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Article

How Epistemic Community Shapes Global Governance of AI in Military Domain?

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Abstract

The rapid development and applications of artificial intelligence (AI) technology in the military realm pose significant technical, ethical, and geopolitical risks. This article examines how members of the epistemic community, particularly Chinese academic and policy players, influence and shape the governance of AI's military applications. Using social network analysis and comparative case studies, this research explores China's interactions with its Western and non-Western counterparts, comparing their engagement in knowledge production as well as the construction of cooperative mechanisms. Our findings reveal that while Chinese stakeholders are quickly developing within the epistemic community, they lag behind their international counterparts in terms of knowledge production and their patterns of interaction within the global network. These Chinese members could strengthen their contribution by using a wider range of platforms to engage stakeholders and collaborate with international peers to produce knowledge about military AI. Our research is based on an original dataset of international academic and policy collaboration in AI's military applications since 2013. This dataset will support and expand future research in this area.

Introduction

The application of artificial intelligence (AI) technologies in the military realm is still in its preliminary phase. Yet, its impact is expanding and has already permeated numerous fields, including but not limited to command and control, intelligence analysis, offence and defence, logistical maintenance, and training across strategic, operational, and tactical levels, creating high levels of uncertainty regarding global security. Many believe that using AI in processing data could strengthen the effectiveness of weapon systems and perhaps alter

the entire combat environment.[1] Some technological optimists even argue that AI is already reshaping warfare.[2]

While AI holds great potential for enhanced efficiency in certain areas, its inherent uncertainties also present numerous risks. Technically, these risks span from algorithmic bias and data poisoning to concerns over system robustness in the face of adversarial attacks.[3] Furthermore, AI can alter the dynamics of human–machine interactions, increase the probability of conflict escalation, and lead to inadvertent or full-scale conflict.[4] Rather than rendering militarised engagements more precise or "cleaner," the misuse of AI could exacerbate the inhumanity of conflict. For instance, the Israeli Defence Forces employed an AI-powered database, "Lavender," along with the AI-enabled decision support system "Gospel," for tracking human targets, resulting in higher civilian deaths and raising concerns about the reliability of AI-enabled decision support systems, algorithmic bias, insufficient human intervention, data integrity issues, and over-reliance on automation in combat operations.[5]

An ongoing debate exists within the technology development and security research community regarding the future pace, trends, and potential of AI's military applications. The more optimistic view holds that we are on the brink of advancing towards a state akin to artificial general intelligence: a technology that can disruptively transform the character of warfare and the mechanisms of achieving victory.[6] The more cautious viewpoint asserts that military applications of AI are still in their infancy and inherently flawed. What unites both

[1] Joe Burton and Simona R. Soare, "Understanding the Strategic Implications of the Weaponization of Artificial Intelligence," paper delivered to the 11th International Conference on Cyber Conflict, Tallinn, Estonia, 2019, pp. 1–17; Michele A. Flournoy, "AI Is Already at War: How Artificial Intelligence Will Transform Military," *Foreign Affairs*, Vol. 102, No. 6 (2023), pp. 56–69.

[2] Paul Scharre, *Army of None: Autonomous Weapons and the Future of War* (New York: W. W. Norton & Company, 2019), Chapter 4–8; Kenneth Payne, *I, Warbot: The Dawn of Artificially Intelligent Conflict* (London: C. Hurst & Co. Ltd., 2021), Chapter 1; Jean-Marc Rickli and Federico Mantellassi, "Artificial Intelligence in Warfare: Military Uses of AI and Their International Security Implications," in Michael Raska and Richard A. Bitzinger, eds., *The AI Wave in Defence Innovation: Assessing Military Artificial Intelligence Strategies, Capabilities, and Trajectories* (New York: Routledge, 2023), pp. 12–29.

[3] Mark A. Visger, "Garbage In, Garbage Out: Data Poisoning Attacks and Their Legal Implications," in Laura A. Dickinson and Edward W. Berg, eds., *Big Data and Armed Conflict: Legal Issues Above and Below the Armed Conflict Threshold* (Oxford: Oxford University Press, 2023), pp. 179–206; Manuel Carabantes,"Black-Box Artificial Intelligence: An Epistemological and Critical Analysis," *Ai & Society*, Vol. 35, No. 2 (2020), pp. 309–17; Heather M. Roff and David Danks, "'Trust but Verify': The Difficulty of Trusting Autonomous Weapons Systems," *Journal of Military Ethics*, Vol. 17, No. 1 (2018), pp. 2–20; Arthur Holland Michel, *The Black Box, Unlocked: Predictability and Understandability in Military AI* (Geneva: United Nations Institute for Disarmament Research, 2020).

[4] James Johnson, "The AI-Cyber Nexus: Implications for Military Escalation, Deterrence and Strategic Stability," *Journal of Cyber Policy*, Vol. 4, No. 3 (2019), pp. 442–60; James Johnson, "Inadvertent Escalation in the Age of Intelligence Machines: A New Model for Nuclear Risk in the Digital Age," *European Journal of International Security*, Vol. 7, No. 3 (2022), pp. 337–59; Edward Geist and Andrew J. Lohn, *How Might Artificial Intelligence Affect the Risk of Nuclear War* (Santa Monica: RAND Corporation, 2018).

[5] Bethan McKernan and Harry Davies, "The Machine Did It Coldly: Israel Used AI to Identify 37000 Hamas Targets," *The Guardian*, 3 April 2024, https://www.theguardian.com/world/2024/apr/03/israel-gaza-ai-database-hamas-airstrikes; Marta Bo and Jessica Dorsey, "Symposium on Military AI and the Law of Armed Conflict: The 'Need' for Speed – The Cost of Unregulated AI Decision-Support Systems to Civilians," *Opinio Juris*, 4 April 2024, http://opiniojuris.org/2024/04/04/symposium-on-military-ai-and-the-law-of-armed-conflict-the-need-for-speed-the-cost-of-unregulated-ai-decision-support-systems-to-civilians/; Noah Sylvia, "The Israel Defence Forces' Use of AI in Gaza: A Case of Misplaced Purpose," The Royal United Services Institute (RUSI), https://www.rusi.org/explore-our-research/publications/commentary/israel-defence-forces-use-ai-gaza-case-misplaced-purpose.

[6] Klon Kitchen, "Understanding the Dawn of the Artificial General Intelligence Era," The American Enterprise Institute, 20 November 2023, https://www.aei.org/op-eds/understanding-the-dawn-of-the-artificial-general-intelligence-era/; The Economist, "AI Will Transform the Character of Warfare," 20 June 2024, https://www.economist.com/leaders/2024/06/20/war-and-ai; The Bulletin of the Atomic Scientists, "AI and the Future of Warfare: The Troubling Evidence from the US Military," https://thebulletin.org/2023/11/ai-and-the-future-of-warfare-the-troubling-evidence-from-the-us-military/; Michael Hirsh, "How AI Will Revolutionize Warfare," *Foreign Analysis*, 11 April 2023, https://foreignpolicy.com/2023/04/11/ai-arms-race-artificial-intelligence-chatgpt-military-technology/.

perspectives is the inherent uncertainty and possibility of a sudden turn in the development of AI's military applications.[7]

The international community has yet to concoct any unified mechanism or standard to address the risks associated with the military use of AI. It is challenging to learn from previous international coordination experiences in managing risks from other types of emerging military technologies or arms control regimes. Previous strategies have traditionally followed a linear development process in which technological advancements generate higher domestic costs and escalate the risk of an arms race. However, the rapid and unpredictable advancement of AI introduces significant uncertainties that challenge the feasibility of existing arms control regimes. Major difficulties include misalignment between regulations and technology, persistent knowledge gaps, deepening trust deficits, and the complex impacts of AI on the military domain.[8] Consequently, there is both room for and need to consider an alternative way of arms control governance, one of which is led by knowledge.

These challenges can only be addressed through international and multilateral cooperation. However, governmental and intergovernmental collaboration faces significant barriers, such as immense complexity, extended timelines, and slow response. Most governance-related frameworks are either in an embryonic form or only partially developed. In this context, since technological development in AI is uncertain, combined with the immaturity of governance mechanisms and a need for proactive governance, this underscores the need for participation from the epistemic community.[9] Peter Haas defines an epistemic community as a network of experts in a particular field who share common beliefs, causal understandings, notions of legitimacy, and policy goals.[10] Many scholars have widely adopted this conceptual framework to explore the role of experts in numerous dimensions of global governance.[11]

Given the high level of specialised knowledge required for the military application of AI—where issues such as information asymmetry, transparency, divergent interests, and trust deficit are prevalent—the epistemic community can make contributions by providing recommendations, establishing dialogue platforms, and facilitating cooperation between multi-stakeholders. Furthermore, due to the high uncertainty caused by AI technology and the absence of a comprehensive mechanism involving all permanent stakeholders, existing arms control architectures may be insufficient to ensure the responsible military use of AI. Therefore, participation from the epistemic community is indispensable for addressing the challenges posed by AI, particularly in sustaining early-stage technology application and governance.

[7] Steffan Puwal, "Should Artificial Intelligence Be Banned from Nuclear Weapons Systems?" NATO Review, 12 April 2024, https://www.nato.int/docu/review/articles/2024/04/12/should-artificial-intelligence-be-banned-from-nuclear-weapons-systems/index.html.

[8] Paul Scharre, "Artificial Intelligence and Arms Control," CNAS, 12 October 2022, https://www.cnas.org/publications/reports/artificial-intelligence-and-arms-control.

[9] Haas contended that rising uncertainties in international affairs intensify societal demand for specialized expertise, thereby amplifying the influence of experts and fostering the growth of epistemic communities. These communities play a crucial role in clarifying pivotal issues and events. Amid the complexities of uncertainty, they support governments and societies in discerning patterns, interrelations, and causal linkages, pinpointing focal areas for effective policy responses. Through these functions, epistemic communities contribute to the shaping of national interests and the strategic direction of policy formulation, see Peter M. Haas, "Introduction: Epistemic Communities and International Policy Coordination," *International Organization*, Vol. 46, No. 1 (1992), pp. 14–5.

