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THE TRAGEDY OF THE GLOBAL COMMONS IN THE AGE OF ARTIFICIAL INTELLIGENCE: ILLEGAL MINING, TRANSNATIONAL CRIME, AND THE FUTURE OF EU GLOBAL ENFORCEMENT

David Schultz *

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1. Introduction

Transnational organized crime is among the most consequential governance failures of the twenty-first century. The United Nations Office on Drugs and Crime estimates that the proceeds of transnational crime amount to roughly 1.5 to 2 percent of global GDP annually, with illegal resource extraction occupying an increasingly prominent and rapidly growing share of that total¹. Yet despite the scale of the problem, the legal and

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¹ UNODC, *Global Report on Trafficking in Persons*, 2021.

institutional architecture assembled over decades to combat transnational crime remains fragmented, chronically underfunded, and structurally ill-suited to the speed and sophistication of contemporary criminal networks. Two developments in the present decade have dramatically sharpened this mismatch and demand urgent scholarly and policy attention.

First, the geopolitical foundations of the rules-based international order are fracturing. The United States has withdrawn from the posture of multilateral leadership that sustained international enforcement cooperation through the post-Cold War era. Russia has demonstrated that great powers can wage wars of territorial conquest and resource seizure with manageable international costs. The BRICS bloc is consolidating an alternative normative framework resistant to Western-led enforcement regimes. And China is extending its economic and political influence across the global south in ways that create parallel governance structures incompatible with EU regulatory standards². Second, artificial intelligence is transforming the operational landscape of transnational crime with a speed that no existing legal framework has matched, simultaneously empowering criminal networks with capabilities that were previously beyond their reach and opening new possibilities for detection and prosecution that law enforcement agencies are only beginning to develop³.

This article uses illegal mining and natural resource extraction as the central lens through which to examine these converging pressures, for reasons that go beyond the intrinsic importance of the phenomenon. Illegal mining is not a peripheral or exotic problem. It generates billions of dollars annually, finances terrorism and insurgency in multiple regions of strategic significance to the EU, drives deforestation and ecological collapse at a scale that directly undermines EU environmental commitments, and sustains networks of forced labor and sex trafficking that reach European consumer markets⁴. It is also a paradigmatic tragedy of the commons: a situation in which individually rational actors collectively destroy a shared resource by exploiting it faster than any cooperative governance regime can protect it⁵. As global demand for rare earth minerals, lithium, gold, and other critical resources intensifies alongside the green energy transition, the structural incentives for illegal extraction will grow stronger, not weaker.

The European Union occupies a unique and critical position in this landscape. As both a major consumer of globally extracted resources and the world's most ambitious supranational regulatory actor, the EU possesses both the motive and, at least in principle, the tools to lead a global response. The EU Conflict Minerals Regulation⁶, the Corporate

² G.J. IKENBERRY, *The End of Liberal International Order?*, in *International Affairs*, 2018, vol. 94, no. 1, pp. 7-23; S.M. WALT, *The Hell of Good Intentions: America's Foreign Policy Elite and the Decline of U.S. Primacy*, 2018; J.J. MEARSHEIMER, *Bound to Fail: The Rise and Fall of the Liberal International Order*, in *International Security*, 2019, vol. 43, no. 4, pp. 7-50.

³ Europol, *Serious and Organised Crime Threat Assessment: A Corrupting Influence*, 2023.

⁴ Global Financial Integrity, *Transnational Crime and the Developing World*, 2017.

⁵ G. HARDIN, *The Tragedy of the Commons*, in *Science*, 1968, no. 162, art. 3859, pp. 1243-1248.

⁶ Regulation (EU) 2017/821 of the European Parliament and of the Council, *laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas*, of 17 May 2017, in OJ L 130, 19 May 2017, pp.1-20.

Sustainability Due Diligence Directive (CSDDD)⁷, the Deforestation Regulation⁸, and the AI Act⁹ together constitute a nascent architecture for governing the intersection of resource crime, supply chain accountability, and AI-enabled enforcement. Yet this architecture remains incomplete, internally fragmented, and insufficiently connected to the EU's external action instruments. Whether it can be developed into a genuinely effective global enforcement framework is the central question this article addresses.

The argument proceeds as follows. Section 2 examines the economics of illegal resource extraction and the structural incentives that drive it. Section 3 applies the tragedy of the commons framework, drawing on both Hardin and Ostrom, to situate illegal mining within a broader theory of collective action failure. Section 4 presents case studies across the Amazon, South Africa, international waters, the Arctic, and wildlife trafficking that illustrate the transnational dimensions of the problem. Section 5 analyzes the criminal nexus linking illegal mining to drug trafficking, terrorism financing, human trafficking, and corruption. Section 6 surveys the international and EU legal framework, with detailed attention to how the EU's due diligence instruments interact and where they fall short. Section 7 examines the breakdown of the global order and its enforcement consequences. Sections 8 and 9 provide sustained analysis of AI as a tool for committing and for detecting and prosecuting transnational crime respectively. Section 10 draws governance implications for the EU. Section 11 concludes with a broader reflection on the stakes of governance failure in the age of artificial intelligence.

2. The Economics of Illegal Resource Extraction

Economics begins with scarcity¹⁰. There is never an infinite supply of desired resources, and the fundamental challenge of any economic or governance system is to determine how scarce resources are allocated among competing claimants. In principle, modern societies allocate resources through two complementary legitimate mechanisms: markets and legal regulation. Markets allocate through price signals, directing extraction and production toward their highest-valued uses. Legal regulation establishes the framework within which markets operate, defining property rights, environmental limits, labor standards, and the scope of permissible exploitation. Where both mechanisms fail

⁷ Directive (EU) 2024/1760 of the European Parliament and of the Council, *on corporate sustainability due diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859*, of 13 June 2024, in OJ L, 2024/1760, 5 July 2024.

⁸ Regulation (EU) 2023/1115 of the European Parliament and of the Council, *on the making available on the Union market and the export from the Union of certain commodities and products associated with deforestation and forest degradation and repealing Regulation (EU) No 995/2010*, of 31 May 2023, in OJ L 150, 9 June 2023, pp. 206-247.

⁹ Regulation (EU) 2024/1689 of the European Parliament and of the Council, *laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act)*, of 13 June 2024, in OJ L, 2024/1689, 12 July 2024.

¹⁰ P.A. SAMUELSON, W.D. NORDHAUS, *Economics*, XIX ed., 2009.

or are absent, a third allocation mechanism asserts itself: illegal appropriation. Individuals and organizations take what they cannot legally acquire, or circumvent the regulatory constraints that limit how much and under what conditions they may extract.

The financial incentives for illegal resource extraction are extraordinary by any measure. Illegal gold mining alone generates an estimated \$10 billion or more annually worldwide, much of it unreported, untaxed, and laundered through international commodity markets¹¹. Illegal, unreported, and unregulated (IUU) fishing accounts for between 11 and 26 million tonnes annually, valued at up to \$23 billion and representing as much as one-fifth of global reported catch¹². Wildlife trafficking, encompassing the illegal trade in animals, plants, and their derivatives, generates a further estimated \$23 billion annually, ranking it as the fourth largest illegal trade globally after narcotics, human trafficking, and arms¹³. Illegal timber harvesting adds billions more. These figures do not exist in isolation from legitimate commerce: they reflect the extent to which illegal extraction is embedded in and subsidized by legal supply chains, commodity markets, and financial systems, including those of the European Union.

