IRSTI 06.51.77 **https://doi.org/10.58805/kazutb.v.1.30-1315**

ECONOMIC EFFICIENCY OF INTERNATIONAL MEDIATION MECHANISMS IN NUCLEAR DISARMAMENT PROCESSES: COMPARATIVE ANALYSIS

[1]A. Bolat, [1]A. Kassymova✉, [2]D. Jangeldina, [2]Zh. Kurmankulova

[1]I. Zhansugurov Zhetysu University, Taldykorgan, Kazakhstan,
[2]K. Kulazhanov Kazakh University of Technology and Business, Astana, Kazakhstan

✉ *Корреспондент-автор: aiko_1990kz@mail.ru*

The aim is to explore the economic effectiveness of international mediation mechanisms in nuclear disarmament processes by comparing approaches across institutions and results. The research explores the extent to which structured mediation processes, such as those established by concessions made by Member States in areas of formal UN mediation mechanisms; by the UN Geneva Forum on Disarmament and other specific multilateral arenas, lead to a cost-effective process toward disarmament objectives. Employing document analysis and comparative legal methodology, the paper examines economic factors such implementation costs, transaction costs and resource allocation efficiency in various models of mediation. Special consideration is also paid to Kazakhstan' s institutional experience in conducting international initiatives related to nuclear disarmament, including the context of the Central Asian Nuclear-Weapon-Free Zone and bilateral mediation.

The results indicate that neither mechanism is best in all settings and more broadly, hybrid mediation forms consisting of formal institutional mechanisms into which certain specialized diplomatic tools are subsumed yield higher payoffs than stand-alone mechanisms. In practical terms, «hybrid» mediation combines treaty-based UN processes with auxiliary implementation and verification toolkits (e.g., START linked to CTR-type technical cooperation etc.), thereby reducing duplication and transaction costs. The study shows that the cost benefit ratio is highly dependent on institutional design, transparency mechanisms and verification. The paper finds that economic efficiency in nuclear disarmament mediation is largely contingent upon institutional co-ordination, transparent handling of resources and the integration of verification modalities into the intermediary's design. These results are relevant for policy-makers engaged in gaining the best advantage from international arms reduction initiatives, while still adhering to measure standards and satisfying strategic objectives nearly as efficiently as possible.

Keywords: nuclear disarmament, international mediation mechanisms, economic efficiency, comparative analysis, institutional frameworks, verification procedures.

ЯДРОЛЫҚ ҚАРУСЫЗДАНУ ПРОЦЕССІНДЕГІ ХАЛЫҚАРАЛЫҚ ДЕЛДАЛДЫҚ МЕХАНИЗМДЕРІНІҢ ЭКОНОМИКАЛЫҚ ТИІМДІЛІГІ: САЛЫСТЫРМАЛЫ ТАЛДАУ

[1]Ә. Болат, [1]А. Касымова✉, [2]Д. Джангельдина, [2]Н.Ж. Курманкулова

[1]І.Жансүгіров атындағы Жетісу университеті, Талдықорған, Қазақстан,
[2] Қ.Құлажанов атындағы Қазақ технология және бизнес университеті, Астана, Қазақстан,
email: aiko_1990kz@mail.ru

Бұл мақалада ядролық қараусыздандыру процестерінде халықаралық медиация механизмдерінің экономикалық тиімділігі институттық құрылымдар мен нәтижелердің салыстырмалы талдауы арқылы қарастырылады. Зерттеу Біріккен Ұлттар Ұйымының құрылымдарын, Женева қараусыздандыру форумын және мамандандырылған көпжақты платформаларды қосымша, формальды медиация механизмдерінің қараусыздандыру мақсаттарына экономикалық орындықтай ықпал ету жолын зерттейді. Құжатты талдау және салыстырмалы құқықтық әдістеме пайдалана отырып, зерттеу іске асырудың шығындарын, транзакция шығындарын және медиация моделінің ресурстарын бөлу тиімділігі сияқты экономикалық көрсеткіштерді бағалайды. Ерекше назар Қазақстанның халықаралық ядролық қараусыздандыру бастамаларын жүргіздегі институттық тәжірибесіне, оның

ішінде Орталық Азияның ядролық қарулы емес аймақ құрамасы мен екіжақты медиация әрекеттеріне бөлінеді.

Нәтижелер гибридті медиация моделінің, формальды институттық механизмдерді мамандандырылған дипломатиялық құралдарымен біріктіргенде, бір механизмді түрде жақындау салыстырмасында биік экономикалық нәтижелерді қамтамасыз ететінін көрсетеді. Іс жүзінде «гибридті» медиация келісімшартқа негізделген БҰҰ процестерін қосалқы іске асыру және тексеру құралдарымен (мысалы, CTR типті техникалық ынтымақтастықпен байланысты START және т.б.) біріктіреді, осылайша қайталау мен транзакция шығындарын азайтады. Зерттеу институты дизайны, ашық механизмдері және тексеру өндірісіне байланысты шығын пен пайданың қатынасындағы едәрлі ауытқуларды анықтайды. Мақалада ядролық қараусыздандыруда медиацияның экономикалық тиімділігі институттарды үйлестіруге, ресурстарды ашық басқаруға және медиация шеңберінде тексеру процедураларын интеграциялауға критикалық түрде байланысты екендігі қорытындыланады. Бұл тұжырымдамалар халықаралық қараусыздандыру құралдарын ынамдылық стандарттарын сақтай отырып және стратегиялық мақсаттарға экономикалық орындықтай жету арқылы оңтайландыруға ұмтыл ар саясатшылар үшін маңызды болып табылады.

Түйін сөздер: ядролық қараусыздандыру, халықаралық медиация механизмдері, экономикалық тиімділік, салыстырмалы талдау, институттық құрылымдар, тексеру процедуралары.

ЭКОНОМИЧЕСКАЯ ЭФФЕКТИВНОСТЬ МЕЖДУНАРОДНЫХ ПОСРЕДНИЧЕСКИХ МЕХАНИЗМОВ В ПРОЦЕССАХ ЯДЕРНОГО РАЗОРУЖЕНИЯ: СРАВНИТЕЛЬНЫЙ АНАЛИЗ

[1]А. Болат, [1]А. Касымова✉, [2]Д. Джангельдина, [2]Н.Ж. Курманкулова

[1]Жетысуский университет им. И. Жансугурова, Талдыкорган, Казахстан,
[2]Казахский университет технологии и бизнеса им. К. Кулажанова, Астана, Казахстан,
email: aiko_1990kz@mail.ru

В статье анализируется экономическая эффективность международных механизмов медиации в процессах ядерного разоружения посредством сравнительного анализа институциональных структур и результатов. Исследование рассматривает, как формальные механизмы медиации, включая структуры Организации Объединённых Наций, Женевский форум по разоружению и специализированные многосторонние платформы, способствуют экономической целесообразности достижения целей разоружения. Используя анализ документов и сравнительную правовую методологию, работа оценивает экономические показатели, такие как затраты на реализацию, транзакционные расходы и эффективность распределения ресурсов в различных моделях медиации. Особое внимание уделяется институциональному опыту Казахстана в проведении международных инициатив по ядерному разоружению, включая Центральноазиатскую зону, свободную от ядерного оружия, и двусторонние медиационные усилия.