[10] Haas, "Introduction," p. 3.

[11] Many scholarly works employ the concept of epistemic community in the context of environmental governance issue, see Peter M. Haas, "Banning Chlorofluorocarbons: Epistemic Community Efforts to Protect Stratospheric Ozone," *International Organization*, Vol. 46, No. 1 (1992), pp. 187–224; Clair Gough and Simon Shackley, "The Respectable Politics of Climate Change: The Epistemic Communities and NGOs," *International Affairs*, Vol. 77, No. 2 (2001), pp. 329–45; Ben Almassi, "Climate Change, Epistemic Trust, and Expert Trustworthiness," *Ethics and the Environment*, Vol. 17, No. 2 (2012), pp. 29–49; Bentley B. Allan, "Producing the Climate: States, Scientists, and the Constitution of Global Governance Objects," *International Organization*, Vol. 71, No. 1 (2017), pp. 131–62.

A global epistemic community in the military AI governance is loosely organised but is building a strong transnational network and exerting global influence. However, the roles and influence of different players in the community vary significantly. This study addresses two key questions: How do these differences in influence and governance roles manifest among members of the epistemic community, and what explains these differences?

This article is structured as follows: First, we conduct a literature review on the epistemic community, outlining the primary ways in which it exerts influence and suggesting an analytical framework. An analysis based on original data and social network analysis (SNA)[12] is followed to address the overall development pattern of the epistemic community in the military AI governance on a global scale. SNA is well-suited for this study as it provides a visual and quantitative insights into the complex relationships and interactions within these networks. Furthermore, case studies examine the influence of specific institutions in different mechanisms and conditions. A significant contribution of this research is the construction of a database on international academic and policy collaboration in the area of military AI since 2013 (updated until September 2024). This analysis pays special attention to understanding the distinct and overlapping roles of Chinese participants in the epistemic community compared to their international counterparts. This article concludes with recommendations on the future governance of AI's military applications.

Epistemic Community in Theory: Knowledge Production and Construction of Cooperative Mechanisms

The concept of an epistemic community has gradually materialised since scholars such as Thomas S. Kuhn and John Ruggie conducted their seminal studies.[13] Peter Haas defines an epistemic community as a network of experts in a specific field who share common beliefs, causal convictions, notions of legitimacy, and common policy orientations.[14] These four common traits distinguish epistemic communities from bureaucratic agencies, interest groups, or social movements.[15] Members of this network construct collective professional norms and cultures through different types of interaction. This process not only shapes the community's internal coherence but also establishes its influence on the development of governance in relevant fields.[16]

Moreover, an epistemic community is ideally characterized by its transnational nature. Across different countries, epistemic community members cooperate to develop, refine, and share knowledge through collaborative research platforms, communication forums, joint publications, and informal exchanges. These activities help bridge the gap between knowledge and policy. A community with solid transnational ties tends to have a more structured impact on the positive relationship between knowledge and policy.[17] Therefore, strengthening transnational connections is essential for an epistemic community to disseminate their ideas more widely and effect structural change. In lieu of such networks, new ideas or knowledge may remain confined to specific groups at the domestic level.[18] The following section

[12] Please refer to Table A.1 for the definitions of key concepts and metrics used in the SNA analysis in this article.

[13] Thomas S. Kuhn, *The Structure of Scientific Revolution* (Chicago: University of Chicago Press, 1962); John G. Ruggie, "International Responses to Technology: Concepts and Trends," *International Organization*, Vol. 29, No. 3 (1975), pp. 557–83.

[14] Haas, "Introduction," p. 3.

[15] Ibid., pp. 16–20.

[16] Mai'a K. Davis Cross, "Rethinking Epistemic Communities Twenty Years Later," *Review of International Studies*, Vol. 39, No. 1 (2013), p. 150.

[17] Haas, "Introduction," p. 17.

[18] Emanuel Adler and Peter M. Haas, "Conclusion: Epistemic Communities, World Order, and the Creation of a Reflective Research Program," *International Organization*, Vol. 46, No. 1 (1992), p. 378.

will establish a framework to analyse the different approaches to the epistemic community's impact.

Epistemic Community and Structural Factors

When examining how an epistemic community exerts its influence, at least three analytical approaches are identified. The first is the regime-focused approach, which explores how particular political regimes impact the role of the epistemic community or community of practice. Such arguments would claim that as a structural factor, regime type influences the operation of epistemic communities, the degree and role of state involvement, and the extent of their engagement in global governance. For instance, in non-democratic countries, members of epistemic community are more state-directed, particularly in areas like knowledge production.[19] At the same time, democracies provide open platforms for an epistemic community to thrive.[20] Haas argues that regime type also impacts the flow of information, with democracies generally being more receptive to adopting ideas produced by epistemic communities than authoritarian regimes.[21] The central claim of this approach is that the political environment influences how different epistemic community players behave.

A second analytical approach, also focusing on the structural dimension, explores the attributes of actors within the epistemic community. According to Haas, community members may be experts from various professions with authoritative knowledge in specific domains.[22] This creates diversity in terms of the distribution of labour among members from independent research institutes, government-affiliated institutions, advisory bodies within governments or intergovernmental organisations (IGOs), and transnational advocacy networks (TANs). While some community members focus on providing theoretical knowledge,[23] others emphasise practical advice.[24] Beyond these divergent focuses, institutions varying in affiliations, resources, and expertise may also exert different levels of influence. Those affiliated with governments or embedded in the advisory bodies of IGOs may acquire more direct and visible influence than independent agencies. However, this can be a double-edged sword, as research institutions with government affiliations may face constraints that hinder their ability to produce knowledge more objectively. The bottom line of this approach is that institutional identity shapes behaviour.

Both approaches address some crucial aspects of the roles and patterns of different community members. They share a necessary common focus on the relationship between the epistemic community and the government. In both liberal democratic and non-democratic regimes, epistemic community members develop different types of governmental relationships, while those in non-democratic systems are typically more closely associated with governmental agencies. Additionally, organisations directly affiliated with or sponsored by the government often align their actions more closely with the role of government in global governance.

[19] Qiao-Franco Guangyu and Zhu Rongsheng, "China's Artificial Intelligence Ethics: Policy Development in an Emergent Community of Practice," *Journal of Contemporary China*, Vol. 33, No. 146 (2024), pp. 189–205.

[20] Ingvild Bode and Hendrik Huelss, "Constructing Expertise: The Front- and Back-Door Regulation of AI's Military Application in the European Union," *Journal of European Public Policy*, Vol. 30, No. 7 (2023), p. 1231.

[21] Peter M. Haas, "Introduction: Reconstructing Epistemic Communities," in Peter M. Haas, ed., *Epistemic Communities, Constructivism, and International Environmental Politics* (Oxford: Routledge, 2016), p. 11.

[22] Haas, "Introduction," p. 16.

[23] Sara Z. Kutchesfahani, *Politics and the Bomb: The Role of Experts in the Creation of Cooperative Nuclear Non-Proliferation Agreements* (New York: Routledge, 2014).

[24] Haydn Belfield, "Activism by the AI Community: Analysing Recent Achievements and Future Prospects," paper delivered to AAAI/ACM Conference on AI, Ethics, and Society (AIES' 20), New York, USA, 7–8 February 2020; Matthew Breay Bolton and Cayman C. Mitchell, "When Scientists Become Activists: The International Committee for Robot Arms Control and the Politics of Killer Robots," in Matthew Breay Bolton et al., eds., *Global Activism and Humanitarian Disarmament* (London: Palgrave Macmillan, 2020), pp. 27–51.

However, this binary and structural perspective oversimplifies the complexities of such a community. The regime-based approach overlooks the fact that countries with different regime types can still possess institutions and actors with similar functions in the epistemic community. For instance, both democratic and non-democratic countries have comparable security and military research institutions, think tanks, or AI advisory bodies that operate under similar mandates. Bureaucracy also hinders the engagement and influence of the epistemic community in the decision-making process regardless of the political regime. Indeed, the complexity of multi-layered processes in democratic societies can limit the ability of an epistemic community to exert influence and may even compromise transparency.[25]

Similarly, the institutional-attribute perspective neglects the complexity inherent in such a community and that community members often play more complex roles. For example, Henry Kissinger not only developed ideas within the arms control epistemic community but also directly applied them, demonstrating a dual capacity.[26] More broadly, actors within the epistemic community possess dual identities. These individuals or institutions often engage in both theoretical and practical work, simultaneously contributing to scholarly discourse and applying their knowledge in real-world scenarios. In addition, extensive collaborations occur between different types of actors within the epistemic community. For instance, theoretical advancements in AI ethics frequently draw directly from the practical challenges faced by engineers or policymakers and vice versa.

Regime types and institutional attributes as structural factors can either support or constrain the role of the epistemic community in translating ideas into policy. Different regime types can directly affect the independence of a community, while institutional attributes significantly influence the capacity of community members to scale their work and impact global governance. These factors help explain why epistemic community members from distinct countries or backgrounds may behave differently and contribute in diverse ways to governance. However, these two structural approaches are overly dichotomous and fail to capture the complexity of how the epistemic community develops and behaves. Therefore, a framework that broadens the discussion beyond a binary perspective is needed to address the more nuanced nature of the epistemic community.

Structure-Practice Approach

To better understand the roles and behaviour of actors within an epistemic community, this paper adds a practice-based perspective and builds a framework that merges it with the two structural factors. Such a framework strengthens the previous approaches by capturing the nuance of how actors in an epistemic community behave and interact, as well as its intersubjective nature, which can engage in co-creation and knowledge dissemination with governments and other stakeholders.[27]

Practices are socially patterned actions that embody, enact, and potentially reinforce or solidify background knowledge and discourse.[28] The interaction between different practices can foster new forms of normative substance.[29] Thus, the socially constructed nature of practices not only reflects and reinforces existing knowledge and discourse but also fosters new normative developments.