The resource categories most implicated in illegal extraction have expanded significantly with the demands of the twenty-first-century economy. Precious metals, particularly gold, remain the most extensively documented case, with illegal mining concentrated in the Amazon basin, West Africa, Central Asia, and the Congo basin. But the transition to a green economy has created urgent new demand for a different set of critical materials. Lithium, cobalt, nickel, manganese, and rare earth elements are indispensable components of electric vehicle batteries, wind turbines, and solar panels. As the EU pursues the targets of its Green Deal and global demand for these materials surges, the pressure to source them through channels that circumvent legal, environmental, and labor standards intensifies¹⁴. There is a profound and underappreciated irony in the possibility that the green energy transition could accelerate the illegal extraction of the very materials on which it depends.

The political economy of illegal extraction distributes its costs and benefits in ways that entrench the governance failures driving it. The direct financial benefits accrue primarily to criminal networks and corrupt officials. At a further remove, they accrue to legal commodity traders and manufacturers who benefit from access to raw materials at prices depressed by the inclusion of illegally sourced supply in global markets. The costs fall primarily on local communities and indigenous populations displaced or poisoned by illegal operations, on source-country governments deprived of revenues and regulatory control, and on the global environment. This distributional asymmetry is itself a governance problem of the first order: those who bear the costs of illegal extraction typically have the least political power to demand enforcement, while those who benefit

¹¹ Global Financial Integrity, *op. cit.*

¹² D.J. AGNEW ET AL., *Estimating the Worldwide Extent of Illegal Fishing*, in *PLOS ONE*, 2009, vol. 4, no. 2, art. e4570.

¹³ UNODC, *World Wildlife Crime Report*, 2020.

¹⁴ S. MULLIGAN, *Energy, Environment, and Security: Critical Links in a Post-Peak World*, in *Global Environmental Politics*, 2010, vol. 10, no. 4, pp. 79-100.

most from it often have the resources, legal sophistication, and political connections to insulate themselves from accountability¹⁵.

3. The Tragedy of the Global Commons

The concept of the tragedy of the commons, first systematically articulated by Garrett Hardin in his landmark 1968 *Science* article, provides the indispensable theoretical framework for understanding why illegal resource extraction is so structurally resistant to governance¹⁶. Hardin's argument, while simple in outline, has proven remarkably durable across a wide range of empirical contexts. When a resource is held in common, accessible to multiple actors without exclusive property rights or effective collective regulation, each individual actor faces a rational incentive to extract as much as possible as quickly as possible. The benefit of each additional unit of extraction accrues entirely to the individual, while the cost of depletion is distributed across all users of the commons. The individually optimal strategy of maximizing extraction therefore produces a collectively catastrophic outcome: the destruction of the shared resource that all actors depend upon.

Elinor Ostrom's Nobel Prize-winning work on governing the commons introduced a crucial refinement to Hardin's framework. Ostrom demonstrated that communities do sometimes develop effective institutions for managing common resources, avoiding the tragedy through combinations of clearly defined boundaries, congruent rules, collective choice arrangements, monitoring, graduated sanctions, and nested governance structures¹⁷. The conditions under which Ostrom's cooperative solutions emerge are, however, precisely those that are absent in the case of global resource extraction: shared identity among resource users, mutual monitoring, enforcement authority, and a limited enough scale that the consequences of defection are visible to all parties. The global commons lack all of these conditions. Its scale is vast, its users are diverse and anonymous, monitoring is technically difficult and politically contested, and no enforcement authority with genuine power exists.

The concept of maximum sustainable yield, analyzed by Finley and Oreskes, adds a further dimension to the commons tragedy in the context of resource extraction¹⁸. Maximum sustainable yield, originally developed as a fisheries management concept, defines the largest catch that can be taken from a fish stock without impairing its ability to reproduce itself. But as Finley and Oreskes demonstrate, this ostensibly scientific concept has historically functioned as a policy rationalization for extraction at the maximum rate that can be sustained, rather than a conservative limit that leaves meaningful buffer against uncertainty and environmental variability. When multiple

¹⁵ Global Financial Integrity, *op. cit.*

¹⁶ G. HARDIN, *op. cit.*

¹⁷ E. OSTROM, *Governing the Commons: The Evolution of Institutions for Collective Action*, Cambridge, 1990.

¹⁸ C. FINLEY, N. ORESKES, *Maximum Sustained Yield: A Policy Disguised as Science*, in *ICES Journal of Marine Science*, 2013, vol. 70, no. 2, pp. 245-250.

actors are competing for the same resource, the race to harvest before competitors generates systematic pressure toward extraction rates that exceed even maximum sustainable yield calculations, producing the kind of stock collapse seen repeatedly in global fisheries and increasingly in mineral resources.

Resource competition has also historically functioned as an instrument of geopolitical power. As Bunker and Ciccantell demonstrate, the history of globalization is in substantial part a history of races for resources, in which powerful states deploy military force, legal maneuvering, trade agreements, and economic pressure to secure preferential access to the raw materials needed to sustain industrial and military power¹⁹. Daniel Yergin's monumental account of the global oil industry illustrates with particular vividness how intimately resource access is bound up with state power, alliance politics, and armed conflict²⁰. In the current geopolitical environment, this dynamic is reasserting itself with particular intensity, as China secures long-term mineral concession agreements across Africa and Latin America, Russia leverages hydrocarbon resources as a tool of political coercion, and the United States recalibrates its resource strategy around concepts of energy dominance and critical mineral security²¹.

For the EU, the tragedy of the global commons represents a policy problem of acute strategic importance. The EU's internal market is deeply integrated with global resource supply chains: European manufacturers consume vast quantities of minerals, metals, timber, and fish extracted from territories where EU regulatory standards do not apply and EU enforcement authority is absent. EU regulatory frameworks, however ambitious in design, cannot by themselves govern extraction that occurs in ungoverned or poorly governed spaces thousands of miles from Brussels. The structural challenge is not simply one of legal design but of governance architecture: the EU must find ways to extend the regulatory reach of its internal market standards across the full geographic extent of the supply chains that feed it, through mechanisms that are effective in contexts where state authority is weak, corruption is pervasive, and alternative governance frameworks offered by China and others compete with EU conditionality²².

4. Case Studies in Illegal Extraction and Their EU Dimensions

The global geography of illegal resource extraction is diverse in its manifestations but consistent in its underlying logic. The following case studies are selected not merely as illustrations of a general problem but as contexts in which the EU's specific legal, institutional, and political responsibilities are most clearly implicated.

¹⁹ S.G. BUNKER, P.S. CICCANTELL, *Globalization and the Race for Resources*, 2005.

²⁰ D. YERGIN, *The Quest: Energy, Security, and the Remaking of the Modern World*, 2011.

²¹ S. MULLIGAN, *op. cit.*

²² A. BRADFORD, *The Brussels Effect: How the European Union Rules the World*, Oxford, 2020; E. OSTROM, *op. cit.*

4.1. The Amazon Basin and the Brazilian Gold Trade

Illegal mining in the Brazilian Amazon, known locally as *garimpagem*, reached crisis proportions during the early 2020s. Deforestation attributed to illegal mining activity reached a forty-year high in 2021, with the Yanomami indigenous territory recording a 46 percent increase in illegal mining between 2020 and 2021 alone²³. The environmental consequences extend far beyond deforestation. Mercury used in artisanal gold extraction contaminates river systems across vast areas, accumulating in the food chain and poisoning indigenous communities whose subsistence depends on fish. The Yanomami crisis of 2023, in which thousands of indigenous people were found to be suffering from malnutrition and mercury poisoning as a result of illegal mining on their territory, represents one of the most acute humanitarian emergencies produced by illegal resource extraction in recent years.

