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The European Union's Contribution to Global Nuclear Security Governance: An Institutional and Policy Analysis

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ABSTRACT

This research paper looks at how the EU contributes to global nuclear security governance, specifically how the EU is influencing the international landscape of nuclear security and safety. The concern is the weak and disjointed nature of global nuclear governance, with overlapping authorities and uncertainties about compliance by states, leaving clear gaps in nuclear security mechanisms. EU's political influence and its regulatory power remain underutilized as far as institutional coherence and impact on global policies are concerned. The study is informed by Institutionalism and Global Governance Theory and focuses on the manner in which supranational institutions coordinate norms, compliance mechanisms and transnational policy diffusion. The approach used for the investigation is a qualitative research methodology with the use of document analysis and comparative policy review. The data comprises EU treaties, European Commission policy documents, reports from the International Atomic Energy Agency (IAEA), as well as selected case studies from EU-funded nuclear security programs from 2005-2025. These findings indicate that the EU plays a substantial role in the form of regulatory harmonization, funding nuclear safety projects, export controls and capacity building initiatives in partner states. However policy coherence and responsiveness to global challenges can be hampered by institutional fragmentation of EU agencies and member states at times. The measurable outcomes are improvements in the tracking systems for nuclear material, bolstering of inspection regimes and strengthening of international cooperation frameworks in the areas where the EU provides technical assistance. The overall finding is that the EU is a normative and operational player in the field of global nuclear security governance, but that better coordination within the EU and more multilateral cooperation are needed for it to be more effective.

Keywords: European Union, Nuclear Security Governance, Institutionalism, Global Governance, IAEA, Policy Analysis, Nuclear Safety Cooperation

1. Introduction

1.1 Context and Background of the Study

Nuclear security governance is one of today's most critical and technologically challenging geopolitical fields. As civilian nuclear energy programs grow, demand for low-carbon energy solutions rises and geopolitical tensions grow, all three factors have served to increase concern around the safe handling, storage, and transportation of nuclear materials. Nuclear energy is helpful to Sustainable Development, but also poses risks of proliferation, sabotage, terrorist attack, and accidental release of radioactive materials.

IAEA's constant messages about nuclear security are that it is a collective responsibility of the world, it needs coordinated institutional mechanisms, standardized regulations and consistent international cooperation (IAEA 2023). In this sense, governance is not just about the capabilities of single states, it is about multi-level institutional arrangements between states, international organizations and supranational actors.

Now one of the most powerful supranational players in this governance arena is the European Union (EU). The EU has a distinctive legal and institutional framework that, in particular, includes the European Atomic Energy Community (Euratom), the European Commission and the European External Action Service (EEAS), which help influence the development of nuclear safety rules both inside and outside the EU country borders (European Commission 2024).

The EU has a different set of tools than traditional international organizations, being able to shape nuclear governance in various ways through regulation, financial instruments and diplomacy. The EU's external nuclear governance has also grown considerably, with the EU providing assistance for nuclear safety improvements, training and reform of nuclear regulations in partner countries via its funding philosophy, the Instrument for Nuclear Safety Cooperation (INSC). Such projects are especially applicable in areas of developing nuclear power, or in transitional nuclear powers. EU external action is increasingly incorporating nuclear security in its broader global security and sustainability policies and approaches, according to EEAS (2026).

Nuclear Governance is still confronted with changing challenges, even though there has been progress within the institutions. The growing threat of cyber-attacks at nuclear sites is one of the main concerns. Digital systems are critical to the operation, control and monitoring processes of modern nuclear infrastructure, and are also used for communication. This means that the safety of operations and material security is not safe from cyberattacks. Cyber-nuclear convergence has made nuclear security into a hybrid space that needs both physical and digital approaches to securing it (Jones, 2023).

Geopolitical fragmentation is also a major challenge. Global governance structures and institutions have lost trust and cooperation because of growing tensions between nuclear states. Multilateral cooperation and trust in global governance are on the decline due to increased tensions between nuclear states. This is because it makes it difficult to set common safety standards and implement compliance mechanisms. In addition, the illicit trafficking of nuclear and radiological materials remains a threat on a transnational scale, especially in areas of poor governance.

These challenges highlight the need for robust institutional actors that can fill governance gaps. This is especially relevant for the EU, which by its regulation and financial resources can significantly contribute to mitigating the vulnerabilities through cooperative governance mechanisms.

Research Gap

Nuclear security governance has received considerable attention in the field of international relations and security studies, but previous scholarship has tended to emphasize the global institutions (e.g., the International Atomic Energy Agency, the IAEA) or state-level nuclear planning and strategies. In the context of current EU integration proceedings, the EU is frequently talked about as a supporting player, not a main actor, in terms of its institutional role.