[25] Ursula C. Schröder, "Security Expertise in the European Union: The Challenges of Comprehensiveness and Accountability," *European Security*, Vol. 15, No. 4 (2006), pp. 471–90.

[26] Emanuel Adler, "The Emergence of Cooperation: National Epistemic Communities and the International Evolution of the Idea of Nuclear Arms Control," *International Organization*, Vol. 46, No. 1 (1992), p. 132.

[27] Haas, "Introduction," p. 17.

[28] Emanuel Adler and Vincent Pouliot, "International Practices: Introduction and Framework," in Emanuel Adler and Vincent Pouliot, eds., *International Practices* (Cambridge: Cambridge University Press, 2011), pp. 3–35.

[29] Guangyu Qiao-Franco and Ingvlid Bode, "Weaponised Artificial Intelligence and Chinese Practices of Human-Machine Interaction," *Chinese Journal of International Politics*, Vol. 16, No. 1 (2023), pp. 111–3.

In this context, the epistemic community is substantively associated with the idea of "communities of practice."[30] Epistemic communities, TANs, and security communities are all examples and subsets of communities of practice in their corresponding fields.[31] As epistemic community members work together to develop, share, and maintain knowledge through collective practices, collective learning manifests within the community.[32] As a community of practice develops, its knowledge spreads and is selectively retained, shaped by the members' preferences and expectations, which then influence the social order within which the community exists.[33] These groups interact with other actors to diffuse their shared knowledge and practices, which in turn helps advance collective understanding and shape collective identities.

As a community of practice, the epistemic community exhibits a strong intersubjective nature. To form a community, members must share beliefs, policy objectives, and notions for validating knowledge. The socially constructed practices within the community are integral to their intersubjectivity. Their practices carry norms, beliefs, and knowledge, whereas their ability to form cooperative networks enables them to diffuse these norms, beliefs, and ideas in a more solidified manner.

Haas and Adler's seminal work has established the foundation for a practice dimension. They propose that the epistemic community influences policy through a four-step process that transforms knowledge into action: policy innovation—members of the epistemic community drive policy innovation by setting political agendas, defining national interests, establishing standards, and shaping the discourse and narratives that guide key policy decisions;[34] policy diffusion—community members share policy recommendations across borders through conferences, joint publications, and other forms of communication, leading to significant changes in governance structures;[35] policy selection—when decision-makers lack expertise on a particular issue, community members help set the agenda and define important interests;[36] policy persistence—through ongoing socialisation, members of the epistemic community help ensure that policies are consistently implemented.[37] Based on this roadmap, we can specify the significant functions that determine the development and role of the epistemic community.

The practice dimension does not ignore or completely depart from the regime and institutional attribute approaches. Rather, it harmonises the structural constraints while incorporating more nuances and complexities of the constructive nature of the epistemic community. Shared beliefs and collective practices within the community can overcome the framing effects or obstacles posed by differences in regimes or institutional attributes.

Although regime type inevitably influences the variations among academic and policy players from different countries, the collective practices and interactions within an epistemic community can shape shared views, norms, and even identities. For instance, academic interactions between American and Soviet scientists from 1983 to 1986 fostered a shared belief in nuclear arms control, influencing both governments. This collaboration contributed to the signing of the Intermediate-Range Nuclear Forces (INF) Treaty between President Reagan

[30] Etienne Wenger, *Communities of Practice: Learning, Meaning, and Identity* (Cambridge: Cambridge University Press, 1998), pp. 47–9; Eienne Wenger, "Communities of Practice: Learning as a Social System," *Systems Thinker*, Vol. 9, No. 5 (1998), pp. 1–5.

[31] Emanuel Adler, "The Spread of Security Communities: Communities of Practice, Self-Restraint, and NATO's Post-Cold War Transformation," *European Journal of International Relations*, Vol. 14, No. 2 (2008), p. 199.

[32] Emanuel Adler, *World Ordering: A Social Theory of Cognitive Evolution* (Cambridge: Cambridge University Press, 2019), pp. 165–6.

[33] Ibid., p. 3.

[34] Adler and Haas, "Conclusion," pp. 375–8.

[35] Ibid., pp. 378–9.

[36] Ibid., pp. 381–3.

[37] Ibid., pp. 384.

and Soviet Leader Gorbachev in 1987.[38] This is, in fact, the very nature of an international epistemic community. In global governance, actors engage in continuous dialogue, collaboration, and sometimes contestation. These interactions lead to the convergence of ideas or new norms that transcend regime types, illustrating that the dynamics within the epistemic community are more complex than what a binary regime-based analysis might suggest.

Similar dynamics occur between different types of actors, as actors within the epistemic community shape each other's priorities, leading to a further blurring of the lines between different attributes of these actors. Through interactions and collective experiences, those engaged in basic research and policymaking can become more attuned to each other's perspectives. This dynamic interplay creates opportunities for the evolution of roles and contributions that are far more fluid and integrated than what a dichotomous approach suggests.

The practice-oriented approach recognises that while the roles of actors within the epistemic community are influenced by structural factors such as regime type or individual attributes, they are not rigidly defined by them. Instead, it acknowledges agency and the fluidity and complexity of interactions, focusing on the shared understanding and collaborative processes that define a community. This perspective better captures the intersubjective nature of these relationships and reflects the dynamic and evolving nature of an epistemic community. While both structural factors can exert an impact, their influence depends on the specific contexts and does not exclude dual identities, collaborative efforts, and the mutual shaping of roles through collective practices.

Contributions and Practices of Epistemic Community

The structure-practice approach directly addresses the main contributions of members of an epistemic community to global governance, particularly in the complex and rapidly evolving field of AI's military applications. First, they promote normative agendas. As shared beliefs gain acceptance within the group, they evolve into norms that shape the community's ability to frame issues, propose policy alternatives, and advocate for specific policy responses.[39] Additionally, they can establish new norms by setting agendas in international forums, academic publications, or collaborating through TANs. For example, in the governance of military AI, scholars and think tank researchers utilise social media to raise public awareness about the risks of warfare automation or join humanitarian disarmament networks to launch broader campaigns.[40]

Second, the epistemic community can help shape identities. Through training, academic interaction, and a shared culture, members develop a professional identity that becomes embedded in policymaking and institutions,[41] influencing other actors in the international system.[42] Over time, these identities can alter behaviour within specific contexts. For example, collaboration between Chinese and Western members of the epistemic community in Track 2 dialogues on AI and security fosters a shared identity focused on ethical AI development despite differing political systems. This co-construction of identity challenges rigid regime-based distinctions.[43] However, compared to norm diffusion, identity development

[38] Frank Von Hippel, "Arms Control Physics: The New Soviet Connection," *Physics Today*, Vol. 42, No. 11 (1989), pp. 39–46.

[39] Elizabeth Bloodgood, "Epistemic Communities, Norms, and Knowledge," in paper prepared for presentation at the International Studies Association Annual Conference, San Francisco, March 26–29, 2008, pp. 8–11.

[40] Bolton and Mitchell, "When Scientists Become Activists," pp. 36–7.

[41] Cross, "Rethinking Epistemic Communities Twenty Years Later," pp. 150–1.

[42] Adler and Haas, "Epistemic Communities, World Order, and the Creation of a Reflective Research Program," pp. 385–6.

[43] Ryan Hass and Colin Kahl, "Laying the Groundwork for US-China AI Dialogue," The Brookings Institution, 5 April 2024, https://www.brookings.edu/articles/laying-the-groundwork-for-us-china-ai-dialogue/.

is prolonged and faces disruption and uncertainty. As such, this study focuses on the promotion of normative agendas and the spread of shared beliefs and norms.

To achieve these contributions, epistemic community members rely on two primary practices. Drawing on general literature and a structure-practice approach, this paper categorises them into two areas: socialising and functional practices. The former represents the constructivist aspect of the epistemic community, while the latter is institutional.

As illustrated in Figure 1, the socialisation function aligns with what Haas and Adler describe as policy innovation, diffusion, and selection. The epistemic community plays crucial roles in fostering knowledge innovation, generating information and data, and advancing standards and initiatives. In promoting knowledge innovation and providing data, think tanks, scholars, and research institutions contribute to knowledge development through the construction of theories and conceptual frameworks.[44] In the area of AI's military applications, researchers have endeavoured to conceptualise the trajectory of algorithmic warfare,[45] AI's impact on the escalation of nuclear war,[46] and human–machine interaction.[47]

Moreover, members of the epistemic community can produce knowledge by translating ideas into political agendas, international standards, and policy advocacy. Many scholars and think tank researchers employ social media platforms to attract public attention to the dangers of warfare automation or join humanitarian disarmament TANs to launch campaigns at a larger scale.[48] In addition, epistemic community members may become embedded in policymaking, including formally joining the bureaucratic systems to instill knowledge, perspectives, and ideas into decision-makers. For example, before the USA initiated negotiations with the Soviet Union on the Anti-Ballistic Missile Treaty, American scholars and scientists, serving as advisors in the Kennedy and Johnson administrations, directly influenced then Secretary of Defence Robert McNamara's views on the deployment of anti-ballistic missile systems.[49] Beyond engaging in government-level actions, epistemic community members also influence public opinion—and indirectly impact government decisions—through academic publications, social media, public speeches, and forums such as Congressional hearings in the US political environment.[50]

[44] Adler, "The Emergence of Cooperation," p. 113.