The EU dimension of the Amazon crisis is direct and legally significant. Gold extracted illegally from the Amazon does not remain in Brazil. It moves through a network of informal refineries, fraudulent export certificates, and international commodity traders, ultimately reaching gold markets in Dubai, Switzerland, the United Kingdom, and the European Union. EU gold importers and financial institutions that hold gold as a commodity or financial instrument are therefore potential recipients of illegally extracted Brazilian gold, creating compliance obligations under the EU Conflict Minerals Regulation and AMLD6 that are currently enforced with insufficient rigor²⁴. The EU Deforestation Regulation's prohibition on commodities linked to deforestation is also directly relevant, since beef, soy, and timber from deforested Amazon land also reach EU markets through supply chains that are poorly monitored.

4.2. South Africa and the Organized Crime Mining Nexus

South Africa presents a distinct case study in the organized crime dimensions of illegal mining. Criminal networks known as *zama zamas* operate in abandoned and active mines across the country's gold and platinum belts, often armed, often violent, and deeply connected to broader criminal ecosystems. These networks do not operate in isolation from international organized crime: the proceeds of illegal South African mining are laundered through informal gold refineries and exported through networks with documented connections to organized crime groups operating across Europe and Asia²⁵. The violence associated with *zama zama* operations, including armed confrontations with legal mine operators and police, has claimed numerous lives and represents a direct challenge to state authority in the world's most unequal major economy.

²³ Instituto Socioambiental, *Illegal Mining in Yanomami Territory: A Crisis of Governance and Human Rights*, 2022.

²⁴ Global Financial Integrity, *op. cit.*

²⁵ T. LEBONE, *Illegal Mining in South Africa: Organized Crime and the Zama Zama Phenomenon*, 2021.

The South African case illustrates a phenomenon of general importance: illegal mining can persist and expand even in countries with relatively sophisticated legal systems and law enforcement infrastructure, when the financial incentives are large enough and the governance of remote or industrial spaces is structurally weak. It also illustrates the limits of source-country enforcement as the primary response to illegal mining. The South African state has deployed military resources against *zama zama* networks without achieving more than temporary disruption, because the underlying incentive structure, driven by high gold prices and deep poverty, remains unchanged. Effective enforcement requires intervention not only at the point of extraction but throughout the supply chain, including at the EU market entry points where illegal gold is converted into legitimate financial assets.

4.3. International Waters: IUU Fishing and Seabed Mining

Illegal, unreported, and unregulated fishing in international waters represents one of the largest and most economically significant forms of illegal resource extraction globally, and one in which EU actors are directly implicated. IUU fishing systematically depletes fish stocks, undermines the livelihoods of legal fishing communities in developing countries, and generates proceeds that are laundered through the same shell company and flag-of-convenience vessel networks used by other forms of organized crime²⁶. European vessels and companies have been identified in IUU fishing operations in West African, Pacific, and Antarctic waters, raising questions about the effectiveness with which EU member states enforce EU fisheries law against their own nationals operating in external waters.

Deep-seabed mining presents a rapidly emerging frontier of illegal or inadequately governed extraction. As technological capability for commercial seabed mining has developed, the governance framework under the International Seabed Authority has lagged behind, with ongoing disputes about the environmental standards required for licensing and the rights of states to sponsor extraction in the Area beyond national jurisdiction²⁷. The combination of technological opportunity, governance vacuum, and intensifying demand for the polymetallic nodules that contain nickel, cobalt, manganese, and copper creates conditions precisely suited to the kind of illegal exploitation that the tragedy of the commons framework predicts.

4.4. The Arctic: Climate Change and the New Commons Race

Climate change is opening the Arctic to resource extraction at a rate that governance institutions have not kept pace with, creating what is perhaps the most consequential new instance of the global commons tragedy. As sea ice retreats, previously inaccessible deposits of oil, natural gas, minerals, and fish become reachable, and shipping routes

²⁶ D.J. AGNEW *ET AL.*, *op. cit.*

²⁷ International Seabed Authority, *Annual Report*, 2023.

through Arctic waters open that could dramatically reduce transit times between Europe and Asia. The jurisdictional landscape is acutely complex: Arctic territories are claimed by EU member states including Finland and Sweden, NATO allies including Norway, Canada, and the United States, and Russia, whose Arctic ambitions are expansive and whose behavior since 2022 has placed it outside the architecture of cooperative international governance²⁸. China has declared itself a near-Arctic state and is investing heavily in icebreaker technology, Arctic research infrastructure, and diplomatic relationships with Arctic-adjacent states.

The Arctic case illustrates with particular clarity the relationship between geopolitical fragmentation and commons governance failure. When the major state actors with interests in an ungoverned or disputed space are themselves in strategic competition, the cooperative solutions that Ostrom identifies as necessary for avoiding the tragedy of the commons become impossible to achieve²⁹. The Arctic Council, the primary multilateral forum for Arctic governance, has been effectively paralyzed since Russia's invasion of Ukraine by the decision of its other members to suspend cooperation with Russia. The result is a governance vacuum in the world's most rapidly changing ecological space, precisely at the moment when the stakes of governance failure are highest.

4.5. Wildlife Trafficking and European Complicity

Wildlife trafficking generates an estimated \$23 billion annually and ranks as the fourth largest illegal trade globally³⁰. It intersects with illegal mining not merely as a parallel criminal enterprise but through shared logistics networks, corrupted officials, and the same criminal organizations that exploit governance vacuums for multiple purposes simultaneously. The EU's role in the global wildlife trafficking system is uncomfortable but well documented: major transit and destination routes for ivory, rhino horn, exotic reptiles, and endangered timber pass through EU ports and airports including Amsterdam, Antwerp, Brussels, and Frankfurt³¹. The EU is both a consumer market for wildlife products and a transit hub for products destined for Asian markets, making effective EU border enforcement a critical component of any global response.

5. The Criminal Nexus: Illegal Mining and Convergent Transnational Crime

Illegal mining does not exist as an isolated criminal enterprise. It is embedded in a dense web of interconnected criminal activities that criminologists have described as criminal convergence: the tendency for different categories of transnational crime to share infrastructure, personnel, financial systems, and governance relationships in ways that

²⁸ S. MULLIGAN, *op. cit.*

²⁹ E. OSTROM, *op. cit.*

³⁰ UNODC, *World Wildlife Crime Report*, cit.

³¹ TRAFFIC, *Wildlife Trade and the EU: Monitoring, Enforcement, and Policy Gaps*, 2021.

make them mutually reinforcing and collectively more difficult to address than any single category in isolation³². Understanding this convergence is essential for designing enforcement responses that are adequate to the actual structure of the problem.

The link between illegal mining and drug trafficking is extensively documented in Latin America and increasingly in West Africa. Criminal organizations including guerrilla groups and cartel networks use illegal mining operations to diversify their revenue streams beyond narcotics, launder drug trafficking proceeds through commodity markets, and maintain territorial control in remote areas that serve simultaneously as drug production zones and mining territories³³. Gold is particularly valuable as a money laundering vehicle because it is a high-value bearer asset that can be traded without documentation, is internationally accepted as a store of value, and can be physically transported or shipped with far less risk of interception than narcotics. Drug trafficking proceeds converted into gold in one jurisdiction can be exported as a legitimate commodity in another, effectively transforming criminal proceeds into legal financial assets. This laundering dynamic creates financial flows that ultimately reach EU commodity markets, gold refineries, and banking systems, implicating European financial institutions in the proceeds of drug trafficking even when they have no direct knowledge of the underlying criminal activity³⁴.

