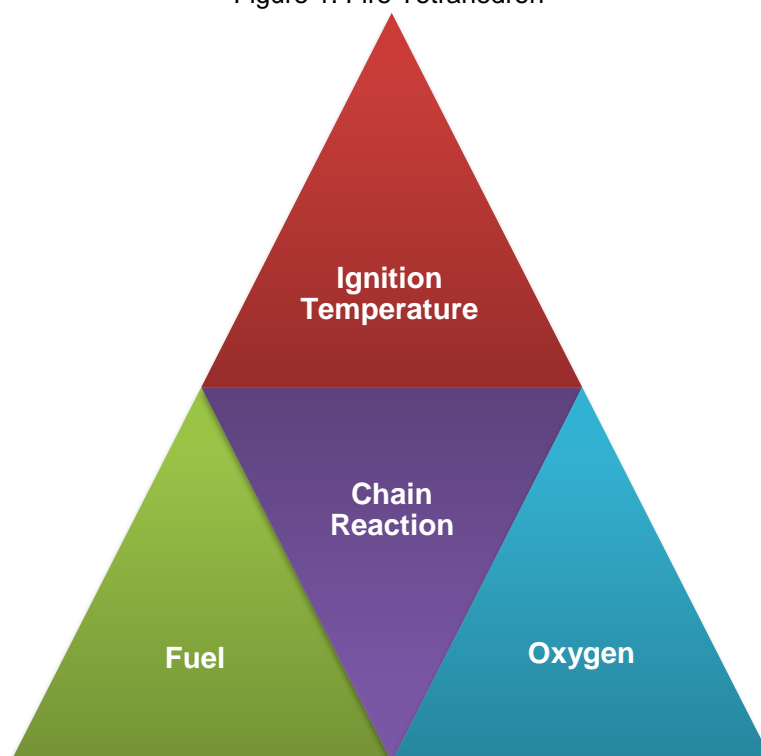
To understand the domains that sustain transnational criminal organizations (TCOs), we propose using the metaphor of the Fire Tetrahedron. This concept, drawn from the science of combustion, identifies four essential elements required for fire to occur and persist: fuel, oxygen, ignition temperature, and chain reaction (Denti; Dallago; Steffens, 2022).

The fire tetrahedron is a conceptual model that explains the essential elements needed for combustion: fuel, oxidizer, ignition temperature, and chain reaction. **Fuel** serves as the substance that burns, which can be solid, liquid, or gas, providing the energy base for the reaction. The **oxidizer**, typically the oxygen



in the air, is crucial for the chemical reaction that sustains combustion. The **ignition temperature** is the minimum heat required to initiate combustion, allowing the fuel to reach the energy level necessary to start burning. Finally, the **chain reaction** keeps the fire going by releasing energy that breaks down more molecules, continuously feeding the process. If any of these elements is missing, combustion cannot occur or will be extinguished, making the tetrahedron a vital tool for understanding and controlling fires.

Figure 1. Fire Tetrahedron



Source: Denti; Dallago; Steffens, 2022

Similarly, these elements align with the domains that enable TCOs to endure over time, offering an integrated perspective on the forces that maintain organized crime globally.

The Fire Tetrahedron metaphor helps identify four fundamental domains sustaining and perpetuating Transnational Criminal Organizations: (1) **illicit resources and markets**; (2) a **facilitating social environment**; (3) human **desires and motivations**; and (4) **adaptive complex criminal networks**. Unlike fire, these domains are interdependent and recursive, continuously influencing one another. Without more than three of them, criminal activities cannot persist.



2.1 FUEL: ILLICIT RESOURCES AND MARKETS

Illicit resources act as the fuel that powers TCOs, enabling them to sustain and expand operations. Activities like drug, weapon, and human trafficking generate substantial financial flows, funding infrastructure, advanced equipment, and corruption of public officials. This illicit capital not only maintains existing operations but also allows diversification into new legal and illegal ventures, creating a reinforcing cycle of growth and strength for TCOs. Without this steady flow of capital, sustaining their activities would become exceedingly difficult.

2.2 OXYGEN: A FACILITATING SOCIAL ENVIRONMENT

The facilitating social environment represents institutional, social, and economic vulnerabilities exploited by TCOs. Factors like weak judicial systems, systemic corruption, socioeconomic inequality, and ineffective international cooperation provide fertile ground for these organizations (Masi, 2013; São Pedro, 2022). Corruption undermines law enforcement, while exclusion and inequality create a ready pool of recruits. These vulnerabilities allow TCOs to operate across national borders, evade law enforcement, and infiltrate government structures (Golubovskii; Kostyuk; Kunts, 2021; Nelen; Siegel, 2021). The absence of robust international coordination further complicates efforts to combat TCOs on a global scale.

