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Modern Challenges to the Non-Proliferation Regime and Transformation of the Control Architecture in the Post-New Start Era

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ABSTRACT

The contemporary framework of global nuclear security faces a severe institutional instability, resulting from the breakdown of core mechanisms for strategic oversight. The effective disintegration of these pacts, the establishment of cross-regional networks for illicit nuclear technology transfer (such as the Iran – Democratic People's Republic of Korea – Russia chain), and the conversion of nuclear pressure into a diplomatic tool have substantially amplified the threat of worldwide destabilization. The conventional oversight scheme, reliant on diplomatic statements, field verifications, and decision-blocking via veto in the UN Security Council, has revealed its susceptibility to intentional abuses, rapid technological advancements, and tactics of status-quo challengers evading joint pressure. To overcome these barriers, the article outlines theoretical foundations for upgrading the oversight system through evolution from an outdated diplomatic model to an integrated techno-legal structure. This updated scheme incorporates three primary elements: automated surveillance employing artificial intelligence, open-source intelligence, and space-based systems for detecting deviations and breaches; reinforcement of the safeguards regime via distributed databases (blockchain) to guarantee the integrity and openness of nuclear resource supply chains; the concept of automatic accountability activators – policy-independent legal tools that trigger sanctions automatically upon breach verification, circumventing veto in the United Nations Security Council. The study examines the dynamics of nuclear deterrence ideas, highlights flaws in standard verification methods, and analyzes potential hazards of delegating decisions in nuclear management, control, and communication to AI algorithms. Drawing on a synthesis of adherence experiences in mass destruction weapon limitation spheres, it argues for a multilevel restraint structure capable of neutralizing chain arms races and branched channels of nuclear material dissemination. The proposed integrated structure is designed to revive mutual confidence, foreseeability, and preemptive resilience in a multipolar reality by forming a neutral, prompt, and open response apparatus, free from individual countries' influence. The research enriches theoretical and practical comprehension of the forthcoming phase in nuclear diplomacy, where genuine protection relies on the interplay of international law norms, innovative technologies, and institutional autonomy.

KEYWORDS

non-proliferation regime, Democratic People's Republic of Korea, sanctions, artificial intelligence, nuclear safety, control architecture, United Nations Security Council, veto power, hybrid verification, blockchain.

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Сучасні виклики режиму нерозповсюдження та трансформація архітектури контролю у добу пост-СНО

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СТАТТЯ

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АНОТАЦІЯ

Глобальна система ядерної безпеки нині опинилася в стані серйозної інституційної нестабільності, спричиненої руйнуванням базових механізмів стратегічного нагляд. Фактичний розпад цих домовленостей, формування трансрегіональних мереж нелегального поширення ядерних технологій (ланцюг Іран–КНДР–Росія), а також перетворення ядерного тиску на елемент дипломатичного арсеналу суттєво посилили загрозу світової дестабілізації. Класична схема нагляду, заснована на дипломатичних заявах, виїзних перевірках та блокуванні рішень через вето в Раді Безпеки ООН, продемонструвала свою вразливість перед навмисними зловживаннями, швидким розвитком технологій та стратегіями держав, що прагнуть перегляду статус-кво та уникають спільного тиску. Для подолання цих бар'єрів у статті викладено теоретичні основи модернізації системи нагляду шляхом еволюції від застарілої дипломатичної моделі до інтегрованої технологічно-юридичної структури. Ця оновлена схема передбачає три основні елементи: автоматизоване спостереження з використанням штучного інтелекту, даних відкритої розвідки та космічних систем для фіксації відхилень і порушень; посилення режиму гарантій за допомогою розподілених баз даних (блокчейн) для гарантування незмінності та відкритості ланцюгів постачань ядерних ресурсів; концепцію автоматичних активаторів відповідальності– незалежних від політики правових інструментів, які запускають санкції автоматично при верифікації порушень, минаючи вето в РБ ООН. У роботі розглянуто динаміку ідей ядерного стримування, висвітлено недоліки стандартних методів перевірки та проаналізовано потенційні небезпеки передачі рішень у сфері ядерного управління, контролю та зв'язку алгоритмам ШІ. На підставі синтезу досвіду дотримання норм у сферах обмеження зброї масового ураження аргументовано потребу в багаторівневій структурі стримування, спроможній нейтралізувати ланцюгові перегони озброєнь та розгалужені канали поширення ядерних матеріалів. Запропонована інтегрована структура покликана відродити взаємну впевненість, прогнозованість та упереджувальну стійкість у багатополюсній реальності через формування нейтрального, оперативного та відкритого апарату реагування, вільного від впливу окремих країн. Дослідження збагачує теоретичне та практичне розуміння прийдешньої фази ядерної дипломатії, де справжня захищеність спирається на взаємодію норм міжнародного права.