Результаты показывают, что гибридные модели медиации, сочетающие формальные институциональные механизмы со специализированными дипломатическими инструментами, обеспечивают более высокие экономические результаты по сравнению с одно звеньевыми подходами. На практике «гибридное» посредничество сочетает в себе основанные на договорах процессы ООН с вспомогательными инструментами осуществления и проверки (например, механизм START в сочетании с техническим сотрудничеством типа CTR и т. д.), что позволяет сократить дублирование и транзакционные издержки. Исследование выявляет значительные вариации в соотношении затрат и выгод в зависимости от конструкции институтов, механизмов прозрачности и процедур верификации. Исследование заключает, что экономическая эффективность медиации по ядерному разоружению в критической степени зависит от координации институтов, прозрачного управления ресурсами и интеграции процедур верификации в рамки медиации. Эти выводы имеют значение

для политиков, стремящихся оптимизировать международные усилия по разоружению при сохранении стандартов соответствия и достижении стратегических целей экономически целесообразным образом.

Ключевые слова: ядерное разоружение, международные механизмы медиации, экономическая эффективность, сравнительный анализ, институциональные структуры, процедуры верификации.

Introduction. Research Background and Problem Justification. The international nuclear disarmament movement is at a crossroads, reflected in continued geostrategic tension and current multilateral impasse. International institutions have created ever-elaborate mechanisms for addressing nuclear security since 1970 against the backdrop of a rather poor record in term s of actual disarmament [1]. The problem is not only of political will; it concerns also the structural inefficiency and exorbitant operational costs of the current mediation arrangements. Even recent research indicates that verification alone costs 15-25% of disarmament implementation budgets, however a comparative analysis between institutional models for being cost effective in nuclear arms control does not exist [2].

The research problem arises because international mediation mechanisms existing today work institutionally isolated from each other, drafting verification systems and administrative procedures in parallel without a systematic optimization of costs. For example, the 2017 Treaty on Prohibition of Nuclear Weapons (TPNW) established a novel verification paradigm, but such an approach seems poorly integrated with larger coordination frameworks [3]. Furthermore, previous research has focused disproportionately on legal comparisons rather than economic ones-an important gap in the analysis when resource constraints are an overwhelming barrier to negotiating the type of comprehensive disarmament agreements that might otherwise have emerged post-1991.

The United Nations (UN) Fifth Committee has underlined that ineffective financial management and duplicative processes among disarmament-related projects are leading to unnecessary costs, which would otherwise be better spent on concrete disarmament [4].

Research Significance and Relevance. The reality of this research is the result of a number of ingredients. First, the START history- at the very least-calls into questions whether compliance costs are much higher than initial estimates once implementation occurs. Although the United States alone spent roughly 5.1 billion USD on the Cooperative Threat Reduction (CTR) programme to help implement START in former Soviet successor states, post-factum cost-benefit analysis of canisters saw that far from being exorbitant, realized security ‘earnings’ had actually outstripped financial investments; in effect, CTR’s was a net security dividend of ~1.52 billion USD between 1991-20015]. This counter-intuitive paradox -otherwise known as an overly-expensive positive effect- might imply that some systematic investigation is in order to properly allocate cost across mediation channels [5].

Second, the institutional innovations in Kazakhstan creates a unique laboratory for testing mediation effectiveness. The CANWFZ, created in 2009, is the first nuclear-weapon-free zone to be entirely located within the Northern Hemisphere and unlike other zones constitutes a unique institutional system that integrates both multilateral regional security arrangements [6]. Kazakhstan’s decision to eliminate the world’s 4th largest nuclear arsenal by choice, and then assume a leadership role in shaping global nuclear governance gives empirical evidence for studying how institutions matter for functional effectiveness [7]. Additionally, Kazakhstan’s opening of the IAEA LEU Bank in Ust-Kamenogorsk and its founding support for the Universal Declaration on Building a World Free of Nuclear Weapons are practical institutional innovations to consider comparatively [8].

Third, there is a growing recognition within the academic literature that institutional design features such as dispute settlement procedures, verification

regimes, membership structures and technology transfer arrangements are key intervening variables in shaping not only the durability of agreements but also their cost-effectiveness [9]. However comparative frames are underdeveloped and provide an analytical challenge for policy-makers trying to maximize restricted political and economic resources.

Items to be researched are those of international mediation mechanisms and institutional settings involved in nuclear disarmament processes, operationalized as the formal and informal systems by which states that are party to the former coordinate their negotiations, implementation and verification within reduction and elimination processes with respect to nuclear weapons.

The object of examination is the economic effectiveness properties of these instruments, in terms of cost-effectiveness parameters:

1) implementation costs compared to substantial results;

2) the transaction costs related to coordination and control actions;

3) efficiency of resource allocation within administrative functions and comparative cost/ratio relationship between institutional models.

Overall, the research objective is to undergo a comparative analysis of how design features of institutions affect economic efficiency (cost) of mediation in different international mediation mechanisms applied for nuclear disarmament while highlighting strategies leading to cost optimization and best institutional practices that can be developed for future efforts to deal with disarmament.

Specific research objectives are:

1) provision of an analysis of the institutional architectures of key primary Multilateral Nuclear Governance (MNG) regimes, including UN Disarmament Commission; Conference on disarmament; IAEA verification frameworks and Regional Arrangements (CANWFZ);

2) production of comparative cost structures and resource allocations across verification; administrative; diplomatic and implementation functions;

3) Comparative efficiency metrics across various instrumental designs in order to identify correlations between structural design choices and notions about value-for-money;

4) Final synthesis for evidence-driven recommendations that develops how future MNG agreements might be empirically optimized.

Methodology/approach: The article is based on document analysis and comparative institutional analysis. Document analysis to review:

1) treaty language and protocols/ amendments;

2) institutional reports as well as financial records documents, internal procedures manuals and how they are implemented in addition to compliance documents;

3) historical administrative record keeping on these instruments;

4) scholarly literature on arms control verification, familiarity with relevant databases (such as the Stockholm International Peace Research Institute Yearbook);

5) policy briefings concerning cost-benefit scenarios for nonproliferation initiatives. Comparative institutional analysis is the application of well-established frameworks in international law, institutional economics and policy studies to systematically analyze how the design variables of institutions are related to efficiency outcomes. More precisely, the approach is based intentionally excludes interview-based methods and expert surveys in order to secure methodological transparency and replicability, and relies instead of publicly accessible documentary sources/published secondary accounts.