2.3 IGNITION TEMPERATURE: HUMAN DESIRES AND MOTIVATIONS

Ignition temperature symbolizes the human desires and motivations that drive individuals to engage with TCOs. Factors such as the pursuit of power, wealth, or social status, combined with survival needs in contexts of poverty and unemployment (Pires, 2023a), make TCOs attractive. For those resistant to these appeals, TCOs often use coercion and threats (Andrade; Lima, 2018). Understanding these motivators is crucial for designing interventions targeting recruitment and retention (Pires, 2023b).

Building on this, the widespread participation of chemical dependents as consumers of illicit drugs highlights a significant and highly complex aspect of



demand. While there is no universally agreed-upon explanation for why individuals engage in drug abuse, understanding the broader, more general motivations behind this behavior is essential for addressing the demand side of illicit markets. Thus, this domain presents the greatest challenge, as it involves deeply ingrained social, psychological, and economic factors that drive consumption. Targeted strategies to reduce demand could disrupt a critical pillar sustaining TCO operations, making it a key focus for comprehensive intervention efforts.

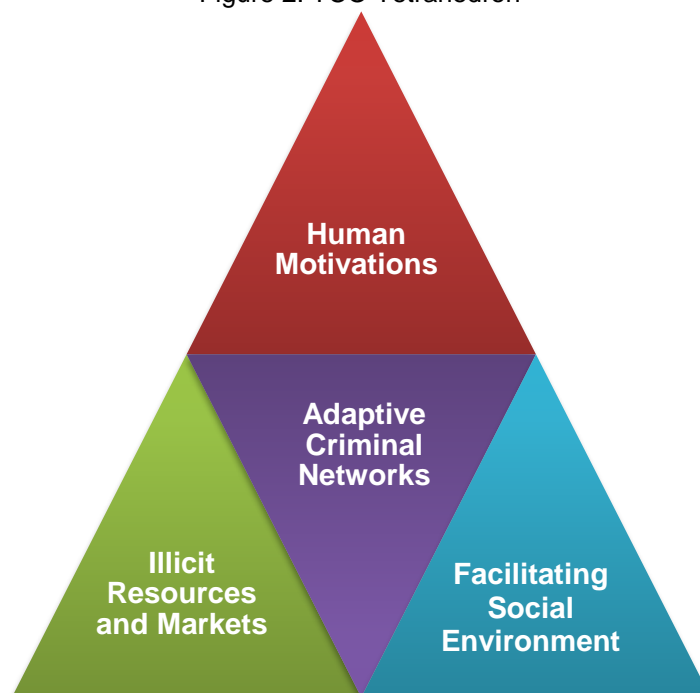
2.4 CHAIN REACTION: ADAPTIVE CRIMINAL NETWORKS

The adaptive capacity of Transnational Criminal Organizations (TCOs) acts as a self-reinforcing mechanism that sustains and expands their criminal activities. These organizations exhibit remarkable resilience, continuously evolving to counteract law enforcement efforts (Buneci, 2021). From adopting advanced technologies to diversifying trafficking routes and altering organizational structures, TCOs innovate rapidly to avoid detection and disruption (Lindley, 2022). Unlike natural phenomena like fire, which cannot adapt to extinguishing efforts, TCOs reconfigure their strategies to thrive under new adverse conditions, exploiting their flexibility and lack of legal constraints to adapt more swiftly than security forces.

A significant factor behind this adaptability is the strong motivational component within TCOs. These organizations foster deep loyalty and a sense of belonging among their members, often resembling the communal bonds of certain religious groups. This shared identity strengthens internal cohesion and stokes a collective determination to overcome legal and societal obstacles. Freed from legal and procedural constraints, TCOs can rapidly pivot and experiment with new methods, making them highly agile compared to law enforcement, which is often shaped by bureaucracy and rigid ethical boundaries. This combination of structural flexibility and psychological resilience makes TCOs exceptionally tenacious, requiring integrated strategies that address their operational, social, and motivational dimensions.