[45] Regarding relevant works, please see Ingvild Bode et al., "Algorithmic Warfare: Taking Stock of a Research Programme," *Global Society*, Vol. 38, No. 1 (2024), pp. 1–23; Denise Garcia, "Algorithms and Decision-Making in Military Artificial Intelligence," *Global Society*, Vol. 38, No. 1 (2024), pp. 24–33; Lucy Suchman, "Algorithmic Warfare and the Reinvention of Accuracy," *Critical Studies on Security*, Vol. 8, No. 2 (2020), pp. 175–87; Lauren GouId et al., "Innovating Algorithmic Warfare: Experimentation with Information Manoeuvre beyond the Boundaries of the Law," *Global Society*, Vol. 38, No. 1 (2024), pp. 49–66; Bianca Baggiarini, "Algorithmic War and the Dangers of In-Visibility, Anonymity, and Fragmentation," *Australian Journal of International Affairs*, Vol. 78, No. 2 (2024), pp. 257–65.

[46] Regarding relevant works, please see Jessica Cox and Heather Williams, "The Unavoidable Technology: How Artificial Intelligence Can Strengthen Nuclear Stability," *The Washington Quarterly*, Vol. 44, No. 1 (2021), pp. 69–85; Matthew Kroenig, "Will Emerging Technology Cause Nuclear War?: Bringing Geopolitics Back In," *Strategic Studies Quarterly*, Vol. 15, No. 4 (2021), pp. 59–73; James Johnson, "Deterrence in the Age of Artificial Intelligence & Autonomy: A Paradigm Shift in Nuclear Theory Deterrence Theory and Practice?" *Defence and Security Analysis*, Vol. 36, No. 4 (2020), pp. 422–48.

[47] Regarding relevant works, please see James Johnson, "The AI Commander Problem: Ethical, Political, and Psychological Dilemmas of Human-Machine Interactions in AI-enabled Warfare," *Journal of Military Ethics*, Vol. 21, No. 3–4 (2022), pp. 246–71; Michael Mayer, "Trusting Machine Intelligence: Artificial Intelligence and Human-Autonomy Teaming in Military Operations," *Defence and Security Analysis*, Vol. 39, No. 4 (2023), pp. 521–38; Qiao-Franco and Bode, "Weaponised Artificial Intelligence and Chinese Practices of Human-Machine Interaction," pp. 106–28; Hendrik Huelss, "Deciding on Appropriate Use of Force: Human-Machine Interaction in Weapons Systems and Emerging Norms," *Global Policy*, Vol. 10, No. 3 (2019), pp. 354–8.

[48] Bolton and Mitchell, "When Scientists Become Activists," pp. 36–7.

[49] Adler, "The Emergence of Cooperation," p. 127.

[50] Adler, "The Emergence of Cooperation," pp. 130–1; Björn Jerdén, "Security Expertise and International Hierarchy: The Case of 'the Asia-Pacific Epistemic Community'," *Review of International Studies*, Vol. 43, No. 3 (2017), p. 502.

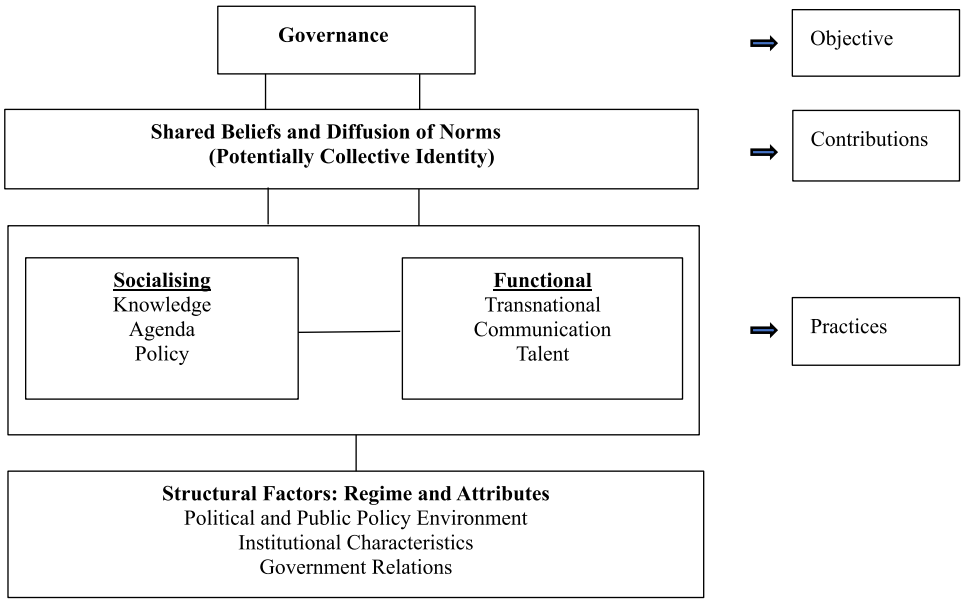

Fig. 1. The Epistemic Community and Its Practices

These aspects of knowledge underscore the role of community members and their collective practices in creating and socialising ideas throughout their evolution. Within these practices, various interactions occur among community members and government actors. The extent of these interactions influences whether the diverse range of knowledge produced can facilitate co-evolution among these actors, support shared governance goals, and enhance overall governance quality.

Second, the functional aspect of the epistemic community involves the construction of cooperative mechanisms, including building frameworks and networks that facilitate collaboration and collective actions among diverse actors. It aligns with what Haas and Adler identify as policy diffusion, selection, and persistence. These cooperative mechanisms ensure that different stakeholders—ranging from military leaders to AI researchers to IGOs—work together effectively, share insights, and develop common standards and protocols.

Epistemic community members can work with peers in other countries to foster transnational networks. In the context of military AI governance, members of the Global Tech Panel from European countries maintain close network relationships with key figures in the US business and political spheres.[51] These networks extend beyond the epistemic community's internal evolution, connecting with external groups to enhance the EU's influence on global regulation of military AI. Members also leverage their transnational networks and platforms to facilitate idea exchange among stakeholders. Research institutions and private sector organisations have used networks and conferences to promote understanding and advocate for ethical AI development.[52]

Additionally, the epistemic community can enhance their networks and collaborative mechanisms by nurturing talent within specialised fields. As Haas and Adler highlight, the longevity of policy ideas depends on the level of consensus within the community. Thus,

[51] Bode and Huelss, "Constructing Expertise," p. 1240.
[52] Belfield, "Activism by the AI Community," p. 16.

developing the next generation of experts is essential to maintaining the influence and persistence of these ideas in policy settings.[53]

In essence, epistemic community members fulfil socialising and functional roles to create and diffuse shared norms and collective identity. By creating, testing, and refining ideas in research and policy, they shape stakeholders' perceptions of global governance. Their networks expand their reach and spread ideas and norms to broader audiences and diverse stakeholders. These collective practices foster cognitive innovation and iteration, facilitating collective learning and actions among diverse actors and translating ideas into action.

Beyond structural influences of the regime and institutional attributes, members of the epistemic community collectively shape the internalisation of specific knowledge and beliefs, expand their networks, influence both practitioners and decision-makers and strengthen collaboration with various actors. Their practices influence normative debates, shape policy discourses, and gradually open new governance spaces.

Epistemic Community in Data: General Status and Government Relationship

AI and other emerging technologies present challenges that are distinct from traditional issues like nuclear and missile technology. The rapid pace of development and the inherent uncertainties make it increasingly difficult to achieve effective arms control and governance.[54] As a result, in this transitional period, where government-supported and -led international governance mechanisms for the military use of emerging technologies like AI are lacking, the importance of the epistemic community becomes ever more evident.

We observe the gradual emergence of an international epistemic community dedicated to military AI governance. Although this community is still relatively loose-knit, it holds significant potential. This section examines the overall structure of this community by developing an original database and using SNA to analyse the data. Given that this method is widely considered a standard research approach in international politics, diplomacy, and transnational issues, we will avoid elaborating on the development and characteristics of SNA in this article.[55]

SNA is well-suited for this study because it provides a way to map and analyse the relationships and interactions among actors in an epistemic community. By examining the

[53] Training next-generation experts has played a crucial role in advancing the traditional arms control framework. Relevant works include Alastair Iain Johnston, "Learning Versus Adaptation: Explaining Change in Chinese Arms Control Policy in the 1980s and 1990s," *The China Journal*, Vol. 35, No. 1 (1996), pp. 39–42; Paolo Foradori, Giampiero Giacomello, and Alessandro Pascolini, "Conclusion: ISODARCO as an Epistemic Community," in Paolo Foradori, Giampiero Giacomello, and Alessandro Pascolini, eds., *Arms Control and Disarmament: 50 Years of Experience in Nuclear Education* (London: Palgrave Macmillan, 2018), pp. 329–36.

[54] Henry A. Kissinger and Graham Allison, "The Path to AI Arms Control: America and China Must Work Together to Avert Catastrophe," *Foreign Affairs*, October 2023, pp. 9–10.

[55] Emilie M. Hafner-Burton et al., "Network Analysis for International Relations," *International Organization*, Vol. 63, No. 3 (2009), pp. 559–92; Chong Chen, "The Contagion of Foreign Policy Convergence: Spatiotemporal Dynamics of Chinese Leadership Visits, 1978–2014," *Chinese Journal of International Politics*, Vol. 16, No. 2 (2023), pp. 157–80; Xun Pang, Lida Liu, and Stephanie Ma, "China's Network Strategy for Seeking Great Power Status," *Chinese Journal of International Politics*, Vol. 10, No. 1 (2017), pp. 1–29; Xianbai Ji, "How Global Summitry Evolves: The Complementary Multilateralism Perspective," *Chinese Journal of International Politics*, Vol. 15, No. 3 (2022), pp. 289–312; Jytte Klausen et al., "The YouTube Jihadists: A Social Network Analysis of Al-Muhajiroun's Propaganda Campaign," *Perspectives on Terrorism*, Vol. 6, No. 1 (2012), pp. 36–53; Adam J. Saffer et al., "It Takes a Village: A Social Network Approach to NGOs' International Public Engagement," *American Behavioral Scientist*, Vol. 63, No. 12 (2019), pp. 1708-27; Pang Xun and Quan Jiayun, "Huigui quanli de guanxi yujing: guojia shehuixing quanli de wangluo fenxi" ("Return to Relational Context of Power: Network Analysis and Measurement of National Social Power"), *Shijie jingji yu zhengzhi* (*World Economics and Politics*), No. 6 (2015), pp. 39–63; Luo Hang and Li Boxuan, "Guoji jiegou fenxi yu guojia quanli celiang: jiyu dashuju wangluo fenxi" ("International Structure Analysis and National Power Measurement: International Relations Network Analysis Based on Big Data"), *Shijie jingji yu zhengzhi* (*World Economics and Politics*), No. 6 (2021), pp. 48–82.

structural positions of different players, SNA enables an in-depth analysis of how institutions, think tanks, and government agencies are interconnected, how information flows, and how ideas and norms diffuse within and beyond the community. This method illustrates not only the overall structure of the epistemic community but also the specific roles and relative influence of different members. Through original dataset insights, SNA effectively uncovers the dynamics of collaboration and influence, making it an ideal tool for exploring the nuances of governance in the military AI field.