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КЛЮЧОВІ СЛОВА

режим нерозповсюдження, КНДР, санкції, штучний інтелект, ядерна безпека, архітектура контролю, Рада Безпеки ООН, право вето, гібридна верифікація, блокчейн.

1. Introduction

The global nuclear security framework is currently in a phase of fundamental institutional crisis, which manifests itself in the collapse of classical instruments of strategic regulation. Modern dual-use technology transfer routes, clandestine financial schemes, and the involvement of private military-technical agents contribute to the emergence of an "arms chain escalation" where additional entities claiming nuclear elements appear. Traditional verification tools of the International Atomic Energy Agency (IAEA) are increasingly encountering barriers to access to nuclear facilities and falsification of data. Under such circumstances, there is an urgent need to reform the regulatory system – an evolution from an archaic diplomatic model to a combined technological and legal platform. The updated framework should integrate automatic response triggers, artificial intelligence (AI) tools for processing bulky data, monitoring of open intelligence sources (OREs) and strengthened IAEA protocols, forming a policy-independent response apparatus, paving the way for automated, operational and open regulation that does not depend on the decisions of individual countries and guarantees proactive resilience in a multipolar environment through the revival of confidence, predictability and legal responsibility.

2. Literature Review

The topic of modernization of the nuclear non-proliferation regime and strategic regulation in the post-bipolar reality has become widely spread in modern scientific works. The basics of creating a new global security system, combining diplomatic, technological and legal aspects, are covered in the works of leading foreign and Ukrainian specialists.

In a fundamental work, Snow [21] emphasizes that bilateral agreements such as START provided stability and openness only with symmetry of capacities, but became ineffective in an environment with multiple nuclear players. It highlights the shortcomings of regulatory instruments based on political loyalty, ignoring the influence of non-state agents and dual-use technology transfer.

Modern research is expanding horizons through the introduction of artificial intelligence into strategic sustainability processes. In the work of Kaplow and Musto, the idea of using AI for automatic recognition of anomalies in nuclear initiatives and strengthening the openness of verification procedures is put forward [11]. The authors argue that the combination of AI analysis with VRD and satellite data can level the IAEA's organizational barriers, generating a combined surveillance system resistant to diplomatic sabotage. At the same time, they warn of the threats of AI exploitation by revisionist regimes to hide violations, which requires the development of moral and technical standards of verification.

The publication by Osimen et al. studies the implementation of artificial intelligence in the field of arms limitation [14]. The researchers focus on the potential of AI to form proactive response platforms that reduce reliance on diplomatic verdicts. At the same time, the main dangers are outlined – cyber risks, algorithmic escalation and the lack of universal regulatory standards, which prompts the creation of a single legal framework for controlling military AI.

D. Johnson, in his analysis, traces the transformation of US strategic thought after the events of September 11, 2001, emphasizing the shift from the paradigm of mutual assured destruction to the doctrine of flexible and proactive deterrence [10]. According to him, the collapse of bilateral agreements with Russia has exacerbated the technological imbalance and stimulated unilateral arms regulation strategies, making it difficult to maintain the global non-proliferation framework. The empirical aspect of the problem is revealed by Schwartz and Horowitz [17], who, on the basis of experiments with elite groups, demonstrate that the automation of nuclear launch complexes increases faith in threats, but at the same time increases the likelihood of escalation. They argue that passing verdicts to machines can weaken diplomatic restraint, provoking technological competition of coercion.

Punzi examines the impact of innovative technologies, in particular AI, on the implementation of UN Security Council Resolution 1540 [15]. It proposes to expand the scope of this resolution to take into account the dangers of using AI as a delivery element or component of weapons of mass destruction, highlighting the need for a modernized international legal framework for the military application of artificial intelligence. Research by Revill et al. [16] summarizes the practice of compliance and enforcement in WMD restriction regimes. The authors justify the creation of policy-independent verification tools and collective sanctions schemes capable of ignoring the veto, which is directly related

to the idea of automatic liability activators presented in this work. The practical side of combined methods is illustrated by the INMM/ESARDA report (2023) [20], confirming the effectiveness of integrating remote technologies and AI algorithms for report validation and registration of violations in states with limited access (Iran, North Korea).