One of the missing factors from the literature is the lack of analysis of the EU as a unified governance actor. Numerous studies focus on EU nuclear policy as disjointed and do not systematically analyse the interaction of internal policy institutions (Euratom, European Commission, EEAS) with regard to the external policy actors' governance output (Helwig

2021). This results in a lack of awareness of the process and coordination of EU policy making and implementation in international systems of nuclear governance.

Moreover, there is a lack of empirical assessment of nuclear safety programs funded by the EU in partner countries. Although EU support is mentioned in policy documents, there is less work evaluating tangible results of EU support, including better regulatory compliance, inspection efficiency and better nuclear material tracking systems.

One aspect that has not been previously mentioned is the theoretical integration of the two theories namely Institutionalism and Global Governance Theory to understand the behavior of EU nuclear policy. Current research mostly uses these frameworks individually, not integrating them to explore hybrid governance arrangements.

This study aims to fill some of the gaps by combining theoretical perspectives and empirical, case-based evaluation of the EU nuclear security governance role in the world.

1.4 Research Objectives and Questions

This study is designed to provide a systematic understanding of the European Union's contribution to global nuclear governance. The specific objectives have been designed to elaborate deeper understanding of the research.

Research Objectives:

1. To critically examine the institutional architecture of the European Union in relation to nuclear security governance
2. To analyze the policy instruments and mechanisms used by the EU for nuclear safety regulation and international cooperation
3. To evaluate the effectiveness and outcomes of EU-funded nuclear security initiatives in selected partner countries
4. To assess the extent to which EU internal institutional coordination affects external policy performance

Research questions:

1. In what ways does the European Union influence global nuclear security governance frameworks?
2. How do EU institutional structures shape policy formulation and implementation in nuclear security?
3. What measurable impacts have EU nuclear safety initiatives produced in partner countries?
4. How does institutional fragmentation within the EU affect its global governance effectiveness?

1.5 Scope and Significance of the Study

This study is limited to EU policies and initiatives in nuclear security that have been adopted since 2005 and are to be adopted until 2025. It contains internal regulatory structures, and external cooperation initiatives aimed at non-EU states. The geographical region is limited to some case studies from Eastern Europe, Western Balkans and Middle East where the EU nuclear safety assistance has been put in practice.

This study is both theoretical and practical in nature. Its theoretical contribution is in bringing together Institutionalism with Global Governance Theory in the context of nuclear security, which is theoretical in nature. It emphasises the role that non-state actors, in this case with regulatory powers, can play in determining security outcomes around the world.

The study offers practical guidance to nuclear regulatory, international security cooperation, and environmental safety governance policy makers. It also helps international bodies, like the IAEA, to better understand the role and contribution of European institutions, like the EU, in the compliance frameworks of the region.

Secondly, it is worth noting that the study assesses the nuclear governance not only as a technical field but as a political and institutional process. This interrelational and transnational perspective is crucial for tackling today's complex security issues that are both multi-dimensional and multi-perspectival (Rosenau 2000).

2. Literature Review

2.2 Key Principles of Nuclear Security Governance

It is well recognized that nuclear security governance is a multi-layered system of rules, institutions and cooperative mechanisms for preventing the misuse of nuclear material. The International Atomic Energy Agency (IAEA) stresses that good governance of nuclear energy needs national regulatory capability and robust international coordination procedures (IAEA 2023). This "dual requirement" has given rise to the notion of nuclear security as a global public good, which states cannot manage alone, as scholars have done. This system can be analyzed, appreciated, and explained through the lens of institutionalist theory. It says that international outcomes are not just a function of state power but a function of formal rules, institutional structures and compliance mechanisms. Cooperation is facilitated and uncertainty is reduced through the setting of predictable norms of behavior in institutions (Keohane 1984). The IAEA and Euratom are considered rule-setting institutions in nuclear governance, establishing a common set of rules for safety and security among the states.

Global Governance Theory also extends this view to the presence of various actors, such as supranational institutions, states, and transnational networks, to address global security issues. In complex issue areas such as nuclear security, Rosenau (2000) holds that governance is "without government"—authority is distributed among overlapping institutions and not concentrated in one.

2.2 The EU as a Normative Power in Global Governance

In this regard, one of the most important frameworks for comprehending the role of the EU in the world is the one developed by Manners (2002), entitled "Normative Power Europe". This theory holds that the EU has a greater impact on international relations via the spread of norms like peace, sustainability, rule of law and regulatory compliance than via military force.

This normative influence is seen in the EU's focus on safety norms, transparency, and harmonization of regulations in nuclear governance. EU external nuclear assistance programmes focus on strengthening institutions and meeting IAEA safety requirements, not strategic coercion, as emphasized by the European Commission (2024). This places the EU in a privileged position as a soft governance actor influencing the norms of nuclear governance around the world.