The connection between illegal mining and terrorism financing has become a primary concern for EU external security policy, particularly in the Sahel region. Armed groups affiliated with al-Qaeda and Islamic State franchises operating in Mali, Burkina Faso, Niger, and neighboring states have increasingly financed their operations through a combination of narcotics trafficking, kidnapping for ransom, and illegal resource extraction including gold mining and the taxation of artisanal mining operations³⁵. The collapse of effective governance in these states, accelerated by a series of military coups between 2020 and 2023 and the expulsion of French and EU security missions, has dramatically reduced the external pressure on these networks and left the EU with sharply diminished leverage. The Sahel case illustrates how state fragility, resource criminality, and terrorism financing form a mutually reinforcing nexus that no single policy instrument can address.

Human trafficking and forced labor are endemic to illegal mining operations worldwide, and supply chains of exploitation can be traced directly from illegal mines to European consumer markets. Trafficking networks recruit workers under false pretenses or through debt bondage, confiscate their documents on arrival, and force them to work in dangerous conditions for little or no pay. Children are particularly vulnerable, in direct violation of ILO Convention No. 182 on the worst forms of child labor³⁶. In some illegal mining operations, sex trafficking accompanies mining activity, with women and girls

³² V. FELBAB-BROWN, *The Extinction Market: Wildlife Trafficking and How to Counter It*, Oxford, 2018.

³³ J. BARGENT, *The Criminal Mining Nexus in Colombia*, in *InSight Crime*, 2016.

³⁴ FATF, *Money Laundering from Environmental Crime*, 2020.

³⁵ UNODC, *Global Report on Trafficking in Persons*, cit.

³⁶ International Labour Organization Convention No. 182, on the Worst Forms of Child Labour, signed in Geneva on 17 June 1999.

trafficked to mining camps. The corporate supply chains that source minerals from regions of illegal mining activity therefore risk complicity in these forms of modern slavery, a risk that the CSDDD directly addresses by requiring companies to conduct human rights due diligence across their global value chains³⁷.

Corruption is the connective tissue without which the convergent criminal networks described above could not function at scale. Illegal mining operations require the tolerance or active cooperation of state officials at multiple levels: local police who do not respond to complaints, customs officers who clear fraudulent shipments, mining inspectors who certify illegal operations, and in some cases senior officials who provide political protection. Corruption payments are not incidental to illegal mining operations but constitute a core operating cost, managed as deliberately as any other business expense³⁸. This systemic corruption has direct implications for EU enforcement strategy: no amount of EU regulatory sophistication can compensate for source-country governance failure that reaches into the official institutions on which enforcement depends.

6. The International and EU Legal Framework

The legal framework addressing illegal resource extraction and its associated crimes is extensive in scope, layered in structure, and deeply inadequate in enforcement. Its architecture rewards careful analysis because understanding its specific failure modes is the prerequisite for meaningful reform.

The foundational international instrument for governing resource extraction in shared spaces is the United Nations Convention on the Law of the Sea³⁹. UNCLOS established the International Seabed Authority to regulate mining beyond national jurisdictions and created the framework of Exclusive Economic Zones that defines coastal state sovereign rights. Its framework for port state control and flag state responsibility has achieved modest success in reducing some forms of IUU fishing but remains entirely dependent on state cooperation that is frequently absent when the flag state is a convenience jurisdiction with no genuine connection to the vessel or its operations⁴⁰. The Convention on Biological Diversity⁴¹ and the Minamata Convention on Mercury⁴² address environmental dimensions of illegal mining, but both suffer from voluntary compliance mechanisms and limited monitoring capacity.

³⁷ ILO, *Global Estimates of Modern Slavery: Forced Labour and Forced Marriage*, 2022.

³⁸ Transparency International, *Corruption Perceptions Index 2022*, 2022.

³⁹ United Nations Convention on the Law of the Sea, signed in Montego Bay on 10 December 1982.

⁴⁰ International Seabed Authority, *op. cit.*

⁴¹ United Nations Convention on Biological Diversity, signed in Rio de Janeiro on 5 June 1992.

⁴² United Nations Minamata Convention on Mercury, signed in Kumamoto on 10 October 2013.

In the domain of transnational crime, the UN Convention against Transnational Organized Crime (UNTOC)⁴³ and the UN Convention Against Corruption (UNCAC)⁴⁴ establish the primary multilateral frameworks. Both have been ratified by large majorities of UN member states. Both establish significant obligations for criminalization, mutual legal assistance, and law enforcement cooperation. And both suffer from the fundamental structural weakness of international law: they bind only states that choose to be bound, are interpreted by those states in light of their own interests, and lack any central enforcement mechanism with genuine coercive authority⁴⁵. The result is that compliance is episodic, selective, and inversely correlated with the severity of the governance problem: countries most deeply compromised by corruption and criminal penetration of state institutions are precisely those least likely to fulfill their UNCAC and UNTOC obligations.

The EU's internal legal architecture represents a significantly more ambitious attempt to govern supply chains linked to illegal resource extraction, and its distinctive feature is the use of market access as a lever for governing production conditions outside EU territory. The EU Conflict Minerals Regulation⁴⁶, fully applicable since January 2021, requires EU importers of tin, tantalum, tungsten, and gold above specified volume thresholds to conduct due diligence on their supply chains to ensure that imports do not finance conflict or involve serious human rights abuses. This regulation represented a landmark in extending EU regulatory reach into the supply chains of globally traded commodities, but its structural limitations are significant. It covers only four minerals. Its due diligence obligations are proportionate to import volume, exempting smaller importers. Its enforcement relies on member state customs authorities with highly variable capacity and political prioritization. And its conflict financing focus, while important, does not comprehensively address the full range of illegal extraction harms including environmental damage, non-conflict corruption, and labor exploitation⁴⁷.

The Corporate Sustainability Due Diligence Directive substantially broadens the due diligence framework by applying it across industries and requiring large EU companies to identify, prevent, mitigate, and account for adverse human rights and environmental impacts throughout their global value chains. The CSDDD creates civil liability for companies that fail to meet their due diligence obligations, a provision that potentially enables private enforcement through litigation in EU member state courts and introduces financial accountability that the Conflict Minerals Regulation lacks. The EU Deforestation Regulation prohibits placing on the EU market commodities including cattle, cocoa, coffee, palm oil, soy, wood, and derived products that have been produced on land that was deforested after December 31, 2020, requiring importers to submit due

⁴³ United Nations Convention Against Transnational Organized Crime, signed in Palermo on 12 December 2000.

⁴⁴ United Nations Convention against Corruption, signed in Mérida on 9 December 2003.

⁴⁵ N. BOISTER, *An Introduction to Transnational Criminal Law*, Oxford, 2012.

⁴⁶ Regulation (EU) 2017/821, cit.

⁴⁷ European Commission, *Report on the Functioning of the EU Conflict Minerals Regulation*, 2021.

diligence statements certifying the geographic origin and deforestation-free status of their products.