Data Collection

This paper relies on an original database to systematically examine academic exchanges and collaboration data within the epistemic community focused on military use of AI from 2013 to September 2024. Based on this database, SNA is employed to analyse the data. We first explore the overall trends of the collaboration network's development within the community by using indicators such as network density, clustering coefficient, and average shortest distance. Subsequently, we compare the degree, closeness, and betweenness centrality metrics to assess the influence of different institutions.

This article examines the academic collaborations on AI's military applications among global think tanks, university research institutes, and other institutions from 2013 to 2024.[56] These collaborations include various forms of academic cooperation, such as international and domestic conferences, forums, seminars, and Track 2 and 1.5 dialogues. The study also considers joint publications, including co-authored articles, book chapters, monographs, and research reports produced in partnership by scholars or between think tanks. Furthermore, we analyse long-term collaborative projects, such as joint research initiatives between think tanks or academic institutions.

When selecting the institutions and publicly available academic and policy outputs for this study, we prioritised several key areas. First, it includes the top 100 think tanks in the AI field, as identified in the *2020 Global Go To Think Tank Index Report* by the University of Pennsylvania.[57] The study also examines think tanks and academic institutions that participated in the United Nations Group of Governmental Experts (GGE) meetings on Lethal Autonomous Weapons Systems (LAWS) under the United Nations Convention on Certain Conventional Weapons (CCW) from 2014 to 2024.[58] Additionally, we consider participants

[56] To get access to the data, please visit https://dataverse.harvard.edu/privateurl.xhtml?token=2155ffa7-7481-4c8c-bb53-17091f8c075e.

[57] University of Pennsylvania, "2020 Global Go To Think Tank Index Report," https://www.bruegel.org/sites/default/files/wp-content/uploads/2021/03/2020-Global-Go-To-Think-Tank-Index-Report-Bruegel.pdf.

[58] UNODA, "Convention Certain Conventional Weapons Informal Meetings of Experts 2014," https://meetings.unoda.org/ccw-ime/convention-certain-conventional-weapons-informal-meeting-experts-2014; UNODA, "Convention Certain Conventional Weapons Informal Meetings of Experts," https://meetings.unoda.org/ccw-ime/convention-certain-conventional-weapons-informal-meeting-experts-2015; UNODA, "List of Experts," https://docs-library.unoda.org/Convention_on_Certain_Conventional_Weapons_-_Informal_Meeting_of_Experts_(2016)/2016_LAWSMX_ProgrammeofWork_ListofExperts.pdf; UNODA, "Convention Certain Conventional Weapons Informal Meetings of Experts," https://meetings.unoda.org/ccw/convention-certain-conventional-weapons-group-governmental-experts-2017; UNODA, "Lists of Participants," https://unoda-documents-library.s3.amazonaws.com/Convention_on_Certain_Conventional_Weapons_-_Group_of_Governmental_Experts_(2018)/GGE+LAWS+2018+List+of+Participants.pdf; UNODA, "Lists of Participants," https://unoda-documents-library.s3.amazonaws.com/Convention_on_Certain_Conventional_Weapons_-_Group_of_Governmental_Experts_(2019)/CCW%2BGGE.1%2B2019%2BINF.1%2BRev.1.pdf; UNODA, "Convention Certain Conventional Weapons Informal Meetings of Expert," https://meetings.unoda.org/meeting/62100/documents?f%5B0%5D=author_type_documents_%3AInternational%20Organization&f%5B1%5D=author_type_documents_%3ANon-governmental%20organization; UNODA, "Convention on Certain Conventional Weapons Group of Governmental Experts on Lethal Autonomous Weapons Systems 2021," https://meetings.unoda.org/ccw/convention-certain-conventional-weapons-seventh-group-governmental-experts-2021; UNODA, "Convention on Certain Conventional Weapons Group of Governmental Experts on Lethal Autonomous Weapons Systems 2022," https://meetings.unoda.org/ccw/convention-certain-conventional-weapons-group-governmental-experts-2022; UNODA, "List of Participants," https://docs-library.unoda.org/Convention_on_Certain_Conventional_Weapons_-Group_of_Governmental_Experts_on_Lethal_Autonomous_Weapons_Systems_(2023)/CCW-GGE.1–2023-INF.1_List_of_participants.pdf; UNODA, "Convention on Certain Conventional Weapons

in the 2023 and 2024 Responsible AI in the Military Domain (REAIM) Summit,[59] the first Global AI Safety Summit in the UK, and smaller but regular events such as the "China-U.S. Dialogue on Artificial Intelligence and International Security," jointly organised by the Center for International Security and Strategy of Tsinghua University (CISS) and the Brookings Institution.[60] Many conferences, whether organised by IGOs or academic institutions, are often closed-door events, making it difficult to gather public data. Therefore, this study primarily relies on think tank reports and information from the Web of Science database.

For the collection of data on academic collaborations and publications, this study examines whether the selected institutions have co-authored research or think tank reports with other organisations. Using the Web of Science database, the publication date range is set between 2013 and September 2024, and searches are conducted for journal articles, book chapters, and conference papers using specified keywords.[61] We also document the authors' institutional affiliations.

Based on this data, a two-mode affiliation matrix is created, mapping activities and institutions, which is then converted into a one-mode network matrix. The analysis utilises overall network measurements and three centrality metrics. The following section presents an overview of the current state of the epistemic community by comparing academic and policy activities, with a focus on whether they are government-hosted or not. The following section delves into the differences in how various members of the community contribute, specifically examining their relationships with governments and their roles in knowledge production and the development of cooperative mechanisms.

General Status

In analysing the basic characteristics of the network, this study considers the dimension of government hosting.[62] By presenting networks that include both government-hosted activities and those without government intervention (purely academic or think tank activities), we aim to depict the fundamental characteristics of the epistemic community. The analysis begins with a general description of the networks, distinguishing between those with and without government hosting, followed by a discussion of the overall state of the epistemic community. Subsequently, this section specifically compares the influence and roles of government relationships among different actors within the epistemic community, emphasising the impact of government hosting in these interactions.

Our initial analysis compares networks with and without government hosting to understand the overall network characteristics. Analysis of Figure 2 demonstrates that between 2013 and 2020, the academic network in AI's military applications expanded, regardless of government-hosted activities. The sole exception was in 2021, when both networks

Group of Governmental Experts on Lethal Autonomous Weapons Systems 2024," https://meetings.unoda.org/ccw-/convention-on-certain-conventional-weapons-group-of-governmental-experts-on-lethal-autonomous-weapons-systems-2024.

[59] Government of the Netherlands, "Explore the REAIM 2023 Programme," https://reaim2023.org/programme/#programme; Responsible AI in the Military Domain Summit (REAIM) 2024, "Overview," https://reaim2024.kr/home/reaimeng/contents/ctntsDetail.do?encCtntNo=4d734f6c504f714f51657948783678736a6f2f6a44673d3d&encMenuId=4e63794b574d79692f7962726b56685150665a652f673d3d.

[60] UK Government, "AI Safety Summits Confirmed Governments and Organisations," https://www.gov.uk/government/publications/ai-safety-summit-introduction/ai-safety-summit-confirmed-governments-and-organisations; Center for International Security and Strategy Tsinghua University, "The China-U.S. Track II Dialogue on Artificial Intelligence and International Security Interim Report," 6 April 2024, https://ciss.tsinghua.edu.cn/info/CISSReports/7041.

[61] We use the following keywords: "military artificial intelligence (AI)," "military use of artificial intelligence (AI)," "artificial intelligence (AI) in defense (defence)," "autonomous weapons sytems," "Lethal autonomous weapons systems (LAWS)," "algorithmic warfare," "artificial intelligence (AI) in conflict," "artificial intelligence (AI) arms control," "artificial intelligence (AI) race," "artificial intelligence and strategic stability" and so forth.

[62] Government hosting refers to any activities directly hosted, organised, or led by government entities. Events organised by non-governmental entities are not considered government-led activities, even if these entities maintain close partnerships with governments.