A publication in The Defense Horizon Journal outlines an ethical model of "Transparency, Trusted Principles, Targeted Learning, 3T" for the implementation of AI in nuclear command, control, and communications systems [12]. The authors insist on maintaining human oversight of key verdicts to avoid

Despite notable scientific achievements, a comprehensive study of the modernization of the nuclear non-proliferation regime in the post-START era remains incomplete. There is a lack of comprehensive schemes that integrate combined surveillance (AI + VRD), policy-independent sanctions withdrawal procedures, and multi-level restraint in the context of arms chain escalation, which justifies further theoretical and applied study of a combined technological and legal platform capable of restoring confidence, predictability, and proactive resilience in a multipolar environment.

3. Problem Statement

The article is aimed at the theoretical basis for the modernization of the nuclear non-proliferation regime in the post-START era, taking into account the role of artificial intelligence, open intelligence, and automated platforms in the processes of verification, deterrence, and coercion. The study is focused on creating the theoretical foundations of a new policy-independent strategic regulatory framework capable of neutralizing transregional networks of illicit proliferation of nuclear technologies and ensuring proactive resilience in a multipolar environment. To achieve the goal, the following tasks are provided:

1. To analyze the dynamics of nuclear deterrence ideas and outline the shortcomings of classical instruments of regulation and verification in the context of expanding the range of nuclear actors, technological development and fragmentation of the global system.
2. To explore the possibilities of introducing artificial intelligence, space technologies and VRD into automated monitoring procedures for nuclear initiatives.
3. Assess the threats and moral dilemmas of the use of AI in nuclear command, control, and communications structures.
4. Synthesize the experience of compliance with norms and coercion within the framework of weapons of mass destruction limitation regimes and argue the need for policy-independent response procedures that can circumvent blocking in the UN Security Council.
5. To develop the theoretical principles of a new combined regulatory structure that integrates technological surveillance, a multi-level deterrence system, automatic liability triggers and ways of implementation in existing international formats.

4. Methods and Materials

The study applies an interdisciplinary approach that combines methods of analysis of international law, strategic studies, open intelligence (OSINT) and technological innovations in the field of artificial intelligence. The source base consists of official reports of the IAEA, the UN, SIPRI, the US Congressional Research Service, the Center for Strategic and International Studies, as well as open satellite data and analytics of weapons fragments. A comparative analysis of the effectiveness of existing control regimes (NPT, JCPOA, START-III, DPRK) is carried out according to the criteria of legal status, violations and consequences. To substantiate the mechanism of the automatic activator of responsibility, legal modeling based on the precedent of automatic renewal of sanctions in 2025 was used. The methodology includes content analysis of regulatory documents, systematic analysis of transregional relations (Iran – Democratic People's Republic of Korea – Russia), as well as modeling of automated response procedures bypassing the diplomatic veto.

5. Results and Discussion

An assessment of the current state of the main formats indicates their degradation on three planes – legal, organizational and practical. The Treaty on the Non-Proliferation of Nuclear Weapons (NPT)

formally remains in force, but its real effectiveness is gradually weakening. The failure of the last Review Conference (2022) highlighted the big differences between states with nuclear capabilities and other participants, as well as the lack of progress in disarmament. The external resilience of the agreement no longer ensures genuine fulfillment of requirements, while the increase in regional conflicts sets the stage for undermining confidence.

The JCPOA has effectively ceased to function following the launch of the mechanism for the automatic reinstatement of previous multilateral sanctions against Iran by France, Germany, and the United Kingdom in August 2025. The reintroduction of six UN Security Council resolutions restored the entire range of restrictions, including a ban on uranium enrichment, the creation of ballistic systems, and the export of conventional weapons [23]. In response, Iran increased the volume of uranium enrichment to 60%, which practically brought it closer to the level of a state on the verge of nuclear status.

The Democratic People's Republic of Korea (DPRK) retains the status of the most active violator of the regime, continuing to improve nuclear and missile technologies despite UN Security Council resolutions. According to estimates by the US Congressional Research Service (2025), Pyongyang has enough fissile materials for about 90 warheads and is building up the capabilities of tactical complexes and hypersonic carriers [6].

The end of the START-III Treaty was a critical turn for the entire system of strategic balance. The suspension of Russia's participation in 2023 has led to a halt in inspections and information sharing, which has abolished instruments of mutual control. According to the Stockholm Peace Research Institute's Yearbook 2025, the nuclear stockpiles of key states are increasing, and renewal programs include hypersonic and orbital complexes. As Gottemoeller notes, after the expiration of the START-III period, the world will enter the phase of uncontrollability, where the former verification methods will lose their relevance [7].