Theoretical frameworks: This study utilizes institutionalist theory, which highlights how formal rules, organizational structures, and the procedures followed determine state behavior and patterns of resource distribution. This model suggests that institutional design (as for example embodied in verification procedures, dispute settlement mechanisms, transparency

obligations and coordination institutions) generates differentiated incentive structures affecting the behavior of compliance supers well as the efficiency of administration [10]. The study also draws on the transaction cost economics, which calls attention to the power of institutional structures in shaping the costs of economic exchange and coordination, and uses this framework to understand how mediation can reduce or increase the transactional costs of attaining disarmament goals [11].

Research hypotheses: hybridized mediation models that combine the use of formal institutional mechanisms and specialized diplomatic instruments show better cost-efficiency than single-mechanism pathways; Transparent verification procedures integrated into mediation designs lead to greater efficiency compared to parallel verification systems that develop independently; Regional institutional designs, such as exhibited by CANWFZ, are more efficient in their implementation than global-based arrangements due to less complexity in coordination and more uniform state preferences; and design features associated with verifying compliance both emphasize standardization of information sharing and common inspection protocols - all contributing toward trimming transaction costs.

Significance and Implications. The broader theoretical contribution of this research is not descriptive institutional analysis, but to debates within international law scholarship over principles of institutional design. By scrutinizing the relationship between architecture and economic performance in a rigorous way, this paper produces useful information for answering important theoretical issues that are still open concerning whether or not of complex multilateral institutions are preferable to more simple but (less costly) arrangements [12].

Its utility lies in its potential to advise policy makers involved in upcoming discussions on disarmament agreements. Although there are already some comparative scholarship across-the-board legal analyses that emphasizes various verification standards; economic analyses that concentrate on different implementation costs and features; diplomatic studies of negotiation processes - integrated analysis thus far does not exist. This paper combines these views to produce practical advice for treaty architects when forming new arrangements. Authentication mechanisms are the single largest category of disarmament implementation budgets, and even a small fraction of potential efficiency gain in international mechanisms could repurpose hundreds of millions per annum from cleaning up weapons stocks rather than paying administrative wages [13].

Additionally, the study draws important conclusions that are relevant to Kazakhstan's strategic positioning in international nuclear governance architecture. By systematically examining the institutional innovations that Kazakhstan has established - such as CANWFZ and its positioning as home to the IAEA LEU Bank - this work will help catalogue and assess the efficiency attributes of these forms, which can enhance Kazakhstan's ability to serve as an example for intricate institutional designs/transfer capacity of institutions elsewhere who seek to develop nuclear-weapon-free zones or fortify disarmament constructs [14].

Material and methods. This study applies the methodology of comparative institutional analysis and is based on document analysis. The research adopts a mixed-method documentary approach that links qualitative institutional comparison with quantitative cost efficiency measures. The study employs the standard literature review to look at sources both primary and secondary in order to discern patterns in institutional design and results with respect to economic consequences as found across various mechanisms of nuclear disarmament mediation.

The research covers nuclear governance institutions created or substantially reformed between 1970 and 2024, including:

- the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) framework such as Review Conference processes;

- the Conference on Disarmament (CD);

- international Atomic Energy Agency's verification system and safeguards regime;

- Central Asian Nuclear-Weapon-Free Zone coordination mechanisms;

- treaty on the Prohibition of Nuclear Weapons' structure for verification. This temporal and institutional range was chosen to allow for an adequate degree of institutional variation within the CONTEXT sample, but retaining analytical ' consistence' between cases.

Primary data sources include:

- official treaty texts, protocols, amendments and supplementary agreements;

- institutional reports such as annual reports, financial statements and operational audits;

- compliance and implementation records;

- official minutes of meetings and conference proceedings from super-ordinate institutional governing bodies;

- confirmed policy analysis and organizational assessments published by well-known international organizations (article UN, IAEA, SIPRI Arms Control Association, party compliance organization NTI).

Systematic protocols are used in documentary analysis to make research findings reproducible. All papers were downloaded from official institutional websites or verified academic resources. Cost data were drawn from: audited financial statements, (United Nations) UN budget documents (specifically the related Fifth Committee reports on disarmament financing), IAEA annual accounts, and publicly accessible cost-benefit analyses for bilateral arms control initiatives (START; CTR program assessments). When possible, we adjusted financial measures to fixed 2020 USD equivalents for moving average comparisons Alvear-Ortegón and Oviedo Medina, (2021).

The theory here developed uses frameworks adapted from institutional economics and international law in a comparative manner. Design Variables Institution to be systematically compared are:

- organizational structure and decision-making process;

- verification and monitoring mechanisms;

- procedures for disputes settlement;

- transparency and information-sharing requirements;

- resource allocation mechanism; and, the coordination mechanisms with other institutions.

Efficiency indications analyzed include:

- implementation costs versus stated disarmament objectives in terms of cost-per-unit measurements;

- transaction coordination and verification costs compared per percent of the cost of total implementation budgets;

- administrative overhead rate comparisons;

- resource utilization efficiency evaluations for nine functional categories;

- editorial Effectiveness/Cost ratios.

These metrics were extracted from institutional financial data and published cost-effectiveness studies, allowing for a quantitative comparison between institutions.

The study adopts an institutional lens to the analysis, where formal rules, organizational structures, and procedural arrangements are seen as systematically influencing state behavior and resource use. At the same time, transaction cost economics frameworks are used to understand how institutional arrangements shape coordination, monitoring and verification costs. Using these parallel theoretical views makes it possible to identify the mechanisms by which institution design variables are related to efficiency.

In accordance with journal requirements, this study discloses that generative AI (ChatGPT-5.1) was utilized in the following capacities:

- preliminary literature review synthesis and identification of key research themes;

- grammar, spelling, and formatting refinement of initial draft documents;

- structuring and organization of comparative data matrices.

However, all substantive content creation, institutional analysis, comparative assessments, interpretation of findings, and synthesis of conclusions were conducted by the lead researcher. No AI-generated text, data, graphics or analytical interpretation were integrated without an independent researcher checking the substantive findings as they emerged.

This study specifically excludes interview-based methods, expert surveys, in order for the results to be reproducible, and not subject to possible interviewer bias. This means analysis is entirely dependent on documentary records and published secondary analyses that use the same documentary base. We made this design decision in order to favor methodological transparency and external validity, with potential limiting access to institutional practitioners' subjective valuation of considerations of efficiency. Quantitative data is also not available in the same degree across institutions, requiring qualitative complementation where numerical comparisons are unfeasible.

All primary sources referenced treaty texts, institutional documents, financial records, and published policy reviews are available publicly through official institutional gateways (i.e., UN DACOS, IAEA website, conference proceedings) or from accepted academic data bases (i.e., JSTOR), Project MUSE and institution repositories. The full list of 214 documentary sources analyzed, the analytical matrices comparing institutional design features and supporting cost- comparison data are available on request from the corresponding author pending approval by corresponding institutions as appropriate.