But critics say that this is not enough in the areas of high-security. Although the EU plays a major role in funding and regulating nuclear safety, it probably has an indirect impact and requires coordination with other players and international institutions, Bunn (2019) writes.

EU nuclear governance is institutionalized in a multi-level system that has evolved over time. Its nuclear governance system is complexly institutionalized with multiple actors. The Euratom is a key player in the regulation of nuclear safety standards in EU member States, and the European Commission is responsible for external funding and policy coordination. The European External Action Service (EEAS) embeds nuclear security into the overall Foreign Policy approach of the European Commission (European Commission 2024).

This multi-institutional structure enables the EU to work at the domestic, regional and global levels at the same time. But it poses coordination problems as well. Helwig (2021) states that EU-institutions fragment the Union and this affects the implementation of EU

policy, especially in the field of external security. This disintegration can have negative consequences on the effectiveness of EU nuclear governance measures and slow response time during crises. The EU institutional model is highly sophisticated in terms of its legal integration and its regulatory, despite these restrictions.

The EU's external nuclear governance efforts are largely carried out through financial and technical assistance programs. The Instrument for Nuclear Safety Cooperation (INSC) is one of the most important instruments: it supports the development of nuclear safety in partner countries. Their activities are targeted towards the modernization of infrastructure, the training of regulations, and enhancing radiation safety (European Commission 2024). Participation in EU programs has been proven to result in measurable improvements in nuclear governance capacity in countries like Ukraine, Jordan and Serbia. The IAEA (2023) found that countries supported by the EU have better compliance than those countries that are not supported.

Yet, Jones (2023) notes that external support is not enough to overcome the new threats like cyber-attacks on nuclear plants. This indicates that EU programs need to be adapted to new security aspects, as well as building technical capacity.

2.3 Fragmentation and Governance Challenges

A major theme in the literature is the issue of institutional fragmentation within the EU. The EU has good regulatory capacity, but the decision making process has several actors and overlaps. This can be inefficient and cause policy delays (Smith 2022).

Helwig (2021) also claims that the alignment of member states' interests and of the EU-level policy priorities is frequently weakened due to divergence between them. This can lead to the inconsistent application of safety standards at regional level in nuclear governance.

Although fragmentation undermines EU influence, it doesn't mean it is removed. Rather, it establishes what is referred to as a “multi-level governance system”, that is one that is distributed yet not dysfunctional. This corresponds with Rosenau's (2000) notion of decentralized governance systems that are connected in a networked way of coordination but not centrally controlled.

2.4 Trends in the Development of Nuclear Security Governance

New and emerging concerns about nuclear security governance have been emphasized in the recent literature. The growing reliance of nuclear facilities on digital systems for monitoring and control has made cyber security a key concern. Integrated governance frameworks that involve both physical and digital security measures are essential for the cyber-nuclear convergence, as Jones (2023) points out.

The growing relevance of climate-related hazards for nuclear facilities is another new trend. Nuclear plant safety is vulnerable to extreme weather events, flooding and rising sea levels, necessitating adaptive regulatory regimes.

The EU has started to incorporate these emerging risks in its policy agendas, including new safety directives and international cooperation policies (EEAS 2026). But academics suggest that the adaptation of governance is still half reactive and half proactive.

Summary

In general, the literature suggests that the EU has a significant, but complex, contribution to nuclear security governance in the world. It serves as a moral guide, a rule-setting body and a source of funds. But it is limited by institutional disintegration and changing security threats.

Current research offers robust theoretical arguments, but sparse empirical evidence on the results of EU policies. This gap is indicative of the need for a thorough institutional and policy analysis, which combines theory with practice for governance performance.

3. Research Methodology

3.1 Research Design

The research design used in this study is a qualitative research design and the research approach that is used in the study is a normative research approach. A qualitative approach is suitable because the subject is complex and relates to institutional interactions, policy frameworks and governance mechanisms which cannot be fully understood through quantitative measurement. Creswell (2018) found that qualitative research has proven to be very useful in understanding international relations meaning-making in the policies and institutional behavior of actors.

Using an interpretivist approach, the study is based on the premise that governance results are driven by varying political landscapes, actor perceptions and institutional environments and not static variables. This will enable a deeper understanding of the EU's multi-level governance role in nuclear security.

3.2 Analytical Framework

The analysis is based on two main theoretical perspectives: Institutionalism and Global Governance Theory. EU nuclear policy behavior can be explained by formal rules, legal structures and organizational arrangements through the lens of institutionalism (Keohane 1984). Global Governance Theory also focuses on dispersion of authority between a number of actors, such as states, international organizations and supranational bodies (Rosenau 2000).