Figure 2. TCO Tetrahedron



Source: The author

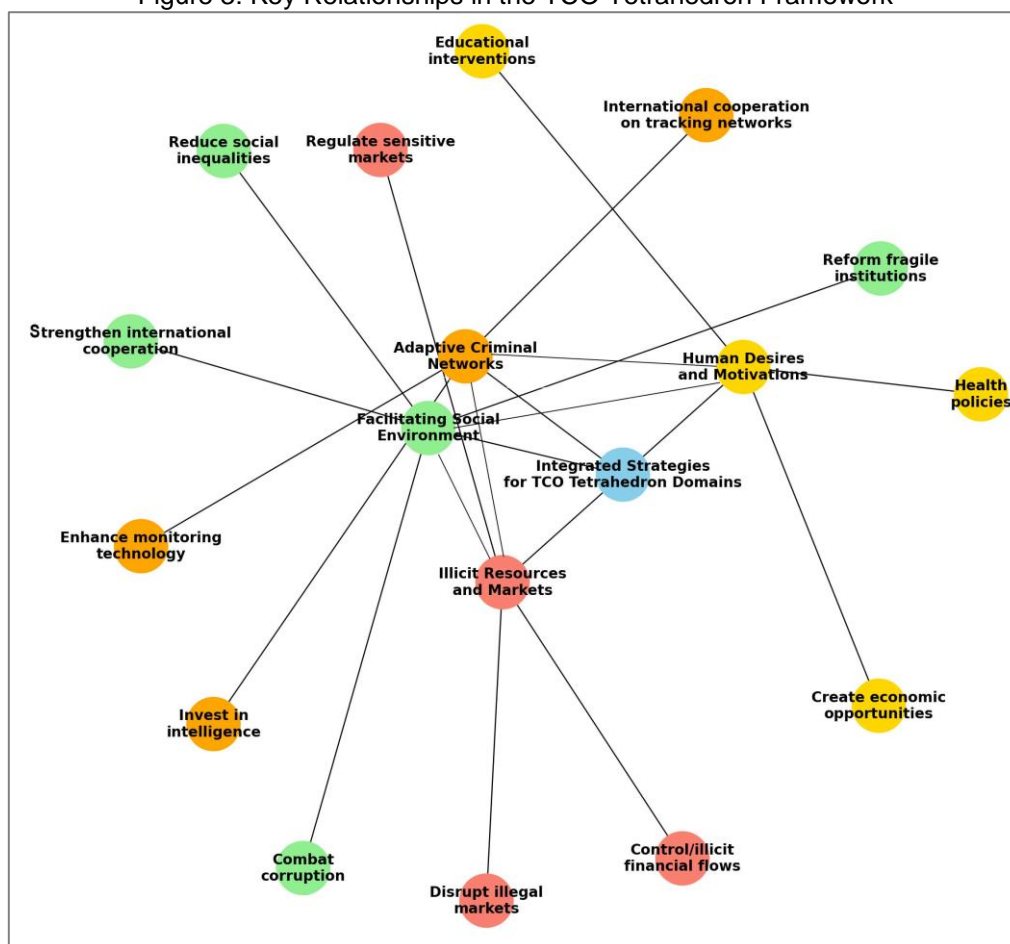
This metaphor draws inspiration from the Fire Pentahedron Operation conducted by Brazil's Federal Police in 2021, which targeted human-caused forest fires. The operation highlighted human action as a critical element amplifying combustion, aligning with the fire tetrahedron. Applying this concept to TCOs helps depict the complexity of criminal networks and their dynamics.

While removing one element extinguishes fire, disrupting one domain of TCOs might only weaken their structure, prompting reconfiguration into new, more resilient forms. Thus, focusing on one or two domains is insufficient to dismantle organized crime. Instead, integrated strategies addressing all four domains — illicit resources, facilitating environments, human motivations, and adaptive capacities — offer a more sustainable approach to destabilizing TCO operations.

This approach underscores the importance of developing **comprehensive** policies and **actions** to combat TCOs. By targeting multiple dimensions simultaneously, stakeholders can increase the likelihood of effectively reducing the global influence and resilience of transnational criminal organizations. The presented diagram uses the dimensions of the TCO Tetrahedron (Transnational Criminal Organizations) as a foundation to visualize the key relationships that influence these organizations.



Figure 3: Key Relationships in the TCO Tetrahedron Framework



Source: The Author

This model aims to explore the fundamental connections between critical dimensions, highlighting interactions that contribute to understanding the complexity of TCO dynamics. The number of relationships is a central element defining the system's complexity. In this diagram, we focus on first-order relationships — direct connections between primary elements and their branches. Recursive or multi-order relationships were deliberately excluded to prevent visual overload and maintain clarity in understanding interdependencies.