These three instruments, the Conflict Minerals Regulation, CSDDD, and Deforestation Regulation, are best understood not as separate initiatives but as elements of an emerging integrated due diligence regime that uses EU market access as a conditional privilege rather than an unconditional right. Together, they create a framework in which access to EU consumers requires demonstrating compliance with EU standards for environmental and human rights performance throughout global supply chains. The coherence and effectiveness of this regime depends, however, on the quality of its enforcement, which remains the weakest link. Verification of due diligence statements is resource-intensive, technically demanding, and requires access to information in third countries where EU institutions have limited authority. The risk of documentary fraud, in which falsified certificates of origin, compliance declarations, and beneficial ownership records are used to disguise non-compliant supply chains, is substantial and, as Section 8 discusses, is dramatically increased by the availability of AI tools capable of producing sophisticated fraudulent documentation at scale⁴⁸.

The EU's enforcement agencies provide additional institutional capacity that remains underutilized in the context of resource crime. Eurojust coordinates cross-border criminal prosecutions and has authority to support joint investigation teams spanning multiple member states and third-country partners. Europol provides criminal intelligence analysis and supports operational law enforcement cooperation. The European Public Prosecutor's Office (EPPO), operational since 2021, has jurisdiction over crimes affecting the EU's financial interests, including fraud involving EU development funds channeled to countries affected by illegal mining⁴⁹. However, all three agencies face severe constraints when operating beyond EU borders: their authority in third countries depends entirely on bilateral cooperation agreements and the willingness of third-country authorities that may themselves be compromised by the criminal networks under investigation⁵⁰.

7. The Breakdown of the Global Order

The international legal framework described in Section 6 was constructed within and depends upon a broader architecture of multilateral cooperation, shared normative commitments, and great power engagement that is now under severe and possibly irreversible stress. Understanding how this breakdown affects the specific domain of transnational resource crime enforcement requires attention to three interlocking developments.

⁴⁸ A. BRADFORD, *op. cit.*

⁴⁹ Council Regulation (EU) 2017/1939, *implementing enhanced cooperation on the establishment of the European Public Prosecutor's Office*, of 12 October 2017, in OJ L 283, 31 October 2017, pp. 1-71.

⁵⁰ Eurojust, *Report on Judicial Cooperation in Environmental Crime Cases*, 2022.

The withdrawal of the United States from robust multilateral engagement represents a structural shift of the first magnitude. For the post-Cold War era, US engagement provided the financial resources, intelligence assets, diplomatic leverage, and political leadership that made international law enforcement cooperation function at something approaching adequate scale. US agencies including the Drug Enforcement Administration, the Financial Crimes Enforcement Network, and the Department of Justice provided irreplaceable expertise and leverage in the prosecution of transnational criminal networks across multiple jurisdictions. The systematic withdrawal of this engagement under an America First framework does not merely reduce the resources available for international enforcement cooperation; it signals to both criminal networks and potential partner governments that the political cost of non-cooperation with international enforcement has been substantially reduced⁵¹.

The Russian invasion of Ukraine has normalized resource seizure as a tool of state policy in ways that will have lasting consequences for international legal norms governing resource governance. Russia's action in seizing Ukrainian territory, including territories rich in coal, iron ore, and agricultural land, and in weaponizing control of energy supply as a tool of coercion against European states, demonstrates that great power resource predation remains a feature of international relations rather than a relic of pre-modern politics. The broader normative implication is damaging: if a permanent member of the UN Security Council can seize the resources of a neighboring state with manageable international costs, the foundational premise of the rules-based order, that state behavior is constrained by legal norms even when it conflicts with immediate state interests, is visibly weakened. This weakening of legal norms at the interstate level creates permissive conditions for non-state actors engaged in illegal resource extraction, for whom state actors' defection from international norms reduces the political pressure on complicit governments to enforce their own laws⁵².

The rise of BRICS and the expansion of Chinese economic influence across the global south creates the most structurally significant challenge for EU external resource governance. China's Belt and Road Initiative and its successor programs have made China the primary source of infrastructure investment in many of the countries most affected by illegal mining, including those in sub-Saharan Africa, Southeast Asia, and Latin America. This investment creates relationships of economic dependency that give China significant political leverage, which it has sometimes used to reduce cooperation with Western-led enforcement initiatives. Chinese investment in resource extraction frequently occurs under governance conditions that fall well below the standards required by EU due diligence regulations, and China's explicit position that development should not be conditioned on governance or human rights performance provides an alternative framework that many recipient governments find more attractive than EU conditionality⁵³. The EU's ability to use market access and development finance to

⁵¹ G.J. IKENBERRY, *op. cit.*; S.M. WALT, *op. cit.*

⁵² J.J. MEARSHEIMER, *op. cit.*

⁵³ S.G. BUNKER, P.S. CICCATELL, *op. cit.*

promote better resource governance in source countries is constrained wherever China offers an alternative that imposes fewer conditions.

8. Artificial Intelligence as a Tool for Committing Transnational Crime

The emergence of sophisticated AI tools has transformed the operational landscape of transnational resource crime in ways that remain insufficiently understood by policymakers and legal scholars. The significance of AI for criminal networks is not merely that it makes existing criminal activities more efficient. More fundamentally, it creates qualitatively new capabilities, lowers barriers to entry for less sophisticated actors, and systematically shifts the balance between criminal innovation and law enforcement response in favor of the former⁵⁴. Understanding these transformations in detail is essential for designing legal and enforcement frameworks adequate to the challenge.

8.1. AI-Enabled Financial Crime and the Undermining of EU AML Frameworks

The laundering of proceeds from illegal mining has historically required extensive criminal infrastructure: networks of corrupt intermediaries, informal money transfer systems, physical gold traders, shell company registrars, and the patient construction of documentary cover for illicit wealth. AI is compressing and automating each stage of this process in ways that dramatically reduce the human capital and organizational complexity required. Machine learning systems trained on regulatory filing data, suspicious activity report patterns, and AML compliance databases can now identify the specific transaction structures, beneficial ownership configurations, and jurisdictional combinations most likely to evade detection, and generate layering strategies that exploit regulatory gaps faster than those gaps can be closed⁵⁵.

The sixth Anti-Money Laundering Directive (AMLD6)⁵⁶ strengthened the EU's AML framework in significant ways, expanding the list of predicate offenses, increasing criminal penalties, and tightening beneficial ownership disclosure requirements. The planned EU AML Authority (AMLA), which will directly supervise high-risk financial institutions from 2025, represents a further step toward more centralized and consistent AML enforcement. But these advances in legal framework are simultaneously undermined by AI's capacity to defeat the documentary verification systems on which they depend. Generative AI can produce highly realistic fraudulent documentation: corporate registration records, mineral provenance certificates, environmental compliance declarations, and beneficial ownership disclosure statements that are visually and textually indistinguishable from authentic documents and that defeat standard

⁵⁴ Europol, *op. cit.*

⁵⁵ FATF, *Opportunities and Challenges of New Technologies for AML/CFT*, 2021.

⁵⁶ Directive (EU) 2018/1673 of the European Parliament and of the Council, *on combating money laundering by criminal law*, of 23 October 2018, in OJ L 284, 12 November 2018, pp. 22-30.

verification checks conducted manually or through automated document scanning systems⁵⁷. The result is that the documentary chain of custody on which supply chain due diligence under the Conflict Minerals Regulation and CSDDD relies can be fabricated at scale, transforming compliance verification from a meaningful safeguard into a performative ritual.