The study uses these frameworks to analyze the internal institutional nature of EU governance and its governance role in international nuclear security governance arrangements.

3.3 Data Collection Methods

Data for this study is collected through secondary qualitative sources. These include:

- European Union treaties and legal documents (especially Euratom provisions)
- European Commission policy papers and nuclear safety directives
- International Atomic Energy Agency (IAEA) annual and thematic reports (2022–2026)
- European External Action Service (EEAS) strategic security reports
- Academic journal articles and peer-reviewed literature on nuclear governance
- Case study documentation from EU-funded nuclear safety projects

According to Bowen (2009), document analysis is a systematic procedure for reviewing and interpreting printed and electronic materials to extract meaningful policy insights.

3.4 Case Study Selection

The study uses a comparative case study approach to examine EU nuclear governance in three regions:

- **Country A (Ukraine)** – representing post-Soviet nuclear infrastructure modernization
- **Country B (Serbia)** – representing EU accession-related nuclear safety alignment
- **Country C (Jordan)** – representing EU external cooperation in emerging nuclear programs

These cases were selected based on their relevance to EU nuclear assistance programs and their variation in geopolitical and institutional contexts. Yin (2018) argues that comparative case studies allow researchers to identify patterns across different governance environments while maintaining contextual depth.

3.5 Data Analysis Technique

The collected data is analyzed using thematic analysis. This involves identifying recurring patterns related to EU governance mechanisms such as regulatory harmonization, capacity-building, funding instruments, and institutional coordination.

Braun and Clarke (2006) define thematic analysis as a method for identifying, analyzing, and reporting patterns within qualitative data. In this study, coding categories were developed around:

- Institutional coordination
- Policy implementation effectiveness
- External cooperation mechanisms
- Governance fragmentation

These themes were then compared across case studies to evaluate consistency and variation in EU nuclear governance performance.

3.6 Reliability and Validity

To ensure reliability, multiple data sources were triangulated, including official EU documents, IAEA reports, and peer-reviewed academic literature. Triangulation improves research credibility by cross-verifying findings across independent sources (Denzin 1978). Validity is maintained through the use of authoritative institutional documents and internationally recognized datasets, ensuring that interpretations reflect actual policy frameworks rather than subjective assumptions.

3.7 Ethical Considerations

This research strictly follows academic ethical standards. All data used is publicly available and properly cited. No classified or restricted nuclear security information is included. Pseudonyms are used for country case studies to ensure neutrality and confidentiality.

3.8 Methodological Limitations

One limitation of this study is its reliance on secondary data, which may not capture real-time policy changes. Additionally, qualitative analysis may introduce interpretive bias, although triangulation has been used to reduce this risk. Another limitation is the focus on selected case studies, which may not fully represent all EU nuclear governance initiatives globally. Despite these limitations, the methodology provides a robust framework for understanding institutional dynamics and policy outcomes in nuclear security governance.

4. Results

4.1 Overview of Key Findings

The findings of this study indicate that the European Union plays a substantial but structurally complex role in global nuclear security governance. Across policy documents, institutional reports, and case study evidence, the EU consistently demonstrates influence in three main areas: regulatory harmonization, capacity-building, and financial-technical assistance. However, the effectiveness of these contributions is moderated by internal institutional fragmentation and varying levels of coordination among EU bodies (European Commission 2024).

4.2 Regulatory Harmonization and Standard Setting

One of the most significant results is the EU's contribution to the harmonization of nuclear safety and security regulations. Through Euratom directives and associated legal frameworks, the EU has established binding safety standards for member states, which also influence partner countries engaged in cooperation programs.

Findings show that countries receiving EU assistance demonstrate improved alignment with International Atomic Energy Agency (IAEA) safety guidelines (IAEA 2023). This suggests that EU regulatory frameworks function as "soft export mechanisms" for global nuclear governance standards. Manners (2002) explains this as normative diffusion, where institutions shape behavior through rules and standards rather than coercion.

4.3 Capacity-Building and Technical Assistance

The EU's capacity-building initiatives emerge as a major operational strength. Through the Instrument for Nuclear Safety Cooperation (INSC), the EU has funded training

programs, infrastructure modernization, and technical upgrades in partner countries. Case study analysis shows measurable improvements in nuclear facility management in Country (Ukraine), including enhanced reactor safety protocols and upgraded monitoring systems. In Country B (Serbia), regulatory institutions have become more aligned with EU safety frameworks, while Country C (Jordan) has developed stronger technical expertise in radiation protection and nuclear oversight. According to European Commission reports (2024), these programs have increased institutional competence and reduced operational safety risks in participating countries.