As the number of relationships and interactions increases, the diagram would quickly become visually cluttered and confusing. This is an inherent challenge in traditional diagrams, which rely on explicit visual connections to convey information. Therefore, there is a clear need to develop a more robust and scalable representation that can capture the system's intricacies without compromising clarity. This could involve leveraging interactive approaches, dynamic tools, or alternative visualization methods such as heatmaps or three-dimensional graphs.



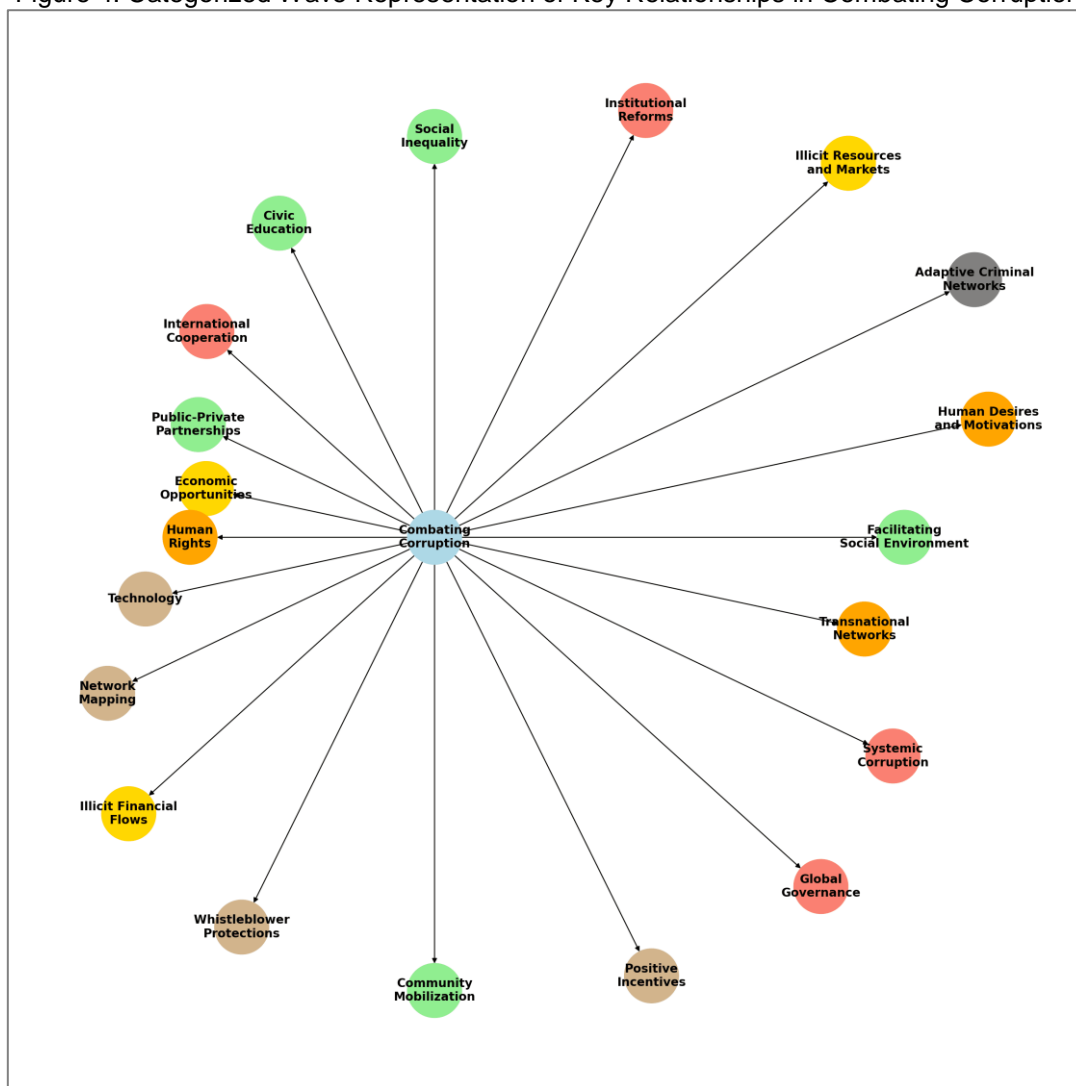
This approach also opens the door to creating new, more specialized diagrams focused on specific areas of interest. For instance, one of the branches in the diagram — combating corruption — could be expanded to explore the specific factors and relationships that influence its effectiveness in greater detail. A dedicated diagram on combating corruption might illustrate how actions like reforming fragile institutions, strengthening international cooperation, and reducing social inequalities are interconnected and directly impact anti-corruption efforts.