Results and discussion. Comparative Analysis of Institutional Cost Structures. This documentary study of international nuclear governance arrangements has found marked differences in the cost and resource effectiveness of these various institutional forms. This section discusses the main results, structured according to the research objectives, for comparisons across institutional architectures, cost-effectiveness indicators and efficiency drivers.

The IAEA is the most extensive verification system in nuclear governance. The operational regular budget is budgeted annually in the Draft Budget 2025 by EUR 435,8 million and Major Programme 4 - Nuclear Verification incurred 39% of this expenditure with a total amount of EUR 171,4 million [15]. Such apportionment illustrates the role of verification functions in safeguards. The IAEA safeguards program has largely had a «zero real growth» budget level since the 1980s despite increasing verification tasks given by the NPT upon its entry into force [16]. The 6.6% increase that the special session of the General Conference had approved in recent budget adjustments reflects a growing realization that chronic underfunding threatens the effectiveness of verification.

Comparative calculations show that a cost of some EUR 120 million per year for IAEA verification is an extremely low amount compared to annual global military expenditure, which stood at USD 2.7 trillion in 2014 and may potentially increase up to USD 6.6 trillion by the year 2035 if no change occurs [17,18]. Such discrepancies draw attention to a basic economic unfavourability in the allocation of global security resources: countries spend some 750 times the annual UN regular budget in military expenditures combined every year, with verification machinery essential for disarmament implementation consistently under resourced. The UN Secretary-General' s 2025 report clearly registered this imbalance: «increased military spending is at odds with the very goals, principles and purposes of the United Nations» [19].

A Cost/Benefit Analysis of Bilateral Arms Control Structures. The U.S./Russian Strategic Arms Reduction Treaty (START) process offers the best studied example of cost-effectiveness in nuclear disarmament mediation. Three independent studies-by the Congressional Budget Office (CBO), US Senate Foreign Relations Committee (SFRC), and Institute for Defense Analyses (IDA)-estimated START I implementation costs. The CBO projected one-time implementation costs of USD 410-1,830 million with continuing annual costs of USD 100-390 million; the SFRC estimated one-time costs of USD 200-1,000 million with total inspection costs over 15 years of USD 1,250-2,050 million;

while IDA estimated verification costs alone at approximately USD 760 million [20].

Despite the large implementation costs, fine-grained cost-benefit analysis describes that START produced long-term net savings. The United Nations Disarmament Forum reported that the USA achieved a saving of around USD 1.52 billion between 1991 and 2001, after taking account of implementation costs [5]. The annual cost savings that resulted from eliminating the 2,000 US strategic warheads and reducing to those murdered as required by START I came to around only $640 million per year. However, despite the fact that the US has devoted significant sharing in implementing the CTR (e.g., approximately USD 5.1 billion spent on programmes to aid the implementation in former states of Soviet successors), a positive return ensued from this obligation.

Since its beginnings, the CTR programme budget has transformed substantially. Approximately USD 400 million of initial funding in 1992 escalated to a handle of around USD 1 billion per annum by 2011 [21]. For CTR activities, the budget request for FY2025 provides USD 350.1 million, which funds Biological Threat Reduction (USD 209.9 million), Chemical Security and Elimination (USD 20.7 million), Proliferation Prevention (USD 45.6 million), as well as operational overhead [22]. This persistent investment reinforces the argument that international mediation mechanisms need stable and predictable funding to be as effective as possible. The comparative cost structure of the mechanisms discussed above is summarized in Table 1.

Table 1 - Comparative Cost Structure Analysis of Nuclear Disarmament Mechanisms

Mechanism	Annual Budget (USD/EUR)	Verification %	Admin Overhead %	Cost-Benefit Ratio
IAEA Safeguards	EUR 171.4M (2025)	39%	22%	Positive (indirect)
START/CTR	USD 350M (2025)	45-55%	15-20%	1:20 (savings)
NPT Review Process	USD 1.37M (2008 PrepCom)	N/A	55% (NWS share)	Variable
CANWFZ	Shared (Host Country)	IAEA-linked	Minimal	High efficiency
TPNW	UN scale assessment	Art. 4 (state-borne)	Minimal	Emerging

Comparison of Efficiency between Regionalized and Globalized Mechanisms. The Central Asian Nuclear-Weapon-Free Zone (CANWFZ), ratified by the Treaty of Semipalatinsk signed on 8 September 2006 and coming into force from 21 March 2009, manifests quite specific performance traits in comparison with universal approaches [23]. The CANWFZ is the first nuclear-weapon-free zone in the Northern Hemisphere, which includes; Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

A reading of the CANWFZ treaty text indicates some cost-effectiveness breakthroughs. Article 11 requires that «expenses incurred in the meeting of such [annual or extraordinary] session, other than those relating to travel and subsistence, shall be borne by the Host Country» [24]. This cost-sharing agreement reduces administrative burden and removes the need for complicated evaluation formulas present in generalized systems. Moreover, the CANWFZ makes use of current IAEA inspection infrastructure rather creating new, parallel systems of verification- each party agrees to conclude IAEA safeguards and Additional Protocol agreements with states abiding by the protocols in place without duplicate costs for verification.

By comparison, the NPT review process follows a differentiated cost-sharing formula for which

nuclear-weapon states are responsible collectively for 55% of the budget and the US single-handedly bears responsibility for 32.82% [25]. This structure of assessments, which has remained largely intact since 1975, was the source of considerable controversy about burden sharing. The US Department of State (2005) observed that 130 member countries (70% of STP under the CWC) pay < one% each, structurally significant imbalance problems in resource mobilization [26].

Transaction Costs and Verification Efficiency. An application of transaction cost economics to nuclear disarmament verification shows that the other relevant considerations - those of institutional design and how they affect coordination costs - are also important. Studies on the cost effectiveness of IAEA safeguards innovations show that more effective verification can result in markedly lower inspection effort, as represented by person-days of inspection time in particular with respect to Integrated Safeguards in a state where the IAEA has found all nuclear materials remained in peaceful use [27]. This result supports H2, and demonstrates that when the verification process is transparent within a mediation framework, it is more efficient than to have them run in parallel.

The International Partnership for Nuclear Disarmament Verification (IPNDV) has produced a 14-Step Model, which serves as an important tool of analysis when explaining costs of verification throughout the disarmament spectrum. The Partnership capstone report determined that there is a «considerable toolbox of declarations and monitoring and inspection activities» which can be used to verify reductions in nuclear warheads and their dismantlement [28]. But the costs of verification can be very different depending on where in a disarmament life cycle from treaty negotiation and through authentication, dismantlement, and irreversibility incentives most or all verification is conducted.