4.4 Financial and Institutional Support Mechanisms

The EU also contributes significantly through financial mechanisms aimed at strengthening nuclear governance infrastructure. Funding programs support equipment upgrades, regulatory training, and cross-border safety cooperation.

Findings suggest that financial assistance is most effective when combined with technical advisory support. However, isolated funding without institutional coordination shows limited long-term impact (Smith 2022). This highlights the importance of integrated governance approaches rather than purely financial interventions.

4.5 Institutional Fragmentation and Coordination Challenges

Despite its strengths, the EU's internal institutional structure presents notable challenges. Evidence shows overlapping responsibilities among Euratom, the European Commission, and the European External Action Service (EEAS), leading to coordination inefficiencies. Helwig (2021) notes that such fragmentation can delay decision-making and reduce policy coherence in external security initiatives. In nuclear governance, this is particularly significant because delays in response or implementation can increase vulnerability to safety risks.

Case study findings suggest that coordination gaps occasionally affect the speed of project implementation, particularly in multi-agency funded initiatives.

4.6 Effectiveness of EU External Nuclear Governance

Overall, EU external nuclear governance initiatives demonstrate moderate to high effectiveness in improving technical capacity and regulatory compliance. Countries receiving EU assistance show higher levels of adherence to IAEA safety frameworks compared to non-assisted states (IAEA 2023).

However, effectiveness is uneven across regions. While Eastern Europe shows strong alignment with EU standards, implementation in other regions is slower due to differences in administrative capacity and political stability.

Jones (2023) argues that emerging risks such as cyber threats also limit the long-term effectiveness of traditional nuclear safety programs, indicating a need for modernization of EU governance strategies.

4.7 Summary of Results

In summary, the EU demonstrates strong influence in shaping nuclear security governance through regulation, funding, and technical assistance. However, its effectiveness is constrained by internal institutional fragmentation and evolving global threats. The results confirm that the EU operates as both a normative and operational actor, but its impact varies depending on institutional coordination and regional context.

5. Dataset Description and Analysis

5.1 Overview of the Dataset

This study utilizes a qualitative secondary dataset derived from authoritative institutional and academic sources spanning 2005–2025. The dataset is designed to capture both the internal policy structure of the European Union and its external engagement in global nuclear security governance. According to Bowen (2009), documentary datasets are

particularly useful in policy research because they allow systematic examination of institutional behavior over time.

The dataset integrates multiple categories of documents, including EU legal instruments, international governance reports, and project-level evaluations. These sources provide a comprehensive view of how nuclear governance policies are formulated, implemented, and assessed across different institutional levels.

5.2 Composition of the Dataset

The dataset includes the following primary components:

- European Union treaties and legal frameworks (Euratom Treaty provisions)
- European Commission nuclear safety directives and funding reports
- European External Action Service (EEAS) strategic documents
- International Atomic Energy Agency (IAEA) nuclear security reports (2022–2026)
- Policy evaluation reports from EU-funded nuclear safety projects
- Peer-reviewed academic literature on nuclear governance

This multi-source structure enables triangulation, improving the reliability and depth of analysis (Denzin 1978).

5.3 Case Study Dataset

To ensure ethical compliance and analytical neutrality, country-level data is anonymized using pseudonyms. The following cases are included:

- **Country A (Ukraine):** Represents post-Soviet nuclear infrastructure modernization and EU technical assistance engagement
- **Country B (Serbia):** Represents EU accession-related regulatory alignment and nuclear safety reform processes
- **Country C (Jordan):** Represents emerging nuclear program development supported by EU capacity-building initiatives

These cases were selected due to their variation in geopolitical context, institutional capacity, and level of EU involvement.

5.4 Dataset Variables and Analytical Categories

The dataset is organized into four key analytical categories:

1. **Regulatory Compliance Indicators** – alignment with IAEA safety standards
2. **Institutional Capacity Measures** – effectiveness of national nuclear regulatory bodies
3. **Technical Assistance Outputs** – training programs, infrastructure upgrades, and monitoring systems
4. **Governance Coordination Indicators** – level of cooperation between EU institutions and partner states

These categories allow structured comparison across cases and identification of governance patterns.

5.5 Data Interpretation Approach

The dataset is analyzed using thematic interpretation rather than statistical modeling. Braun and Clarke (2006) emphasize that thematic analysis enables researchers to identify patterns of meaning across qualitative data sources.

In this study, patterns are coded into themes such as regulatory harmonization, institutional fragmentation, capacity-building effectiveness, and policy diffusion. These themes are then compared across the three pseudonymized country cases to evaluate consistency in EU governance impact.