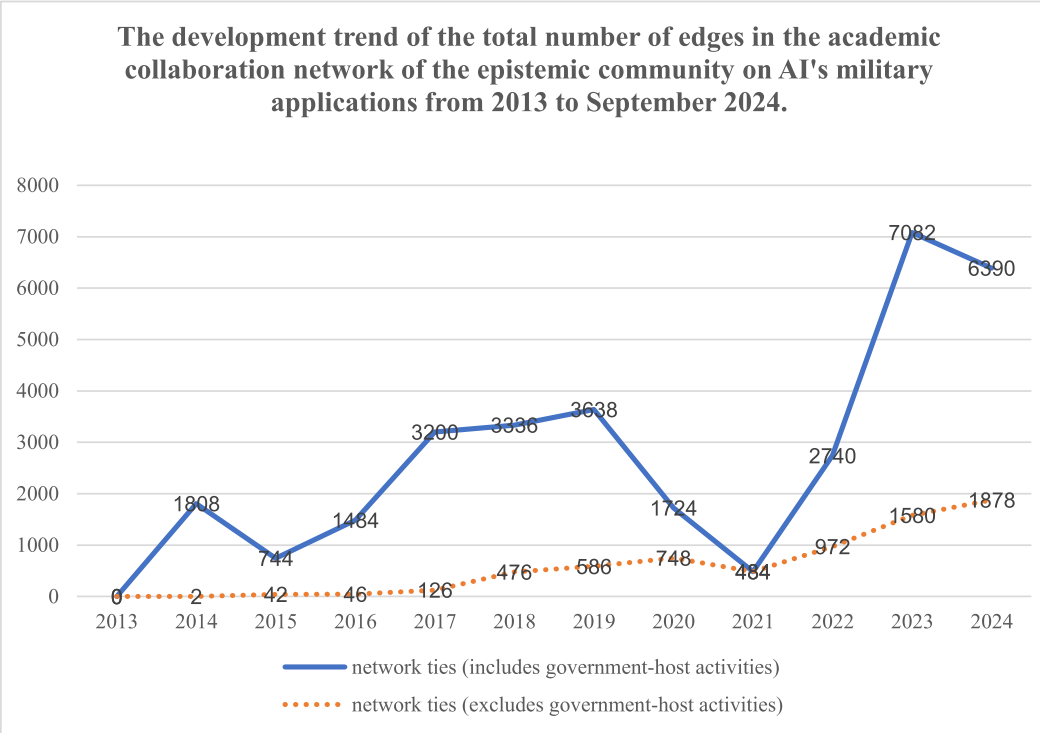

Fig. 2. The Development of the Total Number of Edges in Two Versions of the Network for Each Year

experienced a drop in the total number of edges compared to previous years, an unsurprising trend given the impact of COVID-19. The period of 2022–23 saw a significant increase in edges in both networks, most notably within the international academic network focused on military AI in 2023. This development indicates the epistemic community's growing engagement with the regulation of AI in the military domain and its increasing activity.

Networks incorporating government-hosted activities consistently demonstrate a higher number of edges than those without such involvement. This pattern indicates that government participation serves a key role in building and expanding academic networks, contributing to a larger network scale. Furthermore, it reinforces the notion that the epistemic community benefits from government relationships for effectiveness. Nevertheless, even without government hosting, the epistemic community has shown considerable vitality, indicating a strong initiative within the community to engage in military use of AI during its early and transitional stages. However, counting the number of edges merely provides a basic overview of the network; it does not capture the closeness, connectivity, or overall cohesion of the network. A comprehensive analysis requires consideration of factors like network density, clustering coefficient, and average shortest path.

Network density, representing the proportion of potential connections that actually exist within a network, helps researchers assess information circulation among nodes and network connectivity.[63] Our analysis of Figure 3 and Table 1 reveals that networks that include government-hosted activities show inconsistent density, with increases occurring only between 2015–19 and 2021–23. Conversely, the network without government-hosted

[63] Robert A. Hanneman and Mark Riddle, "Concepts and Measures for Basic Network Analysis," in John Scott and Peter J. Carrington, eds., *The SAGE Handbook of Social Network Analysis* (Thousand Oaks: SAGE Publications Inc., 2011), p. 361.

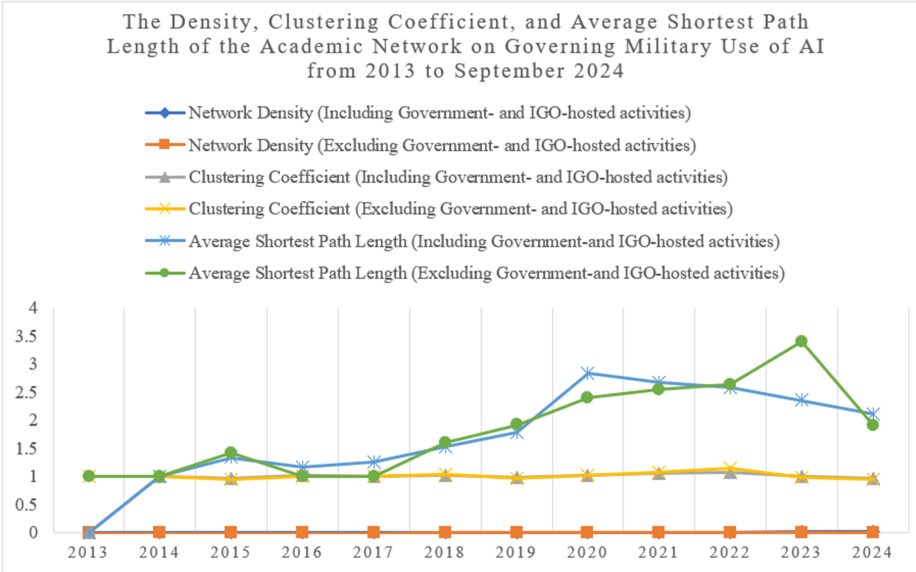

Fig. 3. The Density, Clustering Coefficient, and Average Shortest Path Length of the Academic Network on Governing Military Use of AI

activities exhibits a steady increase in density, particularly from 2018 to 2023. This pattern suggests that the epistemic community, independent of government hosting, faces lower barriers to interconnecting academic and policy institutions, enabling more active development. However, both versions of the network maintain relatively low overall density values, indicating that the international academic network of military AI has remained loosely connected over the past decade.

Regarding the second indicator (clustering coefficient), this measure examines the network's cohesion and the average connectivity between nodes.[64] In contrast to the fluctuating trend in network density, the clustering coefficient across both versions of the network shows a more positive trend. The period from 2019 to 2023 saw a steady increase in the clustering coefficient throughout both networks, indicating that the international academic network in military AI has become more focused and cohesive over the past decade.

The analysis of the average shortest path measures how close nodes are to each other in the network, reflecting the speed at which information spreads.[65] Over the past decade, the average shortest path values have increased in both versions of the network, indicating considerable distance between institutions. While the level of interconnectedness remains relatively low, it is showing gradual improvement.

Our initial findings reveal that a global epistemic community focused on military use of AI has emerged over the past decade. However, this network remains incompletely cohesive; many institutions lack effective connections and collaboration, presenting substantial room for improvement in terms of interconnectedness. The significant rise in the clustering coefficient suggests that "collaborative circles" are forming within this otherwise loosely

[64] Hanneman and Riddle, "Concepts and Measures for Basic Network Analysis," p. 346.

[65] Vincent Chua, Julia Madej, and Barry Wellman, "Personal Communities: The World According to Me," in Scott and Carrington, eds., *The SAGE Handbook of Social Network Analysis* (Thousand Oaks: SAGE Publications Inc., 2011), p. 108.

Table 1. The Density, Clustering Coefficient, and Average Shortest Path Length of the Academic Network on Military Use of AI from 2013 to September 2024

Type of network	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Network Density (Including Government- and IGO-hosted activities)	0	0.005	0.002	0.003	0.008	0.009	0.01	0.005	0.001	0.008	0.019	0.014
Network Density (Excluding Government- and IGO-hosted activities)	0	0	0	0	0	0.001	0.002	0.002	0.001	0.003	0.004	0.004
Clustering Coefficient (Including Government- and IGO-hosted activities)	0	1	0.972	1.016	0.999	1.014	0.981	1.022	1.057	1.072	0.996	0.973
Clustering Coefficient (Excluding Government- and IGO-hosted activities)	1	1	0.94	1	1	1.032	0.972	1.027	1.072	1.146	0.986	0.943
Average Shortest Path Length (Including Government-and IGO-hosted activities)	0	1	1.337	1.173	1.264	1.533	1.781	2.845	2.673	2.584	2.355	2.116
Average Shortest Path Length (Excluding Government-and IGO-hosted activities)	1	1	1.417	1	1	1.597	1.919	2.399	2.543	2.641	3.395	1.908

connected global community. These circles are becoming more cohesive, and connections beyond them are beginning to develop.

Epistemic Community in Action: Structural, Socialising, and Functional Influences

This section examines the influence of different institutions within the epistemic community of military AI governance by comparing two key dimensions: government hosting (how government intervention affects the roles of various institutions) and institutional practices (socialising and functional practices). This analysis aims to provide a clearer understanding of the differences among community members and networks.

To assess these differences, we employ indicators like degree centrality, closeness centrality, and betweenness centrality. These measures help us observe how government hosting affects the ability of community members to expand their networks and exert control within them. According to Linton C. Freeman's framework, degree centrality measures the number of direct connections a node has, demonstrating its activity level or the size of its immediate network.[66] Closeness centrality indicates how quickly a node can communicate with others, showing its ability to spread information independently.[67] Betweenness centrality assesses the extent to which a node controls the flow of information within the network, demonstrating its influence as an intermediary.[68]

Structural Impact

We begin by comparing different actors within the epistemic community to determine whether government hosting is present or not (Figures 4 and 5). The rankings reveal substantial differences between networks that include government-hosted activities and those without are significant. For instance, when excluding activities hosted by governments or IGOs, many academic institutions from China rise significantly in the rankings, with several entering the top 15. As illustrated in Table 2, CISS and China Arms Control and Disarmament Association (CACDA) achieve first and second positions, respectively. Meanwhile, institutions like Stockholm International Peace Research Institute (SIPRI), previously ranked first when government-led activities were included, fall to third place, with its degree centrality falling from 0.85 to 0.181. Similarly, the Geneva Centre for Security Policy (GCSP) and the Center for a New American Security (CNAS) experience significantly reduced rankings and degree centrality. Many international non-governmental organisations (NGOs) drop out of the top 15 entirely. Despite the rise in rankings for Chinese institutions, their degree centrality also decreases.

These changes yield several key insights. The removal of government influence most significantly affects NGOs, precipitating a substantial drop in their network position. In contrast, many Chinese institutions experience an upward shift in their rankings, which could be attributed to two factors: their previous peripheral position in official activities related to military AI or LAWS led by governments and IGOs, or their stronger focus on domestic collaboration. Interestingly, even though institutions like SIPRI, GCSP, and CNAS experience changes in their degree centrality, these shifts are relatively limited, and their positions remain strong, highlighting their significant influence, independent of direct government hosting.