Cryptocurrency and decentralized finance, combined with AI-optimized transaction routing, have created a parallel financial system through which criminal proceeds can be moved across borders with reduced risk of detection. While blockchain transactions are in principle publicly recorded, the use of mixing services that pool and redistribute cryptocurrency from multiple sources, privacy coins designed to obscure transaction trails, and AI-driven transaction structuring that breaks large transfers into patterns designed to evade threshold reporting requirements can effectively obscure the origin and destination of funds even from sophisticated financial intelligence units equipped with blockchain analytics tools⁵⁸. The EU's Markets in Crypto-Assets Regulation (MiCA)⁵⁹ represents an attempt to bring crypto-asset service providers within the AML regulatory perimeter, but its implementation is still in early stages and its effectiveness against sophisticated AI-assisted evasion remains to be demonstrated.

8.2. AI-Optimized Smuggling Logistics and Corruption

Beyond financial crime, AI is transforming the operational logistics of illegal resource extraction and trafficking in ways that directly challenge enforcement at borders, in transit, and at sea. Machine learning models trained on historical law enforcement operational data, including patrol schedules, border inspection frequencies, satellite monitoring coverage gaps, and interdiction rates by route and cargo type, can identify the patterns that minimize the probability of detection and generate optimized smuggling routes that adapt dynamically as law enforcement response patterns change⁶⁰. In the maritime context, where the geographic space to be monitored is vast and enforcement resources are thin, AI-assisted route optimization represents a potentially decisive advantage for criminal networks.

Natural language processing tools have eliminated one of the most significant practical constraints on transnational criminal coordination: the need for multilingual personnel and the associated risks of miscommunication and infiltration. Criminal networks linking illegal miners in the Democratic Republic of Congo, gold traders in Dubai, commodity brokers in Geneva, and laundering specialists in EU financial centers can now coordinate in real time across multiple languages with a fluency and security that

⁵⁷ J.J. BRYSON, A.F. WINFIELD, *Standardizing Ethical Design for Artificial Intelligence and Autonomous Systems*, in *Computer*, 2017, vol. 50, no. 5, pp. 116-119.

⁵⁸ FATF, *Opportunities and Challenges of New Technologies for AML/CFT*, cit.

⁵⁹ Regulation (EU) 2023/1114 of the European Parliament and of the Council, *on markets in crypto-assets, and amending Regulations (EU) No 1093/2010 and (EU) No 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937*, of 31 May 2023, in OJ L 150, 9 June 2023, pp. 40-205.

⁶⁰ Europol, *op. cit.*

far exceeds what was achievable even five years ago⁶¹. AI tools can also systematize the corruption of state officials: social media analysis and financial profiling of law enforcement and regulatory personnel can identify individuals with financial vulnerabilities or behavioral patterns suggesting susceptibility to corrupt offers, making the targeting of corruption more efficient and less dependent on local knowledge.

8.3. The Democratization of Criminal Capability and Its Enforcement Consequences

The most systemically significant consequence of AI for transnational crime governance may be the democratization of criminal capability. Sophisticated financial crime, complex supply chain fraud, and coordinated multinational smuggling operations previously required large, well-organized criminal enterprises with substantial financial resources, trusted networks of human specialists, and years of operational experience. These barriers to entry provided a degree of natural enforcement efficiency: only a limited number of organizations could operate at the scale required to be significant. AI tools are eliminating these barriers. A small criminal network with access to the relevant AI tools and the technical sophistication to deploy them can now execute financial frauds, produce convincing documentary cover for illegal extraction, coordinate multi-jurisdictional logistics, and evade detection across multiple regulatory frameworks in ways that previously required the resources of a major transnational organized crime group⁶². The practical effect is to expand dramatically the population of actors capable of participating in illegal resource extraction networks, making the enforcement challenge substantially more diffuse, more resource-intensive, and more difficult to address through strategies focused on dismantling a limited number of large criminal organizations.

9. Artificial Intelligence as a Tool for Detecting and Prosecuting Transnational Crime

The same technological infrastructure that empowers criminal networks also creates new possibilities for detection, investigation, and prosecution. The critical governance challenge is whether law enforcement and regulatory agencies can deploy these tools with sufficient speed, scale, and legal legitimacy to keep pace with criminal innovation. The EU's position as a regulatory standard-setter, combined with the resources of its member states and the data infrastructure of its space and financial monitoring programs, gives it distinctive advantages in this AI-enabled enforcement competition, but realizing those advantages requires sustained political investment and careful legal architecture.

⁶¹ V. FELBAB-BROWN, *op. cit.*

⁶² Europol, *op. cit.*

9.1. Remote Sensing and Environmental Crime Detection

AI-powered analysis of satellite imagery represents one of the most immediately applicable and potentially transformative tools for detecting illegal mining and related environmental crimes at global scale. Machine learning models trained on large labeled datasets of satellite imagery can identify the specific visual and spectral signatures of illegal mining activity with a precision and at a geographic scale that no human analyst or conventional monitoring program could match. Relevant signatures include vegetation loss patterns distinctive to artisanal mining (different in geometry and progression from legal agricultural clearing), soil disturbance and exposed earth, the characteristic water discoloration downstream of mining sites from sediment and mercury contamination, and the distinctive infrastructure of mining camps including roads, equipment, and waste piles⁶³. These signatures can be detected across millions of square kilometers at regular intervals, providing near-real-time monitoring of areas that would be entirely opaque to conventional surveillance.

The EU's Copernicus Earth Observation Programme provides open-access satellite data with global coverage and revisit times of days to weeks, depending on the sensor and orbit. Copernicus data is already used for environmental monitoring, disaster response, and agricultural policy, but its potential application to illegal mining detection has not been systematically exploited by EU enforcement agencies. Integration of Copernicus data streams with AI monitoring systems operated by Europol or a dedicated EU environmental crime enforcement body would create a persistent global monitoring capability for illegal extraction activity, providing the geographic intelligence needed to coordinate enforcement responses with national authorities and multilateral partners in affected regions⁶⁴. The proof of concept already exists: platforms including Global Forest Watch have demonstrated that AI analysis of satellite data can track deforestation, including mining-related deforestation, in near real time at continental scale⁶⁵. The gap is not technical but institutional and political: converting monitoring data into enforcement action requires functioning governance partnerships with source-country authorities who are often themselves compromised.

9.2. Financial Intelligence, Beneficial Ownership, and Supply Chain Tracing

In the domain of financial intelligence, AI offers the prospect of restoring investigative parity with the criminal innovation described in Section 8. AI-driven transaction monitoring systems capable of processing millions of transactions simultaneously can identify patterns associated with money laundering from illegal

⁶³ R. BALANIUK, O. ISUPOVA, S. REECE, *Mining and Tailings Dam Detection in Satellite Imagery Using Deep Learning, Sensors*, 2020, no. 23, art. 6936.

⁶⁴ European Space Agency, *Copernicus Earth Observation Programme Overview*, 2023.

⁶⁵ M.C. HANSEN ET AL., *High-Resolution Global Maps of 21st Century Forest Cover Change*, in *Science*, 2013, vol. 342, art. 6160, pp. 850-853.

mining at a sensitivity and specificity impossible for human analysts working with conventional database query tools. Relevant patterns include the specific transaction layering structures used to move gold proceeds through commodity trading networks, the beneficial ownership configurations characteristic of criminal shell company networks, and the geographic and temporal flow patterns linking source-country financial systems to EU banking centers⁶⁶. Graph-based AI analysis of corporate registry data, financial transaction records, and commodity trade documentation can trace the ownership chains and financial flows that connect illegal extraction operations to EU market entry points, directly supporting the beneficial ownership transparency requirements of AMLD6 and the forthcoming AMLA supervisory regime.