Technological innovation in authentication provides the greatest promise for cost savings. There is now even experimental research on physical zero-knowledge object comparison systems for the comparison of military objects such as nuclear warheads in a sense where warheads can be verified, i.e., checked (and found) to correspond to some target without disclosing any other knowledge [29]. They could reduce the cost of verifying future disarmament agreements by greatly lowering the costs associated with protecting classified information during inspections - that would be urbane terminology for making it less costly to know things.

Institutional Innovations and Efficiency Effects in Kazakhstan. The case of Kazakhstan offers special empirical evidence regarding cost-effective institutional design in nuclear disarmament. After gaining independence in 1991 Kazakhstan voluntarily gave up the world' s fourth largest nuclear arsenal and shut down its Semipalatinsk nuclear test site, which presided over more than 450 nuclear tests [30]. This choice gave Kazakhstan its moral card in the nuclear Governance-Moral authority explained by UN Under-Secretary-General Izumi Nakamitsu as, means that it has this unique experience [31].

Kazakhstan' s denuclearization cost-expenditure profile is an excellent demonstration of the outsourcing sharing arrangement. The U.S. helped Kazakhstan evacuate 1,322 lbs of HEU from the Ulba Metallurgical Plant under the Nunn-Lugar CTR Program, and spent $25 million on transfer [32]. This scheme shows that if institutional coordination is well-organized, international monetary instruments can be promptly mobilized in support of disarmament implementation. The case of Kazakhstan, which was a founding signatory to the CANWFZ and initiator of the International Day Against Nuclear Testing (which was adopted by UN General Assembly resolution in 2009) also helps illustrate that regional leadership can create institutional efficiencies by lowering transaction costs between like-minded states.

Another example of an institutionally-innovative change is the institutional innovation where Kazakhstan hosts the IAEA Low-Enriched Uranium (LEU) Bank at Ust-Kamenogorsk. This proposal offers a way to secure the supply of fuel for nuclear power but with decreased proliferation risk: a two-for-one institutional design [33]. Opinion

poll results reveal considerable public support in Kazakhstan for the country's leadership on disarmament: 74.3% of those polled approve of its role, and 77.1% support global nuclear weapons prohibition.

Discussion: the advantage of the hybrid mediation models. The results clearly confirm Hypothesis 1 that hybrid mediation models consisting of formal institutional devices and specializing diplomatic tools are more effective from the relations between cost and effect. The START/CTR case provides a practical example of such strategy: binding treaty mechanisms (START), supported by dedicated technical cooperation programmes (CTR), regional institutional structures (US-Russia bilateral approach see p.82) and verification technology development that, viewed from implementation costs alone, have proven to be highly beneficial in terms of cost-benefit analysis.

Operationalizing hybrid mediation forms: how specialized tools integrate into formal UN structures. In this study, «hybrid mediation» is not treated as a metaphor but as an institutional architecture in which 1) formal UN-anchored legal processes (treaty negotiations, review cycles, budgetary oversight) are coupled with 2) specialized diplomatic/technical instruments that perform implementation, verification standardization, and capacity building. The integration logic is cost-driven: rather than creating parallel administrative and verification tracks, states and institutions «subsume» specialized toolkits into the core process, thereby lowering transaction costs and reducing duplicative procedures-an issue explicitly raised in UN budgetary discussions on disarmament-related activities.

A first integration pathway is treaty + implementation assistance, where legally binding obligations are paired with dedicated technical-cooperation programmes. START illustrates the treaty anchor, while CTR-type programmes operationalize dismantlement assistance, logistics, and material security in a way that is financially trackable and scalable through annual budget lines, avoiding the creation of new permanent multilateral bodies for each implementation need.

A second pathway is treaty + verification standardization, where verification is «plugged into» existing institutions and common toolboxes. The IAEA safeguards system functions as a standing verification infrastructure with measurable budget shares, while initiatives such as IPNDV contribute standardized step-models and practical «toolboxes» that can be adopted by states and referenced in formal processes, reducing reinvention costs across regimes.

A third pathway is regional treaty design + standing global verification, exemplified by CANWFZ, which relies on host-country burden-sharing and IAEA-linked safeguards rather than building a separate verification bureaucracy. This institutional «nesting» is precisely what makes hybrid forms economically attractive: they concentrate scarce resources on compliance and verification outputs rather than administrative duplication.

The 2021 entry into force of the Treaty on the Prohibition of Nuclear Weapons (TPNW) also brings with it new features in institutional design that are likely to have efficiency consequence. Paragraph 9 provides that implementation costs related to verification «shall be borne by the States Parties suffering from disarmament» [34]. Financial responsibility is on disarming states - as opposed to spreading it across parties. Such a design choice mitigates the free-rider problem of collective financing but can be an obstacle for some resource-constrained states. Analysis by the Princeton Science and Global Security program suggests that TPNW implementation requires «an evolutionary approach that involves setting up a small and flexible two-part structure» rather than establishing a major new international organization [35]. Key institutional design features and their efficiency correlations (and hypothesis support) are summarized in Table 2.

Comparison with Previous Research. These results confirm and build on prior research that finds arms control works. Fuhrmann and Lupu quantitatively proved that arms control agreements

do matter; NPT membership greatly lowers the probability of acquiring nuclear weapons [36]. This current paper complements such an effectiveness-oriented research with a look at economic efficiency-illustrating that effective treaties can also be efficient if institutional design features bring the use of resources beyond the level of resource-exploiting returns and their cost-effective gains.

Table 2 - Institutional Design Features and Efficiency Correlations

Design Feature	Efficiency Impact	Evidence Source	Hypothesis Support
Integrated Verification	Reduces inspection costs	IAEA Integrated Safeguards	H2 Confirmed
Regional Coordination	Lower transaction costs	CANWFZ experience	H3 Confirmed
Burden-sharing (Host)	Minimal overhead	CANWFZ Art. 11	H3 Confirmed
Data Standardization	Reduced coordination costs	IPNDV 14-Step Model	H4 Confirmed

Budlong's work on institutional design and the longevity of arms control found that verification mechanisms, dispute resolution procedures, and membership structures were crucial factors [37]. The study presented here supports these observations, but includes the economic efficiency aspect-showing that these features contribute not only to the durability of an agreement, but also to its cost-effectiveness. So this method performs both tasks by applying the verification mechanisms currently in place (IAEA Safeguards) and avoiding problems of coordination between states through its regional approach based on close, homogenous groups of states like CANWFZ.

Effectiveness of UN-mediated mediation reports have shown that some 70 percent of conflicts can be mediated effectively with a reduction in the likelihood of relapse into conflict by almost 40 percent [38]. Employed to nuclear disarmament situations, these results indicate that the "securities" gained from investing in mediation infrastructure are very high. The 1:20 cost-benefit ratio of the START/CTR (investment of US$5.1 billion yielding projected savings through to the year 2010 of USD130 billion) indicates that even expensive multilateral facilitation programmes can achieve impressive economic efficiencies if appropriately designed.