Thus, the presented diagram should be regarded as an initial and strategic representation of the relationships among the dimensions of the TCO Tetrahedron. It provides a starting point for understanding the complexity and serves as a framework for addressing the challenges of visualizing highly interconnected systems. From here, the development of specialized diagrams, such as the one focused on combating corruption, and the adoption of innovative visualization methods, can be explored to overcome these limitations and enhance our analytical capacity.

The figure presented below illustrates a focused representation of 20 critical relationships connected to combating corruption, highlighting its interconnectedness with key dimensions of the TCO Tetrahedron framework. This diagram serves as an example of the necessity to organize and prioritize how these relationships are established and their significance in each specific context. By visualizing these connections, the figure underscores the complexity of addressing corruption effectively and demonstrates the importance of adopting a strategic and systematic approach to tackling this multifaceted challenge.



Figure 4: Categorized Wave Representation of Key Relationships in Combating Corruption



Source: The Author

The figure 3 illustrates a wave-like arrangement where the length of each vector represents the importance of that specific relationship in a given context. Additionally, the diagram incorporates a categorization scheme using five distinct colors, each representing a thematic area: social (green), economic (yellow), institutional (salmon), technological (brown), and human (orange) dimensions. This color-coded approach helps to visually group related elements, making it easier to identify and analyze connections within specific domains. The length of each vector continues to emphasize that the significance of each connection is not fixed but varies depending on the circumstances being studied. Shorter vectors may denote relationships that are highly relevant and immediate, while longer ones could highlight broader, less direct influences. This representation, combined with the color categorization, underscores the dynamic nature of these



connections and the need to tailor analyses to the unique demands of each case. By adjusting both the length of the vectors and the thematic grouping through colors, the diagram becomes a versatile tool for understanding and addressing complex systems like combating corruption.

2.5 THE INTERDEPENDENCE OF TCO DOMAINS

The recursive interdependence between these domains explains the persistence and historical strengthening of TCOs. In this context, identifying the effects of the recursive interdependence between these domains is crucial for understanding the persistence and historical strengthening of TCOs. We define **recursive interdependence** as a relationship where the components of a system are linked through continuous cycles of mutual influence, in which the actions of each element affect the others — sometimes in non-trivial ways — and loop back to the original, creating feedbacks that modify and direct the system's future states and its overall behavior (Pires, 2024).

Human desires and decisions create the conditions for TCO operations within corrupt, fragile institutions. Economic success reinforces criminal networks, perpetuating their growth over time. Addressing specific elements like legislative reform or law enforcement training, while critical, represents only parts of a broader, integrated approach. Legislative updates must be enforced by strong, corruption-resistant institutions, while security training must align with intelligence strategies and international cooperation (Bouchard, 2020a).

Isolated efforts targeting a single domain fail to disrupt the reinforcing cycles that sustain TCOs. Only **coordinated**, simultaneous actions across all four domains can weaken these organizations, interrupt their interdependence, and reduce their global influence effectively. Understanding these dynamics provides the foundation for building integrated strategies to combat TCOs sustainably.

3 INTERACTION BETWEEN DOMAINS AND IMPLICATIONS FOR ORGANIZED CRIME COUNTERSTRATEGIES

As previously presented, the four dimensions of the TCO Tetrahedron — illicit resources and markets, facilitating social environment, human desires and



motivations, and adaptive criminal networks — interact in complex, mutually reinforcing ways, creating a robust feedback cycle that strengthens transnational criminal organizations. This **recursive interdependence**, as defined earlier, implies that interventions targeting only one domain are insufficient to effectively dismantle TCOs.

One illustrative example is the "war on drugs," most recently embodied by the Mérida Initiative launched in 2008 between the United States and Mexico (Fambrough, 2020). This strategy predominantly targeted drug cartels by focusing on the **domain of illicit resources and markets**, primarily through intensive military and law enforcement measures. Despite significant investments of approximately \$1.4 billion between 2007 and 2010, Mexican cartels continued to operate with remarkable strength and adaptability, demonstrating that while repression is necessary, it is insufficient on its own to combat TCOs effectively.