[66] Linton C. Freeman, "Centrality in Social Networks: Conceptual Clarification," *Social Networks*, Vol. 1, No. 3 (1978/1979), pp. 219–21.
[67] Ibid., p. 224.
[68] Ibid., pp. 222–4.

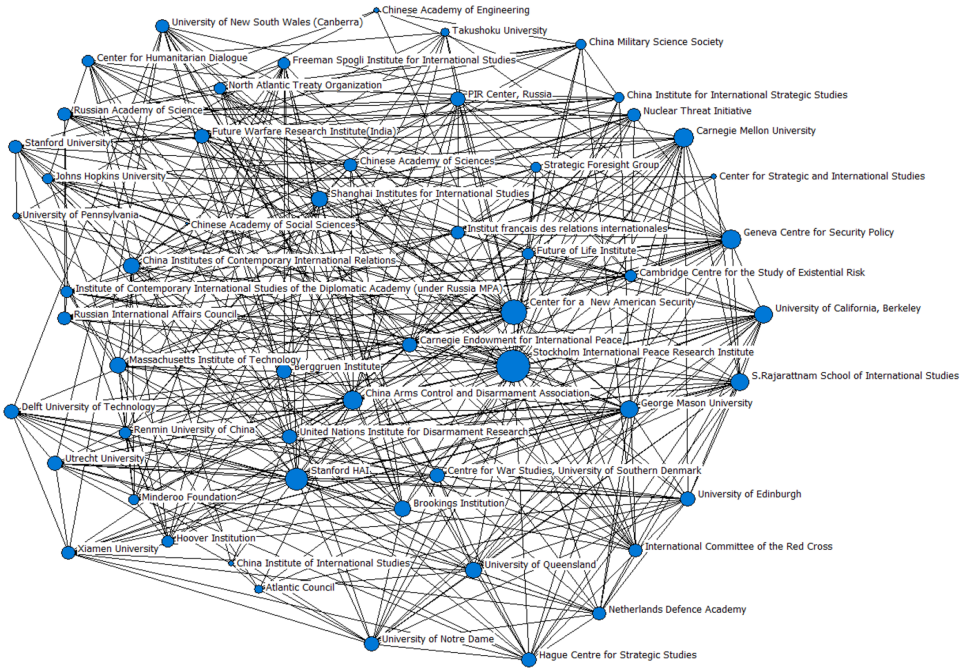

Fig. 4. The Academic Network on the Military Use of AI after Removing Government-Hosted Activities (Top 67 Nodes Ranked by Degree Centrality)

While degree centrality offers valuable insights, this metric alone does not capture all dimensions of network influence, such as access to information or control over the network.[69] An analysis of closeness centrality and betweenness centrality is necessary to provide a more comprehensive understanding of the dynamics at play.

Analysis of rankings based on closeness centrality reveals that government hosting significantly shapes the overall picture, paralleling our findings with degree centrality. As depicted in a Table 3, when government hosting is considered, many NGOs achieve high ranks. However, when government influence is removed, no NGOs remain in the top 15 rankings. While degree centrality measures network influence by the number of direct connections, the closeness centrality rankings encompass other academic institutions such as S. Rajaratnam School of International Studies (RSIS), Carnegie Mellon University, George Mason University, and the Stanford Institute for Human-Centered Artificial Intelligence (Stanford HAI).

A significant finding is that many Chinese institutions that rank highly in degree centrality, such as the China Institutes of Contemporary International Relations (CICIR) and Beijing Normal University, fail to appear in the top 15 for closeness centrality. Closeness centrality measures a node's ability to access information or resources from others, reflecting the efficiency of information dissemination within the network. This difference suggests that while some Chinese institutions have extensive direct networks, they are less capable of independently influencing information flow compared to institutions like SIPRI, CNAS, GCSP, or RSIS. Aside from a few exceptions—such as the Institute of Automation, Chinese Academy of Sciences (CAS)—most Chinese institutions are less effective at obtaining and

[69] Kosuke Imai, *Quantitative Social Science: An Introduction* (Princeton: Princeton University Press, 2017), pp. 208–10.

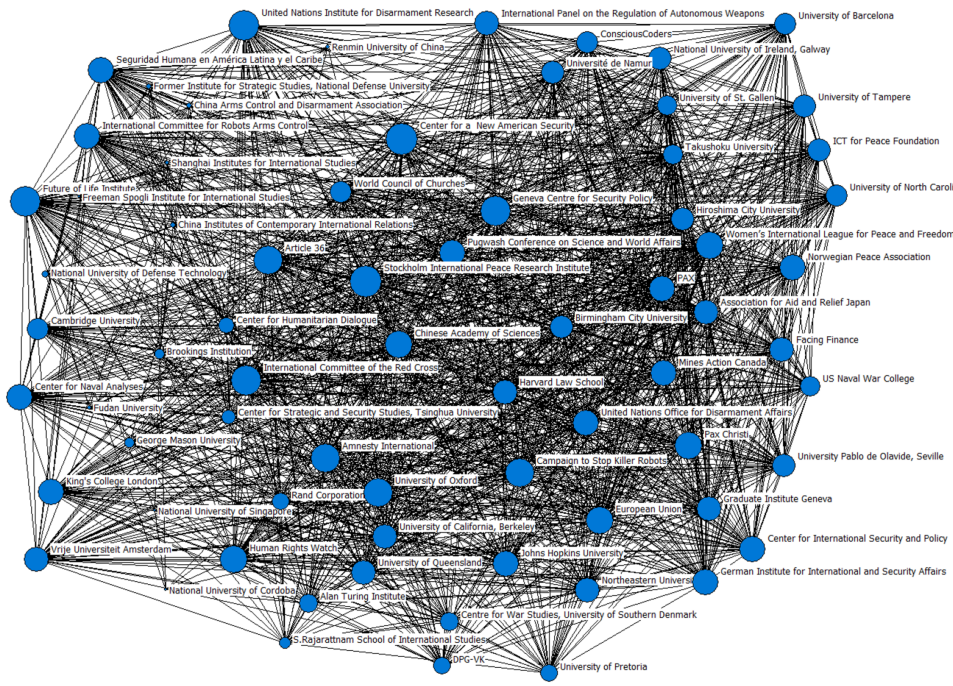

Fig. 5. The Academic Network of the Epistemic Community on the Military Use of AI, Including Activities Hosted by Governments or IGOs (Top 67 Nodes Ranked by Degree Centrality)

spreading information within the epistemic community. Moreover, these institutions exhibit varying patterns of influence: the universities demonstrate greater influence in the absence of government hosting, while CAS relies heavily on its government ties. This divergence reflects their institutional characteristics and government relationships.

Examination of betweenness centrality shows limited variation between the two network versions, aside from the rankings of NGOs and IGOs dropping from second to thirteenth position.[70] As illustrated in Table 4, major Western think tanks like SIPRI, CNAS, and GCSP consistently rank in the top 15 in both versions, underscoring their strong intermediary roles. Only one Chinese research institution appears in the top 15 in both versions of the betweenness centrality rankings. When government hosting is considered, CAS ranks highly. Without government hosting, Chinese institutions such as CISS and Peking University are on the list. This pattern aligns with earlier observations regarding the distinct characteristics of different Chinese institutions. The decline in the number of Chinese institutions in this ranking suggests they function less effectively as network bridges compared to their Western counterparts.

By synthesising the centrality analysis with the consideration of government hosting, this study reveals several key insights. First, government hosting consistently influences the network position of members within the military AI epistemic community. Although the structural effects cannot fully address the impact of epistemic community members, the relationship between epistemic community and governments plays a crucial role in shaping

[70] Imai, *Quantitative Social Science*, p. 209; Matthew O. Jackson, *Social and Economic Networks* (Princeton: Princeton University Press, 2010).

Table 2. Comparative Analysis of Degree Centrality (Top 15 for Each Version)

	Degree Centrality (Excluding Government-Hosted Activities)		Degree Centrality (Including Activities Hosted by Governments and IGOs)	
No	**Institution**	**Value**	**Institution**	**Value**
1	Center for International Security and Strategy, Tsinghua University	0.298	Stockholm International Peace Research Institute	0.85
2	China Arms Control and Disarmament Association	0.202	Geneva Centre for Security Policy	0.795
3	Stockholm International Peace Research Institute	0.181	United Nations Institute for Disarmament Research	0.766
4	China Institutes of Contemporary International Relations	0.156	Center for a New American Security	0.658
5	Peking University	0.154	United Nations Office for Disarmament Affairs	0.615
6	Brookings Institution	0.150	Article 36	0.609
7	National Defence University	0.147	International Committee of the Red Cross	0.597
8	Center for a New American Security	0.141	Campaign to Stop Killer Robots	0.592
9	National University of Defense Technology	0.132	Amnesty International	0.513
10	Geneva Centre for Security Policy	0.130	Human Rights Watch	0.510
11	Beijing University of Posts and Telecommunications	0.127	Future of Life Institute	0.505
12	China University of Political Science and Laws	0.121	Women's International League for Peace and Freedom	0.502
13	S. Rajaratnam School of International Studies	0.115	International Committee for Robot Arms Control	0.481
14	Carnegie Mellon University	0.106	Center for International Security and Strategy, Tsinghua University	0.475
15	Stanford Institute for Human-Centered Artificial Intelligence	0.105	European Union	0.463

the roles and influence of community members. In some instances, governmental involvement directly amplifies actor influence within the network, as they receive state support, funding, and access to decision-making processes. For example, in countries where the government has strong ties with the epistemic community, such as the US Department of Defense's relationship with CNAS, actors hold central positions within the global network and serve as intermediaries for policy recommendations and normative diffusion. Conversely, in cases where government hosting is sparse or absent—as with Chinese academic and policy players—members of epistemic community demonstrate lower centrality and reduced capacity to shape international governance agendas.