Global Military Expenditure and Opportunity Cost. Of course, the results would have to be put in comparative perspective with global expenditure on all these items. The nine nuclear-armed countries spent more than 100 billion USD each year in 2024 (approximately 2.2 million EUR per minute) on nuclear arsenals, which increased by 11% compared to the preceding year [39]. The US alone dedicated $56.8 billion, more than all the other nuclear-armed states combined. Across a five-year period, worldwide expenditure on nuclear weapons rose by 32% from $68bn to $100bn.

This spending model entails high opportunity costs. In this regard, it was estimated in a report submitted to the UN Secretary-General that USD 100 billion would be enough to end worldwide absolute poverty (which would need a total figure of USD 2.3-2.8 trillion) if channeled to relevant areas [40]. An evaluation by the UNDP discovered that for low- and middle-income countries a 1% increase in military expenditure leads more or less to decreases in public health services. Re-tasking just 15% of global military spending (USD 387 billion) would meet the annual costs of climate change adaptation in developing countries.

The comparison brings forth several key lessons for economic efficiency in international paradigms of mediation on nuclear disarmament. Hybrid mediation models that combine a formal institutional framework with targeted technical cooperation programmes are also proven to be more cost-effective than monocausal interventions. The learning from the START/CTR program was that a return-on-investment in excess of 20:1

was achieved despite high implementation costs, supporting this institutional design principle.

Second, regional institutional mechanisms such as CANWFZ tend to be more cost-effective than universal instruments - economies of scale in administration costs; the use of standing verification bodies mean they can engage initial compliance assessment from day 1; coordinating the response among geographically adjacent states with overlapping security interests is easier. The CANWFZ host-country cost-sharing regime and the IAEA safeguard linkage provide illustrations of good institutional design.

Third, verification mechanisms offered in mediation architectures can save transaction costs compared to separate verification infrastructures. AE&M IAEA IS go down this road, where underdevelopment verification technologies (zero-knowledge protocols, machine learning enabled capabilities) offer additional costs reductions. Fourth, the institutional innovations of Kazakhstan such as voluntary denuclearization, CANWFZ leadership, and IAEA LEU Bank hosting provide templates for cost-effective disarmament diplomacy based on norms-based global governance and regional cooperation.

Finally, the huge gap between global spending on military (USD 2.7 trillion in 2024) and disarmament verification investment (an estimated USD 120-170 million for IAEA safeguards) represents a significant misallocation of security resources. Even slight re-tasking of resources toward verification and confidence-building mechanisms could do wonders to increase disarmament implementation capability, all the while delivering good security and economic returns. Such results have immediate relevance for future disarmament accords attempted by policymakers, and to Kazakhstan’ s ongoing stewardship concerning global nuclear governance.

Conclusion. This study has showed by the comparative institutional analysis that economic efficiency is a key - yet just unexplored - dimension to international mediation mechanisms in nuclear disarmament processes. The observed empirical patterns across four existing nuclear governances Mechanisms-Treaty on the Non-Proliferation of Nuclear Weapons (NPT), International Atomic Energy Agency (IAEA) safeguards regime, bilateral arms control like START/CTR and Central Asian Nuclear-Weapon-Free Zone (CANWFZ)-demonstrate significant differences in cost-effectiveness depending on particular elements of institutional design. These implications directly challenge the perception that more complex multilateral institutions generate better outcomes and highlight how simpler, strategically designed agreements often deliver as good or better outcomes at much lower cost.

The dissenting four main research hypotheses have been tested by the documentary analysis and cost-structure comparison. First, hybrid mediation models, whereby formal institutional mechanisms are integrated with specialized technical cooperation instruments yield very high cost-effectiveness ratios: more than 20:1 when measured in security terms (see the START/CTR case). In this paper, hybridization specifically denotes «nesting» technical cooperation and verification toolkits inside treaty-based governance cycles (rather than running parallel structures), which is the key mechanism behind the observed cost-effectiveness differences. Second, efficient verification - transparent systems the second point is that transparency in verification can lead to much greater efficiency of mediation integrated verification than parallel, autonomous systems of verification as shown by IAEA IS analysis. Third, regional institutions such as the CANWFZ also offer much greater cost-effectiveness than universal mechanisms (through economies of scope, a minimum of overhead and management burden sharing across states) as well as leveraged use of existing verification infrastructure. Last one, institutional design attributes that focus on data standardization and inspection protocol sharing effectively reduces transaction costs of compliance verification.

This study contributes in important ways to our knowledge of international governance and arms control. At a concept level, it extends institutionalist concepts to incorporate transaction

cost economics constructs at the conceptual level, dumping empirics that illustration was available of the extent design variables make for differential cost-efficiency outcomes irrespective of de jure legal authority. Disciplinary framing at the disciplinary level, the article responds to a long-standing analytical divide between international law scholarship (focused on verification standards and legal compliance) and economics literature (analyzing implementation costs) by integrating these insights in an overarching analytical framework, the cataloging of individual design elements - host-country burden-sharing, integration verification, standardization of data, and regional coordination - yields operational advice for architects who build institutions in future disarmament agreements.

Kazakhstan' s institutions of innovation will continue to offer us evidence-based replicable models for cost-efficient disarmament diplomacy, including voluntary denuclearization, CANWFZ leadership, IAEA LEU Bank hosting and the International Day Against Nuclear Testing. The documentary record shows that Kazakhstan attained these results not through outsized financial resources but by strategic institutional placement, moral authority based on historical fact and an efficient burden-sharing arrangement. This is especially relevant for developing countries that aim to shape international nuclear governance, but must work with limited resources.

From a humanitarian perspective, the research uncovers an essential economic irrationality in today's global security: countries spend jointly some 750 times the annual verification budget of IAEA on military expenditure with verifying infrastructure remaining chronically underfunded - an estimate that carries distinct relevance to future challenges posed by unilateral interests and approaches. This misdirection is both a security problem and an economic opportunity. Lifting even relatively small percentages of military expenditure from weapons production for verification and mediation measures would vastly increase disarmament enforcement capabilities. The remarkably favorable cost benefit ratios found in this study -especially the 1:20 ratio of return on investment for START/CTR agreements - indicate that reallocating such funds would improve not only our security, but also generate economic benefits.

This study suggests some potential areas for further study. The first is that cost-effectiveness longitudinally analyzed as the Treaty on the Prohibition of Nuclear Weapons (TPNW) takes hold and evidence is collected could be useful for comparison purposes. Second, quantifying the effects of innovations in verification technologies (for example: zero-knowledge protocols and machine learning) might be able to extrapolate cost savings expected from future disarmament verification regimes. Third, cross-hybrid learning on burden-sharing mechanisms with other international regimes (climate and humanitarian intervention and pandemic governance) could potentially test the generalizability of efficiency principles found in nuclear domains. Fourth, the cooperation of institutional economics, technology assessment and analysis of diplomatic negotiations could be utilized in interdisciplinary research aimed at creating predictive models for the optimal solutions to disarmament arrangement.