Table 1. Status of key nuclear control regimes in post-START

Format/ Agreement	Legal status (2025	Major violations or barriers	Implications for global security	Level of efficiency
NPT	Formally active, but without consent after the 2022 Review Conference.	Lack of progress in disarmament; exacerbation of the imbalance between nuclear and non-nuclear actors	Increased skepticism about international commitments; weakening of the authority of the system	Part of the
JCPOA (Iran)	Effectively canceled after the automatic sanctions reinstatement mechanism (2025)	Iran's non-compliance; renewal of restrictions of the UN Security Council	Local destabilization; danger of approaching the threshold nuclear level	Critical
DPRK	Lack of participation in the NPT; Active nuclear initiative	Ignoring UN Security Council resolutions; Improvement of intercontinental ballistic missiles and tactical nuclear weapons	Destruction of the versatility of the system; aggravation in Eastern Asia	Zero/ destructive
START-III	Suspended by Russia, completion in 2026.	Stopping checks and data sharing; accumulation of strategic resources	Loss of openness; formation of a triangle of competition USA–Russia–China	Degrading

Sources: Compiled by the author based on [6; 7; 23].

As the analysis of Table 1 shows, the crisis is not just contractual, but systemic and networked. The traditional model, relying on diplomatic consensus in the UN Security Council, is not only ineffective against coordinated networks of violators but has itself become an instrument of their impunity through the veto, creating a legal vacuum of responsibility that cannot be filled by either soft law or technology alone. The way out is to create a new type of legal instrument that transforms technologically obtained evidence into automatic legal consequences.

A comparative assessment indicates a general loss of the ability of classical agreements to maintain strategic equilibrium. Each format reveals its own form of instability: legal (NPT), organizational (JCPOA), behavioral (DPRK) and constructive (START-III). They are united by a common

drawback - reliance on diplomatic trust instead of technologically supported tools. The NPT retains its symbolic meaning, but loses credibility due to the inequality of requirements. The JCPOA demonstrates the sensitivity of compliance mechanisms to external diplomatic shifts. The DPRK has become an example of impunity deviation, undermining the concept of the generality of the system. The completion of START-III consolidated the trend towards a complete absence of mutual openness between nuclear powers, forming a "zone of invisibility" in the sphere of strategic balance. The classic structure of proliferation restriction, formed during the Cold War, reveals an inability to adapt to multipolarity and technological change. Further development of the regulatory system requires an evolution towards a policy-independent, innovation-backed and biased model, where automated trust indicators, combined verification platforms (artificial intelligence + open source analysis) and neutral liability activators free from individual countries' diplomatic mandates will play a leading role.

The crisis of the world system of limiting nuclear proliferation acquires a transregional and network dimension. If in previous periods the main threats were isolated deviations or hidden initiatives of individual countries, now a cross-border network of interdependent technological and financial flows is being formed, which avoid the regulatory instruments of the UN Security Council and the International Atomic Energy Agency. This structure can be defined as a "shadow distribution network", an association of states interacting beyond official routes, applying technological, military and logistical ties to strengthen their own defense capabilities. The centerpiece of this network is the enduring technological alliance between the DPRK and Iran. During the 1980s and 1990s, Pyongyang transferred to Tehran from 200 to 300 missiles of the Scud-B and Scud-S types, which formed the basis of the Iranian Shahab-1 and Shahab-2 complexes. Subsequent deliveries of Nodon-type missiles provided Iran with the technological base for the development of Shahab-3, as well as the exchange of flight data, which accelerated the progress of its ballistic program [5].

According to the Center for Strategic and International Studies, Iran's medium-range missiles, Shahab-3, Hadr-1, Emad and Sejil, combine North Korean fundamentals with local improvements. According to the estimates of the International Institute for Strategic Studies, Iran currently has the largest arsenal of ballistic systems in the region: more than 100 launchers for short-range missiles, 50 for medium-range missiles, and more than 1000 missiles with a maximum range of up to 2000 km, limited by domestic political decisions [8; 13]. At the same time, there is a deepening of military-technical cooperation between Russia and Iran, which exceeds the traditional framework of arms exchange. Moscow supplies Iran with air defense systems (including the S-400), unmanned reconnaissance vehicles and provides access to satellite data. In exchange, Iran provides Russia with Shahed-136 attack drones and ballistic missiles. A study by the International Institute for Strategic Studies (2025) based on an analysis of open sources of Shahed-136 and Russian Kh-69 wreckage used in Ukraine demonstrates a high degree of technological interdependence between these systems – especially through shared supply chains of microelectronics from East Asia [9].