5.6 Key Dataset Observations

Preliminary analysis of the dataset reveals several important observations:

- EU-funded projects consistently improve technical safety standards in partner countries

- Regulatory alignment with IAEA frameworks increases after EU engagement
- Institutional capacity improvements vary depending on domestic governance strength
- Coordination between EU institutions influences project efficiency and implementation speed

These findings suggest that while EU interventions are effective, outcomes are context-dependent and influenced by local institutional conditions.

5.7 Summary of Dataset Findings

Overall, the dataset demonstrates that EU nuclear governance initiatives produce measurable improvements in safety compliance and institutional capacity. However, the degree of success varies across regions due to differences in governance environments and institutional readiness. The dataset confirms the EU's dual role as both a normative and operational actor in global nuclear security governance.

6. Ethical Considerations

This study strictly adheres to academic and research ethics in line with international standards in policy and institutional analysis. The data presented in this study comes solely from published and publicly available documents and reports from the European Union, the International Atomic Energy Agency (IAEA), and peer-reviewed academic literature. No classified, restricted or sensitive nuclear facility information has been accessed or included in this analysis (IAEA 2023).

For confidentiality and political neutrality all country specific case studies have been anonymised under pseudonyms, namely Country A (Ukraine), Country B (Serbia) and Country C (Jordan). This way it is possible to keep the geopolitical sensitivity to a minimum while maintaining analytical accuracy and comparison between cases. Flick (2018) states that anonymisation is an important ethical criterion in comparative policy analysis with potential international relevance.

Additionally, all intellectual contributions are cited and acknowledged as per MLA academic integrity standards. This avoids any concerns about plagiarism and transparency in the production of knowledge (Creswell 2018). Furthermore, the analysis does not involve any interpretation that may damage the national security interests or misrepresent the institutional roles of nuclear governance systems.

Lastly, the research is objective and does not rely on political interpretations but on using established theories. This helps to ensure that results are based on evidence-based analysis and that they can responsibly feed into academic discussion on nuclear security governance in the world.

7. Theoretical Framework (Institutionalism and Global Governance Theory)

The theoretical underpinnings of the EU's function in global nuclear security governance lie mostly in institutionalism. It describes how institutions influence state and non-state actions by formal rules, norms and procedures. Keohane (1984) claimed that institutions help to make the world of international relations more predictable in terms of cooperation and compliance.

The concept of Institutionalism is highly relevant in the field of nuclear governance because long-term consistency and reliability of regulation, nuclear technical standards, and verification procedures are essential for nuclear security. The European Union (EU) and related regulatory regimes act as an institutional actor that fosters harmonised safety norms between the EU member and partner states (European Commission 2024). This institutional system allows for the EU to shape behaviour without the use of force.

Moreover, Institutionalism can elucidate the increase in compliance in countries receiving EU assistance. Technical assistance, policy rules and monitoring systems lower policy implementation uncertainty and raise the cost of non-compliance, when provided by institutions.

Global Governance Theory supplements Institutionalism by accounting for the distribution of authority among a variety of actors in international security systems. Rosenau (2000) defines governance in a complex global system as a process in which there is no central authority and institutions, states and transnational organizations are connected in networks.

In the field of nuclear security governance, this implies that the EU and the IAEA can together not control the world of nuclear security. Rather, governance is achieved through coordination amongst various stakeholders, such as supranational institutions, national governments and regulatory agencies.

The European Union is one of the actors that can be placed in this model, as it brings resources, regulations, and diplomacy. It plays a supporting, but influential, part in a global coordination framework (IAEA 2023).

7.1 Integration of Both Theories

The mix of Institutionalism and Global Governance Theory offers a complete toolkit to approach EU nuclear governance. The institutionalism approach works with the rules and structures that influence behavior in the EU system, and the global governance approach works with the EU and the global system that is decentralized.

The integrated approach demonstrates that the EU nuclear governance is not fully centralized but rather a combination of both. Rather, it functions as a mosaic type, in which the internal institutional integrity is directly linked to the external governance effectiveness (Helwig 2021).

For instance, the effectiveness of external nuclear assistance programmes is enhanced with good coordination among Euratom, the European Commission and EEAS. On the other hand, institutional fragmentation has a negative impact on policy coherence and delays implementation processes.

7.2 Application to EU Nuclear Security Governance

Theories can be applied to the EU to provide three main analytical insights:

- The EU is a rule-setting institution that influences the nuclear rules for the world, via the EU's regulatory bodies.
- It functions in a distributed governance system that relies on collaboration not command.
- The internal institutional coordination has a direct impact on its external governance performance.

This reading is backed up by Manners (2002) who defines the EU as a normative power that influences the world because of its ideas, values, and institutional transmissions as opposed to military means.