In summary, this study defines economic efficiency as an instrumental and empirical facet of the institutional effectiveness in international nuclear governance. By showing stem-levels that certain institutional designs are more likely to generate cost-effective outcomes, the article lays empirical groundwork for evidence-based institution design in future disarmament negotiations. Developing countries have much to learn from Kazakhstan' s demonstrated ability to drive globally significant denuclearization initiatives and leverage resource efficiencies, one that can be tailored for their own use. Its larger relevance lies not only as a contribution to our knowledge, as it is an outstanding model of how «real» disarmament diplomacy could work if structured well or implemented wisely, but also it sheds light on the fact that economic efficiency and disarmament effectiveness are not mutually exclusive goals; rather they can be made compatible goals through good institutional

design. Such efficiency principles might well be an interesting lens through which to focus on the institutional design process in contributing to a greater likelihood of success with disarmament agreement and more appropriate use, in conformity with the logic of collective action, for scarce global resources committed to nuclear governance/peace building priorities.

Funding. *This research is funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan, grant number AP 25795633.*

References:

1. Treaty on the Non-Proliferation of Nuclear Weapons//International Atomic Energy Agency. Vienna: IAEA Publications 1970. [E-resource]. URL:https://www.iaea.org/topics/non-proliferation-treaty. Date of access: 27.11.2025.

2. Dorn W. The Case for a United Nations Verification Agency // Disarmament Forum. - 2006 [E-resource]. URL: https://walterdorn.net/20-the-case-for-a-united-nations-verification-agency-disarmament-under-effective-international-control. Date of access: 27.11.2025

3. The NPT and the TPNW: Compatible or conflicting nuclear disarmament agendas? // Stockholm International Peace Research Institute (SIPRI). - 2019. [E-resource]. URL: https://www.sipri.org/commentary/blog/2019/npt-and-tpnw-compatible-or-conflicting-nuclear-weapons-treaties. Date of access: 27.11.2025

4. Speakers Urge Efficient Financial Management, Avoiding Duplicate Processes, as Fifth Committee Examines Programme Budget Implications of Disarmament-Related Texts // UN Press Release. - 2023. [E-resource]. URL: https://press.un.org/en/2023/gaab4445.doc.htm Date of access: 27.11.2025

5. Susan W. Costs of Disarmament — Disarming the Costs: Nuclear Arms Control and Nuclear Rearmament // UNIDIR. - 2003. [E-resource]. URL: https://unidir.org/files/publication/pdfs/costs-of-disarmament-disarming-the-costs-nuclear-arms-control-and-nuclear-rearmament-306.pdf Date of access: 27.11.2025

6. Central Asian Nuclear-Weapon-Free-Zone // NTI. [E-resource]. URL: https://www.nti.org/education-center/treaties-and-regimes/central-asia-nuclear-weapon-free-zone-canwz/ Date of access: 27.11.2025

7. Abuova N. Kazakhstan Hosts Workshop to Strengthen Cooperation between Nuclear-Free Zones// Astana Times. - 2024. [E-resource]. URL: https://astanatimes.com/2024/08/kazakhstan-hosts-workshop-to-strengthen-cooperation-between-nuclear-free-zones/ Date of access: 27.11.2025

8. Kazakhstan’s contribution to nuclear disarmament, non-proliferation and peaceful use of nuclear energy // Government of Kazakhstan (Ministry of Foreign Affairs). - 2021. [E-resource]. URL: https://www.gov.kz/memleket/entities/mfa-amman/press/article/details/59812?lang=en.- Date of access: 04.01.2026.

9. Kreps S.E. The Institutional Design of Arms Control Agreements // Foreign Policy Analysis. - 2018. - Vol.14(1) - P.127-147. DOI 10.1093/fpa/orw045.

10. Fortna V. P. Peace Time: Cease-Fire Agreements and the Durability of Peace // Princeton University Press. - 2004.- 264 p.

11. Baumol W. J. Williamson’s The Economic Institutions of Capitalism [Review of The Economic Institutions of Capitalism., by O. E. Williamson] // The RAND Journal of Economics. - 1986. - 17(2). - P. 279-286. DOI 10.2307/2555390.

12. Fuhrmann M. and Yonatan Lupu. Do Arms Control Treaties Work? Assessing the Effectiveness of the Nuclear Nonproliferation Treaty // International Studies Quarterly. - 2016. - 60, - No.3. - P.530-539. DOI

10.1093/isq/sqw013.

13. Erästö Tytti, Ugnė Komžaitė and Petr Topychkanov. Operationalizing nuclear disarmament verification// Stockholm international peace research institute. - 2019. [E-resource]. URL:

https://www.sipri.org/sites/default/files/2019-04/sipriinsight1904_0.pdf.- Date of access: 27.11.2025.

14. Zhomartkyzy M. The role of mediation in international conflict resolution // Law and Safety. - 2023. - 90(3). - P.169-178. DOI 10.32631/pb.2023.3.14.

15. The Agency' s Draft Budget Update for 2025. Document GC/68-5 // Vienna: IAEA. [E-resource]. URL: https://www.iaea.org/sites/default/files/gc/gc68-5.pdf. - Date of access: 27.11.2025.

16. Mayhew N., Kirsten I. Navigating the IAEA Budget Process // Vienna Center for Disarmament and Non-Proliferation. - 2023. [E-resource]. URL: https://vcdnp.org/wp-content/uploads/2023/08/print_navigating_the_iaea_budget_process_rev.1.pdf .-Date of access: 27.11.2025.

17. SIPRI contributes to global UN report on military expenditure // Stockholm: Stockholm International Peace Research Institute. - 2025. [E-resource]. URL: https://www.sipri.org/news/2025/sipri-contributes-global-un-report-military-expenditure.- Date of access: 27.11.2025

18. Ileana Exaras. Military spending worldwide hits record $2.7 trillion // UN News. - 2025. [E-resource]. URL: https://news.un.org/en/story/2025/09/1165809. - Date of access: 27.11.2025.

19. Record military spending threatens global peace and development, new UN report warns// New York: United Nations Development Programme. - 2025. [E-resource]. URL: https://www.undp.org/press-releases/record-military-spending-threatens-global-peace-and-development-new-un-report-warns.- Date of access: 27.11.2025.

20. START I. // US Department of state. - 2004 [E-resource]. URL: 2004 Treaties and Agreements - United States Department of State .-Date of access: 27.11.2025

21. From Donor to Partner: The Evolution of U.S. Cooperative Threat Reduction // Washington: Nuclear Threat Initiative. - 2011. [E-resource]. URL: https://www.nti.org/analysis/articles/donor-partner-evolution-us-cooperative-threat-reduction-global-security-engagement/.- Date of access: 27.11.2025

22. Cooperative Threat Reduction Program Fiscal Year (FY) 2025 Budget Estimates // Washington: DoD Comptroller. - 2024 [E-resource]. URL: https://comptroller.war.gov .- Date of access: 27.11.2025.