AI tools can also significantly strengthen the supply chain due diligence verification that is central to the effectiveness of the Conflict Minerals Regulation, CSDDD, and Deforestation Regulation. End-to-end supply chain tracing using AI analysis of trade documentation, shipping records, processing facility data, and financial transaction patterns can in principle trace minerals from their point of extraction through multiple layers of processing and trading to EU market entry, identifying discrepancies between declared and actual provenance that indicate non-compliance or fraud⁶⁷. This kind of comprehensive supply chain visibility is not yet operational at the scale required to support systematic enforcement of EU due diligence regulations, but it is technically achievable and represents the most credible path to transforming these regulations from aspirational frameworks into effective enforcement tools.

9.3. Predictive Intelligence, Network Analysis, and Border Enforcement

Predictive AI models represent a further enforcement frontier with direct applications to illegal resource extraction. Machine learning models integrating economic, political, geographic, and environmental variables can identify areas at elevated risk of new or expanding illegal mining activity before it reaches the scale detectable by satellite imagery or visible to source-country law enforcement, enabling proactive deployment of monitoring and enforcement resources⁶⁸. Social network analysis tools applied to law enforcement intelligence data, financial transaction networks, and communications metadata can map the organizational structures of criminal networks, identifying the key nodes, financial intermediaries, and operational coordinators whose disruption would be most damaging to criminal operations.

At EU external borders, AI-assisted risk profiling of cargo shipments, vessel movements, and trade documentation can significantly improve the efficiency of enforcement under the Deforestation Regulation and Conflict Minerals Regulation by flagging high-risk shipments for enhanced inspection without requiring proportional

⁶⁶ FATF, *Opportunities and Challenges of New Technologies for AML/CFT*, cit.

⁶⁷ European Commission, *Report on the Functioning of the EU Conflict Minerals Regulation*, cit.

⁶⁸ Europol, *op. cit.*

increases in customs and border enforcement personnel⁶⁹. The current enforcement of these regulations at EU ports of entry is heavily resource-constrained: the volume of relevant imports is enormous, the information required to verify compliance is often held in third countries with limited information-sharing arrangements, and the documentary fraud risk is high. AI-assisted risk profiling cannot solve these problems entirely, but it can substantially improve the targeting efficiency of the enforcement resources that are available.

9.4. Prosecution Support, Evidentiary Standards, and Fundamental Rights

AI has significant potential to support the prosecution of transnational crime cases, which are characteristically complex, document-intensive, multilingual, and multi-jurisdictional. AI-assisted document analysis and translation tools can process the vast quantities of financial records, corporate filings, communications intercepts, and operational records recovered in major criminal investigations, identifying relevant evidence and connections at a speed and scale impossible for human analysts working within prosecution timeframes⁷⁰. Eurojust's coordination of multi-jurisdictional prosecutions would be significantly enhanced by AI tools capable of identifying evidentiary connections across the multiple national legal systems, languages, and evidentiary standards involved in complex transnational resource crime cases.

However, the use of AI in criminal investigation and prosecution raises fundamental legal questions that the EU must resolve before AI-assisted enforcement can be legally sustainable. The admissibility of AI-generated or AI-identified evidence varies across EU member states and has not been definitively addressed at EU level. Algorithmic bias in AI systems used for targeting and risk profiling can produce discriminatory outcomes that violate the EU Charter of Fundamental Rights and the principle of non-discrimination enshrined in EU law. The use of AI surveillance tools including satellite monitoring, social network analysis, and financial transaction profiling raises significant privacy concerns under the General Data Protection Regulation (GDPR) and the Law Enforcement Directive that governs the processing of personal data by competent authorities⁷¹. Effective AI-enabled enforcement must be constructed on a foundation of explicit legal authority, technical robustness, human oversight, and fundamental rights compliance if it is to survive judicial scrutiny and maintain the democratic legitimacy that distinguishes EU enforcement from the authoritarian surveillance practices of some competitor enforcement systems.

There is also the deeper dynamic of the adversarial arms race that any analysis of AI-enabled enforcement must confront directly. Every AI detection tool creates pressure for criminal adaptation. Every advance in satellite monitoring stimulates investment in

⁶⁹ Frontex, *Risk Analysis for 2022*, 2022.

⁷⁰ R. BALANIUK, O. ISUPOVA, S. REECE, *op. cit.*

⁷¹ European Union Agency for Fundamental Rights (FRA), *Facial Recognition Technology: Fundamental Rights Considerations in the Context of Law Enforcement*, 2020.

counter-surveillance measures. Every improvement in transaction monitoring generates experimentation with new evasion techniques. Every prosecutorial AI tool creates demand for criminal AI counter-forensics. This adversarial dynamic means that AI-enabled enforcement cannot be treated as a one-time investment in capability but requires sustained research, development, and adaptation in an ongoing competition with criminal innovators who are not constrained by the legal, ethical, and oversight requirements that govern law enforcement use of these technologies⁷². The EU must build the institutional infrastructure for sustained AI innovation in enforcement, not merely deploy current tools.

10. Building an AI-Ready EU Enforcement Architecture

The analysis in preceding sections points toward an ambitious but necessary governance agenda. The challenge is not merely technical: no combination of AI tools, however sophisticated, will be sufficient to address transnational resource crime if the legal frameworks, institutional architecture, and international partnerships needed to deploy them effectively are absent. The following agenda addresses the legal, institutional, external, and multilateral dimensions of the reform required.

The EU AI Act⁷³ provides the foundational legal framework for AI in European governance, establishing a risk-based approach that classifies AI systems by their potential for harm and imposes requirements for transparency, human oversight, accuracy, and accountability proportionate to risk level. Law enforcement AI applications, including predictive risk scoring, social network analysis for criminal investigation, and biometric identification at borders, are classified as high-risk systems under the Act and subject to stringent conformity assessment, registration, and human oversight requirements. Ensuring that Europol, Frontex, EPPO, and national competent authorities acting in EU law enforcement contexts comply fully with AI Act requirements is a necessary foundation for legally sustainable AI-enabled enforcement. The legal framework must also address the evidentiary standards for AI-assisted evidence in criminal proceedings, a gap that currently creates uncertainty for prosecutors and defense counsel alike⁷⁴.

The Brussels Effect, as Bradford demonstrates, has made EU regulatory standards in domains from data protection to food safety to chemical regulation into effective global standards, as multinational companies find it more efficient to comply with the most demanding standard across their global operations than to maintain parallel compliance systems⁷⁵. The AI Act has the potential to produce a similar effect in the domain of law enforcement AI governance, particularly if the EU actively promotes its standards

⁷² Europol, *op. cit.*

⁷³ Regulation (EU) 2024/1689, *cit.*

⁷⁴ European Commission, *Regulatory Framework on Artificial Intelligence: The EU AI Act Explained*, 2024.

⁷⁵ A. BRADFORD, *op. cit.*

through trade agreements that include AI governance provisions, development cooperation programs that build third-country AI governance capacity, and multilateral forums including the G7, G20, and the Financial Stability Board. Making EU AI governance standards a condition of access to the institutional and operational resources of Europol and Eurojust for third-country partners would create powerful incentives for adoption.