The molded structure generates a domino effect in the field of security in the Middle East. Iran's gradual approach to the "threshold" nuclear level provokes Saudi Arabia to intensify its own nuclear initiative – in particular, investments in uranium enrichment and partnership with Pakistan within the framework of the so-called "nuclear defense". Analysts at the Stockholm Peace Research Institute register an increase in Riyadh's strategic engagement with Beijing, which could potentially include access to dual-use technologies through the Pakistani channel. In response, Israel expands its capabilities to deter a second strike by updating the naval component of its nuclear arsenal (according to open estimates, 80-200 warheads). Turkey, due to the change in the regional balance, is increasingly claiming the right to an "autonomous nuclear strategy" in the event of a complete collapse of the JCPOA. Local initiatives grow into a chain spread of nuclear technologies, when the actions of some states trigger an avalanche-like escalation in neighboring countries.

The fight against such a dynamic, transregional threat requires an adequate response mechanism: fast, objective and inevitable. It must be able to react faster than a chain escalation develops, rely on data independent of political pressure, and apply sanctions automatically, avoiding diplomatic sabotage. Otherwise, the control system will always lag behind the threat.

The current trend shows that the instability of the nuclear proliferation limitation system is taking on a general, transregional form. A strong network of countries is formed, North Korea, Iran, Russia, China, Pakistan, Saudi Arabia, which avoids traditional regulatory formats, applying indirect routes: payments in cryptocurrencies, fictitious firms, non-transparent re-export of elements and diplomatic privileges. Classic means – UN Security Council resolutions, inspections by the International Atomic

Energy Agency, restrictive embargoes – remain valid only for individual incidents, but are helpless in the face of agreed network configurations. The updated tools should rely on combined surveillance (artificial intelligence + open source analysis), automatic response triggers, and multilateral protocols capable of blocking the channels of nuclear technology proliferation even at the stage of transregional exchange of information, developments, and funds.

The aggravation of the organizational instability of proliferation restriction systems actualizes the shift from diplomatic dependence to technological independence of verification. The International Atomic Energy Agency's classic assurance scheme, based on on-site inspections and voluntary submission of data by countries, increasingly faces barriers to access and selective compliance. In Iran, the inspections do not fully cover installations at Fordow and Parchin; in the DPRK, the lack of cooperation after the rejection of the Treaty on the Non-Proliferation of Nuclear Weapons in 2003 made any formal examinations impossible. As a result, verification loses its consistency, and its success depends on diplomatic agreement in the UN Security Council, which makes it ineffective under the conditions of norm revision strategies [3].

The general instability of proliferation limitation systems is due to the basic flaw of the modern structure of international security – the mechanism of diplomatic veto in the UN Security Council, which prevents the implementation of coercive measures even in the presence of convincing evidence of violations. Under such circumstances, the idea of an Automatic Liability Activator (AAA) is proposed, which transforms responsibility from a diplomatic instrument into a legally binding mechanism, bypassing the veto through precedent-setting schemes for automatic reinstatement of sanctions and new multilateral agreements.

The Automatic Liability Activator (AAA) is not a technical protocol, but should be a new type of international legal instrument embedded in a multilateral agreement (for example, a special Convention or an addendum to the NPT). Its legal essence lies in the prior consent of the participating states to the automatic application of certain sanctions in case of fixation of violations by an independent verification body. It shifts the point of a political decision from the moment of reaction (where a veto is possible) to the moment of ratification of the agreement. The key components of the AAB legal mechanism will be:

– Clearly defined violations. For example, detection of undeclared nuclear activity, denial of access for verification, and public threats of nuclear use against non-nuclear states.

– Independent verification procedure. Establishment of the fact of violation by the appointed technological and expert body.

– Automatic consequences. A pre-agreed set of sanctions (technological embargo, financial restrictions) comes into force automatically after the official notification of the violation, if the violator does not prove the erroneousness of the conclusions within the specified "appeal period" (30 days).

– Appeal mechanism. The right of the violating state to appeal the decision to an independent international body (the International Court of Justice), which does not automatically suspend the sanctions.