7.3 Theoretical Implications

In this way, and in combination with the insights of other theories, the EU's nuclear governance is structurally reliant on its internal cohesion and external cooperation. Such dual dependency is why the EU is so effective at norm-setting while at the same time has limited ability to ensure global compliance.

It also has an important focus on how to design institutions in global security governance. Good institutions facilitate policy diffusion, and weak institutional structures hamper government efficiency and responsiveness.

7.6 Theoretical Framework Summary

The overall picture presented by the theoretical framework is a complex hybrid governance system of the European Union. The institutionalism accounts for its own internal force of self-regulation and the Global Governance Theory for its external networked influence. These theories can together offer a holistic picture of EU's role in the fragmented but interwoven world of nuclear security governance.

8. Discussion and Analysis

8.1 The hybrid actor in nuclear security governance

This study suggests that the EU is a hybrid governance actor in global nuclear security that both influences through norm and has operability. The dual nature is reflected in its ability to influence international nuclear safety standards as well as technical assistance programs that are carried out in the partner countries. This phenomenon is termed “normative power” by Manners (2002), and refers to the influence of the EU on international behavior through rules and values, in addition to threats.

But the analysis also indicates that there is a limit to the extent to which normative influence can be effective in high-risk security areas like nuclear governance. The EU does well to encourage the alignment of regulations with IAEA standards but lacks direct enforcement power which relies on the cooperation of the national government bodies (IAEA 2023).

8.2 Effectiveness of EU Regulatory Frameworks

The study concludes that EU regulatory frameworks play a significant role in enhancing the level of nuclear safety in Europe and its partner regions, in particular via Euratom. They provide harmonization of safety measures, inspection and reporting processes in various jurisdictions (European Commission 2024).

The EU has succeeded in establishing countries that are closer to international standards of safety, thus establishing a “soft convergence mechanism” in international nuclear governance. This lends weight to Keohane's (1984) claim that institutions make cooperation more effective by providing actors with a framework of rules that minimize uncertainty.

But these frameworks do not function as effectively in all areas. Overall, there is a high degree of regulatory convergence in Eastern Europe, but implementation is not consistent in states with lower political and institutional strength. This suggests that domestic governance capacity plays a role in the institutional effectiveness.

8.3 Institutional Fragmentation and Governance Inefficiencies

One of the major findings of this study is that the EU's internal institutional divisions have a strong impact on its performance in relation to nuclear governance on the world stage. Coordinating the work of the Euratom, European Commission and European External Action Service (EEAS) can be challenging, as it can slow down decision-making and decrease policy coherence (Helwig 2021).

In other situations, the lack of coherence in the governance system can result in joint activities or mismatching of policy making between partner countries. According to Smith (2022), fragmentation is a frequent occurrence in complex supranational systems and is a serious issue in high security sectors where it is crucial to coordinate timely.

However, EU influence does not disappear when a State experiences fragmentation. Instead, it has created a layered governance structure where various institutions are responsible for various aspects of nuclear security – but not necessarily in a coordinated way.

Nuclear security programmes with EU support have brought tangible gains in technical capacity and in institutional development in partner countries. Results of the case study reveal that Ukraine (Country A) has made substantial progress in improving nuclear safety monitoring systems, and Serbia (Country B) has improved alignment of its regulatory system with EU standards. Jordan (Country C) has enhanced training and radiation protection facilities.

These are outcomes that show EU support helps to materialise improvements to nuclear governance capacity. European Commission (2024) states that such programmes aim at transferring expertise in addition to introducing regulatory norms into local systems.

But Jones (2023) notes that these enhancements focus on conventional nuclear safety issues and cannot necessarily be considered sufficient to cover new ones like cyber threats against nuclear installations. This indicates that EU programs work well in specific areas of basic governance, but need modernisation to cope with emerging security issues.

8.4 Global Governance Dynamics

From a global governance perspective the EU plays the role of a node in a larger system of nuclear security actors. Rosenau (2000) argues that modern systems of governance are decentralized and are dependent on institutional coordination, not on the central authority.

In this context, the EU plays an important but nuanced role. It sets norms in the world through regulation and support of the financial kind, but it needs collaboration from institutions like the IAEA and national governments for implementation and enforcement. The study reveals that the more closely the EU is coordinated with international organizations, the more efficient the governance of the EU is. Weak multilateral alignment on the other hand leads to reduced policy impact and lower rates of diffusion of nuclear safety standards.

8.5 Synthesis of Key Analytical Insights

The analysis reveals four major insights:

- The EU functions as both a normative and operational actor in nuclear security governance.
- Regulatory frameworks under Euratom significantly enhance global safety standard alignment.
- Institutional fragmentation within the EU reduces policy coherence and implementation speed.
- External assistance programs improve technical capacity but require adaptation to emerging risks.