The Mérida Initiative failed to adequately address human desires and motivations, such as the pursuit of economic opportunities (Pereda, 2022), or the facilitating social environment (Bouchard, 2020b), marked by systemic corruption and institutional weaknesses. As a result, violence in Mexico increased (Hapsari; Ramadhanti; Putri, 2021), and cartels adapted their operations, often emerging even stronger, which underscores the reconfigurative capacity of TCOs (Buneci, 2021).

Conversely, Sweden's drug policy in the 1960s and 1970s pursued a different approach by regulating and legalizing drug use to reduce the illicit drug market and associated health harms. This policy targeted the domain of **illicit resources and markets** (Hyttinen, 2023). However, without effective measures to strengthen institutional frameworks or address individual motivators — such as the desire to alter one's state of consciousness — this approach led to increased substance abuse and associated public health issues (Butler; Zakimi; Greer, 2022). By 1980, Sweden reversed course, adopting stricter policies. Yet, as noted by Stenström, Estrada, and Thom (2024), these restrictive measures have not yielded results comparable to those of other regional nations. This example highlights the pitfalls of addressing TCO domains in isolation rather than through systematic and integrated solutions.

These cases demonstrate that strategies focusing on only one or two domains of the TCO Tetrahedron cannot effectively disrupt the feedback cycle



sustaining these organizations. Corruption and institutional weaknesses (facilitating environment) undermine repressive efforts, while socioeconomic inequities and personal motivators (human desires) continue to fuel recruitment into criminal activities and consumption of illicit goods or services. Additionally, TCOs exhibit exceptional adaptive capacity, adjusting their strategies to circumvent new laws and enforcement measures.

For example, initiatives that focus solely on institutional strengthening, without considering human desires, may fail to reduce recruitment among new members or key public officials. Similarly, social programs that do not address systemic corruption may prove ineffective or even provide opportunities for public agents to exploit resources. In 2016, Brazil's Operation Lava Jato revealed deep corruption schemes. Despite significant efforts by certain sectors, these efforts did not lead to structural reforms robust enough to prevent similar illicit activities today. Instead, they became media spectacles, as noted by Pereira and Oliveira Filho (2015).

Integrated strategies that address all domains of the TCO Tetrahedron simultaneously are essential. Only synchronous multidimensional approaches can disrupt the **recursive interdependence** and effectively weaken TCOs.

4 FINAL CONSIDERATIONS

The TCO Tetrahedron, presented as an innovative framework, lays the foundation for developing a conceptual structure to understand and address the complexity of transnational organized crime, in a practical way. We proposed four interdependent and recursive domains that sustain and perpetuate TCO activities: (1) **illicit resources and markets**, (2) a **facilitating social environment**, (3) **human desires and motivations**, and (4) **adaptive complex criminal networks**. Throughout this theoretical study, we argued that counterstrategies focusing solely on one or two of these domains are insufficient to disrupt the criminal activities. They fail to break the feedback cycle that strengthens TCOs and allows them to reconfigure in response to interventions, often emerging more resilient after overcoming law enforcement measures.

In this context, the Fire Tetrahedron metaphor proved effective in highlighting the need for integrated approaches. We illustrated this with examples



such as the "war on drugs," represented in our study by the Mérida Initiative, which focused excessively on combating illicit resources and markets while neglecting institutional and social factors sustaining criminal networks. Conversely, policies like Sweden's drug liberalization (1960–1970) reveal the limits of strategies addressing only social and motivational aspects of human behavior or merely regulating previously illicit markets.

These examples underscore that effectively combating TCOs requires coordinated actions addressing all domains of the TCO Tetrahedron simultaneously. Fragmented initiatives may temporarily weaken these organizations but rarely lead to significant structural changes. Instead, historical examples emphasize the need for more dynamic and multidimensional approaches capable of addressing the complexity and adaptability of TCOs.

Future studies should focus on integrating complementary theoretical models with the TCO Tetrahedron. Incorporating network theories, systemic models, and predictive analytics can deepen our understanding of criminal dynamics, identify operational parameters, and uncover non-trivial commercial and logistical patterns to inform more effective strategies. Additionally, research should investigate how simultaneous interventions across multiple domains can disrupt the feedback cycles sustaining these organizations. By integrating diverse theoretical and operational perspectives, we aim to contribute to the development of more robust, adaptive public policies capable of sustainably reducing the global influence of TCOs.



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