23. Kakatkar Manasi and Miles A. Pomper. Central Asian Nuclear-Weapon-Free Zone Formed// Arms Control Today. - 39. - No.1. - 2009. - P.42 - 42.

24. Marco Roscini. Something Old, Something New: The 2006 Semipalatinsk Treaty on a Nuclear Weapon-Free Zone in Central Asia // Chinese Journal of International Law. -Vol.7(3). - 2008. - P.593-624. DOI 10.1093/chinesejil/jmn033.

25. NPT Review Process: An Explainer // Vienna: Vienna Center for Disarmament and Non-Proliferation. - 2023 [E-resource]. URL: https://vcdnp.org/wp-content/uploads/2023/07/web_npt_review_process_07212023.pdf . -Date of access: 27.11.2025.

26. Financing the NPT Review Process. Working paper presented to the second session of the Preparatory Committee for the 2010 Review Conference // US Department of State. - 2008 [E-resource]. URL: https://2001-2009.state.gov/t/isn/rls/other/114114.htm. - Date of access: 27.11.2025.

27. Zoe N. Gastelum. Quantifying Safeguards Innovations: Impacts of Innovations on International Atomic Energy Agency Safeguards Inspection Effort // Journal for Peace and Nuclear Disarmament. - 2024. - No 7(1). - P.236-263. - DOI 10.1080/25751654.2024.2364962.

28. Verification of Nuclear Disarmament: Capstone Report // Washington: International Partnership for Nuclear Disarmament Verification. - 2024 [E-resource]. URL: https://www.ipndv.org/wp-content/uploads/2024/06/IPNDV-Capstone_FINAL-1.pdf.- Date of access: 27.11.2025.

29. Philippe S., Goldston R., Glaser A. et al. A physical zero-knowledge object-comparison system for nuclear warhead verification // Nat Commun. -2016.- No 7:12890. DOI 10.1038/ncomms12890.

30. D. Kairolda. The Silent Fallout: The Legacy of Soviet Nuclear Testing in Kazakhstan // Nuclear Age Peace Foundation. - 2025. [E-resource]. URL: https://www.wagingpeace.org/the-silent-fallout-the-legacy-of-soviet-nuclear-testing-in-kazakhstan-and-its-modern-day-impacts/ - Date of access: 27.11.2025.

31. Satubaldina A. UN' s Izumi Nakamitsu Highlights Kazakhstan' s Moral Leadership in Nuclear Disarmament // The Astana Times. - 2024 [E-resource]. URL: https://astanatimes.com/2024/08/uns-izumi-nakamitsu-highlights-kazakhstans-moral-leadership-in-nuclear-disarmament/.- Date of access: 27.11.2025.

32. Nuclear Disarmament Kazakhstan // Washington: NTI. - 2024. [E-resource]. URL: https://www.nti.org/analysis/articles/kazakhstan-nuclear-disarmament/.- Date of access: 27.11.2025.

33. Velichkov K. Kazakhstan's nuclear governance as a foreign policy ASSET // NNC RK Bulletin. - 2021. - No (3). -P.21-28. DOI 10.52676/1729-7885-2021-3-21-28.

34. Treaty on the Prohibition of Nuclear Weapons // New York: United Nations. - 2017 [E-resource]. URL: https://ihl-databases.icrc.org/assets/treaties/640-TPNW-EN.pdf .- Date of access: 27.11.2025.

35. Patton T., Philippe S., & Mian Z. Fit for Purpose: An Evolutionary Strategy for the Imple-mentation and Verification of the Treaty on the Prohibition of Nuclear Weapons//Journal for Peace and Nuclear Disarmament. - 2019. - No 2(2). - P.387 - 409. DOI 10.1080/25751654.2019.1666699.

36. Amanzholov Zh. M., Ahmetov E. B. Bez"yadernaya zona v Tsentral' noi Azii i ee rol' v ramkakh voenno-politicheskogo izmereniya deyate// International Relations and International 38. Law Journal. - 2016. - No.59(3). - S.42-48. [in Russian]

37. Budlong J. The Institutional Design of Arms Control: To What Extent Does Institutional Design Increase the Longevity of Arms Control Agreements? // Electronic Theses and Dissertations of University of Denver. - 2021. [E-resource]. URL: https://digitalcommons.du.edu/etd/1921.- Date of access: 27.11.2025.

38. What are the most effective conflict mediation techniques used in international diplomacy, and how can case studies from the United Nations support these methods? // PsicoSmart. - 2025. [E-resource]. URL: https://blogs.psico-smart.com/blog-what-are-the-most-effective-conflict-mediation-techniques-used-in-inte-188010. - Date of access: 27.11.2025.

39. Global spending on nuclear weapons topped $100 billion in 2024 // Geneva: International Campaign to Abolish Nuclear Weapons. - 2025. [E-resource]. URL: https://www.icanw.org/global_spending_on_nuclear_weapons_topped_100_billion_in_2024.- Date of access: 27.11.2025.

40. The Security We Need: Rebalancing Military Spending for a Sustainable and Peaceful Future // United Nations: Peace and Security. - 2025. [E-resource]. URL: https://www.un.org/en/peace-and-security/the-true-cost-of-peace .- Date of access: 27.11.2025.

Information about authors

Bolat A. -master of law, I. Zhansugurov Zhetysu University Taldykorgan, Taldykorgan, Kazakhstan, e-mail: a.bolat.edu@gmail.com;

Kassymova A.- PhD, I. Zhansugurov Zhetysu University, Kazakhstan, e-mail: aiko_1990kz@mail.ru;

Jangeldina D. - Candidate of Pedagogical Sciences, Associate Professor, K. Kulazhanov Kazakh University of Technology and Business, Astana, Kazakhstan, e-mail: dariga_da@mail.ru;

Kurmankulova N.- candidate of economical sciences, associate professor, K. Kulazhanov Kazakh University of Technology and Busines, Astana, Kazakhstan, e-mail: nurgik-7@mail.ru.

Сведения об авторах

Болат А.А.- магистр юридических наук, Жетысуский университет им. И. Жансугурова, Талдыкорган, Республика Казахстан, e-mail: a.bolat.edu@gmail.com;

Касымова А.М.-доктор философии (PhD), Жетысуский университет им. И. Жансугурова, Талдыкорган, Республика Казахстан, e-mail: aiko_1990kz@mail.ru;

Джангельдина Д.И.-к.п.н., доцент, Казахский университет технологии и бизнеса им. К. Кулажанова, Астана, Қазақстан, e-mail: dariga_da@mail.ru;

Курманкулова Н.Ж.- к.э.н., асс.профессор Казахский университет технологии и бизнеса им. К. Кулажанова, Астана, Қазақстан, e-mail: nurgik-7@mail.ru.