Together, these findings demonstrate that EU nuclear governance is effective but structurally constrained. Its influence is strongest in norm-setting and capacity-building, while weaker in enforcement and rapid crisis response.

8.7 Concluding Analytical Reflection

Overall, the discussion confirms that the European Union plays a central but complex role in global nuclear security governance. Its effectiveness depends on balancing internal institutional coordination with external diplomatic engagement. While its normative power remains strong, achieving higher operational efficiency requires addressing fragmentation and enhancing responsiveness to new security challenges (Helwig 2021; Jones 2023).

9. Conclusion

9.1 Summary of Key Findings

In this research project, the role played by the European Union (EU) in the nuclear security governance of the world has been analyzed using institutional and policy lens. The results show that the EU has a very strong, dual role of being both a normative and an operational actor in the governance of the nuclear world. It affects international nuclear safety standards by contributing to nuclear safety regulatory harmonization, as well as partner countries through technical assistance, financing and capacity building (European Commission 2024).

In addition, the study revealed that EU actions are resulting in better adherence to the International Atomic Energy Agency (IAEA) safety norms, in particular in areas where continued support is provided. In countries such as Ukraine (Country A), Serbia (Country B), and Jordan (Country C), measurable improvements in the infrastructure and capacity

of the nuclear safety sector, the sector's regulatory environment, and technical expertise are achieved through EU engagement (IAEA 2023).

But the study also shows structural shortcomings. There is a lack of coherence between Euratom, European Commission and European External Action Service (EEAS) due to institutional fragmentation within the EU. This division hampers the EU's capacity to respond quickly to new nuclear security threats (Helwig 2021).

9.2 Theoretical Implications

Theoretically, the combination of Institutionalism and Global Governance Theory helps to explain the EU's actions in nuclear security governance. Institutionalism illuminates how EU internal rules and regulatory systems result in coherent policy outputs, while Global Governance Theory emphasizes the EU's place in a decentralized international system of rules that are shared amongst distributed actors (Rosenau 2000).

The findings validate the importance of both institutional effectiveness and institutional interactions as key drivers of governance effectiveness. In terms of its normative influence, the EU is strong, however, in terms of operational effectiveness, the EU's effectiveness is limited by fragmented governance (Keohane 1984).

9.3 Policy Implications

The study has several important policy implications:

- Strengthening coordination between EU institutions such as Euratom, the European Commission, and EEAS is essential for improving policy coherence.
- Expanding EU nuclear governance frameworks to include cyber-nuclear security risks is increasingly necessary due to evolving technological threats (Jones 2023).
- Enhancing collaboration with international organizations such as the IAEA can improve global policy alignment and implementation efficiency.
- Increasing long-term monitoring mechanisms in partner countries can ensure sustainability of EU-funded nuclear safety programs.

These recommendations highlight the need for a more integrated and adaptive EU nuclear governance strategy.

9.4 Contribution to Knowledge

This study contributes to academic literature by providing a comprehensive institutional and policy-based analysis of the EU's role in nuclear security governance. Unlike previous studies that focus primarily on either global institutions or state actors, this research highlights the EU as a hybrid governance actor operating across multiple levels of influence.

It also contributes by empirically linking institutional theory with real-world policy outcomes, demonstrating how governance structures directly affect nuclear safety performance across different regions.

9.5 Limitations of the Study

Despite its contributions, the study has certain limitations. It relies primarily on secondary data sources, which may not fully capture real-time policy dynamics or operational changes. Additionally, the use of qualitative methods limits the ability to generalize findings across all global nuclear governance contexts. The selected case studies, while illustrative, do not represent the full diversity of EU engagement globally.

9.6 Recommendations for Future Research

Future studies should incorporate mixed-method approaches that combine qualitative institutional analysis with quantitative indicators of nuclear safety performance. Additionally, further research is needed on the EU's role in addressing emerging risks such as cyber threats and artificial intelligence applications in nuclear systems. Comparative

studies involving other regional organizations could also deepen understanding of supranational governance effectiveness.

9.7 Final Conclusion

In conclusion, the European Union remains a key actor in global nuclear security governance, contributing significantly through regulatory leadership, financial support, and international cooperation. While its normative influence is strong, its effectiveness is constrained by internal institutional fragmentation and evolving global security challenges.

Strengthening institutional coordination and expanding adaptive governance strategies will be essential for enhancing the EU's future role in global nuclear security governance. Overall, the EU exemplifies a complex but influential model of supranational governance in a highly sensitive and technologically evolving security domain (Rosenau 2000; European Commission 2024).

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