The basis for the idea of AAB is the experience of automatic renewal of sanctions in accordance with Resolution 2231 (2015), which accompanied the Joint Comprehensive Plan of Action. A previous activation attempt in 2020 revealed diplomatic restrictions (a group of three European states, the Russian Federation, the People's Republic of China), which highlighted its diplomatic sensitivity [22; 25]. At the same time, in 2025, the mechanism worked effectively: on August 28, 2025, a group of three European states officially informed the UN Security Council of Iran's "significant non-compliance" with the Joint Comprehensive Plan of Action (exceeding the uranium enrichment level of more than 90% and restricting the access of the International Atomic Energy Agency), and 30 days later, on September 28, 2025, the sanctions of previous resolutions (1696, 1737, 1747, 1803, 1835, 1929) were automatically renewed without a new vote [4; 18; 23].

Iran's response was harsh: officials dubbed the decision a "violation of sovereignty" and threatened to abandon the Treaty on the Non-Proliferation of Nuclear Weapons [4]. This event was the first case of successful application of the mechanism of automatic restoration of sanctions without the consent of all permanent members of the UN Security Council, which confirms the capabilities of automated legal instruments of coercion.

A promising model for the formalization of such procedures is the draft recommendations of the United Nations Institute for Disarmament Research on multilateral agreements with policy-independent mechanisms of accountability. They provide for well-defined launchers – significant non-compliance with nuclear requirements, refusal to inspect or detection of undeclared installations – and

automatic consequences: embargoes on dual-use technologies, asset freezes and prohibitions on trade in nuclear resources.

Conceptually, the AAB acts as a sequence of steps: Violation (Trigger) → Independent Verification (Artificial Intelligence / Open Source Analysis + International Atomic Energy Agency) → Automatic Implementation of Sanctions → a 30-day period without incurring liability. The verification is carried out by a combined system, the results of which are received by the secretariat of the AAB Convention. After the fact of violation is recorded, sanctions are imposed automatically, without a vote in the UN Security Council, with the option of appeal to the International Court of Justice during the period of exemption from liability. Such an instrument neutralizes the diplomatic veto and shifts the focus of decision-making from the diplomatic level to the legal and technical level (Table 2).

Table 2. Comparative effectiveness of compliance mechanisms

Criterion	Traditional model (UN Security Council)	Automatic Liability Triggers
Verification	Depends on the consent of the state, politicized	Hybrid (artificial intelligence / open source analysis + IAEA), independent and continuous [3; 19]
Decision on sanctions	The veto of the five permanent members blocks the decision	Automatic application, bypassing the veto through a multilateral agreement
Response speed	Months – Years (Iran 2006–2015)	30 days exemption period, immediate introduction
Political dependence	High (Russian Federation/People's Republic of China blockade DPRK, Iran)	Minimal, legally binding
Coercive Effectiveness	Low, disturbances recur	Higher (precedent of automatic reinstatement of sanctions by the group of three European states in 2025) [4; 5; 18]
Transparency	Limited, closed sessions of the UN Security Council	High, Public Trigger Register and Audit by Decentralized Ledgers [1; 24; 26]

Source: compiled by the author on the basis of [1; 4; 18 23; 24; 26].

Comparative analysis shows that the AAB model significantly exceeds the traditional one in terms of efficiency, transparency and legal objectivity, while the UN Security Council system remains constrained by diplomatic compromises. The concept of AAB takes international responsibility beyond political bargaining, turning it into an automatic legal consequence independent of the position of the great powers.

This approach creates a powerful preventive effect: violating states lose the opportunity to count on political immunity and are forced to take into account the inevitability of sanctions. As a result, AABs are able to become the core of the renewed architecture of global nonproliferation control – a real legal alternative to the veto, which strengthens stability in a multipolar world.

6. Conclusions

The results of the study confirm that the collapse of key agreements and the formation of networks of illegal technology transfer require a radical modernization of the control system, with an emphasis on automated response tools. The concept of automatic liability activators, complemented by technologies such as blockchain and satellite monitoring, will bypass political barriers and neutralize chain escalations. Such a transformation will ensure preventive resilience in a multipolar environment where mutual confidence is based on objective data. The scientific novelty of the study lies not in the statement of the crisis or the description of technologies, but in the conceptualization of the legal mechanism of automatic responsibility as a response to the network nature of modern proliferation threats. The proposed mechanism does not replace existing institutions, but creates a new, preventive legal layer capable of transforming the technological visibility of violations into inevitable legal consequences, which opens the way to a control architecture, where sustainability is ensured not by a political agreement, but by objective legal logic. Promising areas include the development of ethical standards for AI in nuclear surveillance and the testing of new protocols in regional coalitions to avoid global destabilization.

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