Operationally, the EU's enforcement architecture for transnational resource crime requires significant strengthening and institutional integration. The current situation, in which Europol, Eurojust, EPPO, Frontex, and the European Environment Agency each have partial and overlapping mandates relevant to resource crime, produces fragmented responses inadequate to the integrated criminal networks they confront. A dedicated operational mechanism for AI-enabled resource crime enforcement, drawing on the intelligence and analytical assets of all relevant EU agencies and integrating satellite monitoring data from Copernicus, financial intelligence from the planned AMLA, and criminal intelligence from Europol, would provide the coordination infrastructure for a genuinely integrated enforcement response. This mechanism should be supported by dedicated multi-annual funding within the EU's internal security budget, with explicit performance metrics tied to its effectiveness in disrupting illegal resource extraction networks⁷⁶.

The EU's external action instruments must be more systematically aligned with its internal resource governance agenda. The Global Gateway infrastructure initiative, EU development cooperation programs, trade partnership agreements, and the EU's network of association and stabilization agreements all provide leverage for promoting better governance of resource extraction in source countries. Conditional access to EU market preferences, development finance, and infrastructure investment on the basis of verifiable performance against mining governance, AML compliance, anti-corruption enforcement, and human rights protection standards would create meaningful incentives for reform. This conditionality approach must be designed with sufficient nuance to avoid penalizing countries for governance failures they lack the capacity to address without EU support, and must be accompanied by substantial technical assistance programs that build the institutional capacity required for compliance⁷⁷.

Finally, the EU must exercise leadership in reforming international legal frameworks to address the AI dimensions of transnational crime. UNTOC and UNCAC were negotiated in an era when AI was not a relevant consideration for organized crime governance, and their provisions on mutual legal assistance, evidence sharing, and law enforcement cooperation reflect the assumptions of that era. A systematic update of both conventions, addressing the evidentiary standards for AI-generated evidence, the protocols for sharing AI-derived intelligence across jurisdictions, the legal frameworks for satellite surveillance in law enforcement, and the obligations of states regarding criminal use of AI within their territories, is necessary for international enforcement

⁷⁶ Eurojust, *op. cit.*

⁷⁷ European Commission, *Report on the Functioning of the EU Conflict Minerals Regulation*, cit.

cooperation to remain effective in the AI era. The EU is best positioned to lead this reform agenda, given its combination of legal expertise, institutional resources, and multilateral relationships, provided it is willing to expend the diplomatic capital required.

11. Conclusion

The tragedy of the global commons has always been, at its core, a problem of collective action failure. The resources shared by humanity, whether ocean fisheries, tropical forests, atmospheric carbon sinks, or Arctic mineral deposits, are depleted by the individually rational behavior of actors who have no reliable mechanism for internalizing the costs of their extraction on others. Hardin identified this dynamic half a century ago⁷⁸. Ostrom demonstrated that it is not inevitable, that communities can develop institutions for cooperative management of shared resources under the right conditions⁷⁹. The challenge of the twenty-first century is that those conditions, never easy to achieve, are deteriorating across multiple dimensions simultaneously.

This article has argued that three interlocking crises are driving an acceleration of the tragedy of the global commons in the domain of resource extraction crime. The structural incentives created by resource scarcity and the extraordinary profitability of illegal extraction are intensifying. The geopolitical conditions under which multilateral enforcement cooperation was possible are eroding rapidly, as the US withdraws from multilateral leadership, Russia normalizes resource seizure by force, and China offers alternative governance frameworks that compete with EU regulatory conditionality. And artificial intelligence is transforming criminal capability at a pace that existing legal frameworks cannot match, lowering barriers to entry for illegal extraction networks, undermining the documentary foundations of due diligence enforcement, and creating adversarial dynamics in which criminal innovation systematically outpaces enforcement adaptation.

Against this backdrop, the European Union has assembled a body of supply chain due diligence law, AML regulation, and AI governance that represents the most ambitious attempt by any jurisdiction to address the intersection of resource crime and modern criminal innovation. The Conflict Minerals Regulation, CSDDD, Deforestation Regulation, AMLD6, and AI Act together constitute a serious governance architecture. But this architecture is incomplete, fragmented, and insufficiently connected to the enforcement infrastructure and external action instruments needed to make it effective beyond EU borders. Realizing its potential requires sustained political investment in enforcement capacity, institutional integration among EU agencies, ambitious deployment of AI detection tools within a rights-compliant legal framework, and a determined effort to extend EU regulatory standards globally through external action, trade conditionality, and international legal reform.

⁷⁸ G. HARDIN, *op. cit.*

⁷⁹ E. OSTROM, *op. cit.*

None of this agenda is easy to accomplish, and intellectual honesty requires acknowledging the limits of what EU regulatory ambition can achieve in a geopolitical environment defined by great power competition and the erosion of multilateral norms. The EU cannot replicate the enforcement leverage it exercises within its single market across the entire globe. It cannot compel source-country governments to enforce their own laws when those governments are themselves compromised. It cannot win an AI arms race with criminal networks if it is unwilling to match their pace of innovation within the constraints of its fundamental rights commitments. And it cannot substitute for the US engagement in multilateral enforcement that the current geopolitical moment has withdrawn.

But acknowledging these limits is not an argument for passivity. The EU's regulatory market power, institutional resources, and normative leadership still represent the most credible foundation available for a global response to transnational resource crime. The alternative to ambitious EU action is not a stable equilibrium of manageable crime but an accelerating dynamic in which AI-enabled criminal networks extract global commons at rates that exceed any governance mechanism's capacity to respond, while the proceeds of that extraction finance terrorism, corruption, human trafficking, and environmental collapse across multiple continents. The tragedy of the commons, Hardin (1968) argued, would lead rational actors to demand governance mechanisms that protect shared resources from individual predation. The age of artificial intelligence has raised both the costs of that predation and the technical possibilities for governance response. Whether the political will to build adequate institutions exists is the question on which the answer depends.

ABSTRACT: Illegal mining and natural resource extraction represent one of the most complex and underexamined dimensions of transnational organized crime, intersecting with drug trafficking, terrorism, human trafficking, money laundering, and environmental degradation. Drawing on Hardin's (1968) tragedy of the commons and Ostrom's (1990) analysis of collective action problems, this article argues that global resource scarcity creates structural incentives for illicit exploitation that existing international and European Union legal frameworks are increasingly unable to contain. The erosion of the rules-based international order under renewed power politics, the withdrawal of the United States from multilateral governance, and the consolidation of rival geopolitical blocs further compound enforcement failures by eliminating the cooperative conditions on which international law depends. Against this backdrop, artificial intelligence is transforming transnational crime on every front: criminal networks deploy AI to evade financial controls, fabricate supply chain documentation, and optimize smuggling logistics, while law enforcement agencies are developing AI-driven tools for satellite environmental monitoring, financial intelligence, predictive network analysis, and prosecutorial support. The European

Union, through an emerging architecture of supply chain due diligence law, anti-money laundering regulation, and AI governance, is positioned to lead global efforts to address AI-enabled transnational resource crime. This article examines how the EU can integrate these instruments into a coherent enforcement framework, extend their reach through external action, and lead the reform of international legal institutions inadequate to the demands of the AI era.

KEYWORDS: Artificial Intelligence – European Union – Illegal Mining – Tragedy of the Commons – Transnational Crime.