Nevertheless, our findings indicate that regime type alone does not determine outcomes, as Western institutes have established closer government relationships. While structural factors such as regime type may not completely determine the roles of epistemic community members, the extent of government hosting within these networks significantly influences their effectiveness. Thus, structural effects are not negligible, as governmental support

Table 3. Closeness Centrality Comparison (Based on Freeman Closeness Normalised Values)

	Closeness Centrality (Excluding Government-Hosted Activities)		Closeness Centrality (Including Activities Hosted by Governments and IGOs)	
No	**Institution**	**Value**	**Institution**	**Value**
1	Stockholm International Peace Research Institute	0.19	United Nations Institute for Disarmament Research	0.432
2	S. Rajaratnam School of International Studies	0.188	Stockholm International Peace Research Institute	0.431
3	Center for a New American Security	0.187	Center for a New American Security	0.428
4	Peking University	0.186	Geneva Centre for Security Policy	0.427
5	Carnegie Mellon University	0.185	International Committee of the Red Cross	0.409
6	Geneva Centre for Security Policy	0.185	United Nations Office for Disarmament Affairs	0.408
7	George Mason University	0.185	International Research Center for AI Ethics and Governance, Institute of Automation, Chinese Academy of Sciences	0.406
8	National Defense University	0.185	Future of Life Institute	0.404
9	Stanford Institute of Human-Centered Artificial Intelligence	0.185	Article 36	0.401
10	United Nations Institute of Disarmament Research	0.185	Campaign to Stop Killer Robots	0.401
11	University College Cork	0.185	Johns Hopkins University	0.401
12	University of California, Berkeley	0.185	University of California, Berkeley	0.401
13	University of Notre Dame	0.185	RAND Corporation	0.398
14	University of Queensland	0.185	Amnesty International	0.396
15	Brookings Institution	0.184	Northeastern University	0.396

or lack thereof can either constrain or empower an epistemic community within global governance processes.

Furthermore, this difference is largely related to the nature of the institutions. Academic institutions, such as universities, exhibit greater influence when government hosting is excluded. Meanwhile, NGOs and international advocacy networks often experience diminished influence. However, major Western think tanks generally maintain their influence regardless of government participation. This pattern is evident in international discussions on military AI governance, where NGOs rely on government platforms to engage actively with other institutions. This is particularly notable in forums like the United Nations' discussions on lethal autonomous weapons, where TANs, such as the Campaign to Stop Killer Robots (CSKR), have been prominent.

Second, despite sharing similar attributes globally, institutions' roles, practices, and positions within epistemic networks differ significantly across countries and regions. US and European institutions tend to be more active in the flow of information and network intermediation compared to their Chinese counterparts.

For instance, many Chinese institutions rank highly in degree centrality, indicating strong direct networks. They exert less influence in information control and intermediary roles within collaborative networks. Despite establishing extensive connections, they

Table 4. Betweenness Centrality Comparison (Based on Normalised Value)

	Betweenness Centrality (Excluding Government-Hosted Activities)		Betweenness Centrality (Including Activities Hosted by Governments and IGOs)	
No	Institution	Value	Institution	Value
1	Stockholm International Peace Research Institute	0.036	Center for a New American Security	0.073
2	Center for a New American Security	0.028	United Nations Institute for Disarmament Research	0.06
3	Johns Hopkins University	0.022	Johns Hopkins University	0.05
4	S. Rajarattnam School of International Studies	0.019	Geneva Centre for Security Policy	0.046
5	Peking University	0.019	Stockholm International Peace Research Institute	0.042
6	Carnegie Mellon University	0.018	International Committee of the Red Cross	0.027
7	Geneva Centre for Security Policy	0.017	Future of Life Institute	0.023
8	Brookings Institution	0.017	International Research Center for AI Ethics and Governance, Institute of Automation, Chinese Academy of Sciences	0.021
9	Carnegie Endowment for International Peace	0.016	Center for International Security and Strategy, Tsinghua University	0.021
10	George Mason University	0.014	George Mason University	0.02
11	Center for War Studies, University of Southern Denmark	0.014	University of California, Berkeley	0.019
12	Center for International Security and Strategy, Tsinghua University	0.014	RAND Corporation	0.018
13	US Army Research Laboratory	0.014	University of Oxford	0.018
14	United Nations Institute of Disarmament Research	0.013	US Army Research Laboratory	0.018
15	Campaign to Stop Killer Robots	0.012	United Nations Office of Disarmament Affairs	0.018

lack a comparable impact in information dissemination and network coordination as other institutions.

Furthermore, leading Western think tanks, including CNAS, SIPRI, and GCSP in Switzerland, consistently achieve high rankings across all centrality measures. These institutions have played a crucial role in developing and advancing the international academic network on military AI governance over the past decade. Their influence stems not only from their high level of activity but also from their ability to control information and serve as key coordinators within the network. Given the limitations of the data in this study, it is reasonable to theorise that similar major Western think tanks possess significant potential for network influence.

Socialising and Functional Practices

This section examines which institutions play the most prominent roles in socialising and functional practices by comparing three centrality measures related to cooperative

functions. As Table 5 illustrates, the Atlantic Council, the University of Turin, and the University of Pennsylvania rank highest in terms of degree centrality for knowledge production. The majority of the top 15 institutions are universities from the USA, the UK, and other European countries.

As discussed earlier, the attributes of institutions play a role. However, we cannot rely on this dichotomous perspective to fully understand the role of the epistemic community. The top rankings in the academic publishing network are almost exclusively held by academic institutions, with few NGOs or TANs making the list. This state of affairs suggests that while international NGOs influence knowledge production by participating in conferences or leveraging social media, universities remain the key players in shaping their influence directly through knowledge innovation.

When examining closeness and betweenness centrality, there is a noticeable shift compared to degree centrality. In addition to universities, think tanks like the Atlantic Council, the Brookings Institution, and SIPRI also rank within the top 15. This achievement highlights the vital role that both think tanks and university research institutions play in bridging gaps in knowledge creation and dissemination. They demonstrate a significant degree of autonomy in controlling information, particularly among institutions based in the USA and Europe. Interestingly, there are only a few non-western institutions such as RSIS and Peking University in these lists. This indicates that although Chinese and other non-western institutions exhibit certain level of activity in producing knowledge on military AI, their impact could not compare with institutions from Western countries.

While prioritising the functional aspect of practices, we excluded academic publishing data from the overall network and concentrated on data related to conferences and long-term collaborative projects. As observed in Table 6, the top 15 in degree centrality for academic conferences and long-term projects include a large number of IGOs and NGOs. A few think tanks—such as SIPRI, GCSP, CNAS, and CISS—appear in this list. This fact, combined with the earlier findings that include government hosting, suggests that TANs have been essential to the military AI epistemic community over the past decade, particularly in the development and enhancement of cooperative mechanisms.

Two key observations stand out regarding the closeness and betweenness centrality of academic conferences and long-term projects. First, SIPRI, GCSP, and CNAS consistently rank within the top 15 for these metrics, reaffirming their status as "all-rounders" within the military AI governance community. CAS also ranks in the top 15 for both centrality measures. This suggests that, unlike in knowledge production, certain Chinese institutions or representatives play an active role in establishing cooperative mechanisms.

Upon analysing the centrality measures, this study highlights several findings. First, government hosting plays a crucial role in enabling NGOs and TANs to participate in global governance on military use of AI. Governments provide platforms for these organisations to set agendas, engage in dialogue, and offer policy recommendations, thereby expanding their influence. However, these organisations are not at the core of the military AI governance network.

Second, although institutions share similar attributes globally, their roles, practices, and positions within epistemic networks differ across countries and regions. US and European institutions are more active in the flow of information and network intermediation compared to their Chinese counterparts. Leading think tanks from the USA and Europe have proven instrumental in advancing the regulation of military AI use. They are not only effective in building extensive networks and independently influencing information dissemination but also serve as critical intermediaries within the network. Their influence remains strong, regardless of direct government hosting.

Third, universities are inimitable in knowledge production. While leading think tanks contribute primarily to policy-oriented and advocacy-related knowledge, universities

Table 5. Centrality Comparison of Academic Publication Types on Military Use of AI (Based on Normalised Scores)

	Degree Centrality		Freeman Closeness Centrality		Betweenness Centrality	
No.	Institution	Value (normalised)	Institution	Value (normalised)	Institution	Value (normalised)
1	Atlantic Council	0.021	Atlantic Council	0.088	Atlantic Council	0.259
2	University of Turin	0.018	University of Pennsylvania	0.088	University of Pennsylvania	0.002
3	University of Pennsylvania	0.016	University of Queensland	0.088	Peking University	0.002
4	University of Queensland	0.016	Geneva Centre for Security Policy	0.088	Harvard Law School	0.002
5	US Army Research Laboratory	0.015	Peking University	0.088	Stockholm International Peace Research Institute	0.002
6	Geneva Centre for Security Policy	0.015	AI Ethics Lab	0.088	University of Queensland	0.001
7	Peking University	0.015	Center for Naval Analyses	0.088	University of Notre Dame	0.001
8	AI Ethics Lab	0.013	International Institute for Strategic Studies, UK	0.088	US Naval Academy	0.001
9	Center for Naval Analyses	0.013	S. Rajaratnam School of International Studies	0.088	Stanford University	0.001
10	International Institute for Strategic Studies, UK	0.013	University of Notre Dame	0.088	Belfer Center for Science and International Affairs, Harvard University	0.001
11	Imperial College London	0.013	University of Tokyo	0.088	Massachusetts Institute of Technology	0.001
12	Institute of Contemporary International Studies of the Diplomatic Academy (under Russia MPA)	0.013	US Naval Academy	0.088	Australian National University	0.001
13	Johns Hopkins University	0.013	Peace Research Institute, Oslo	0.088	Brookings Institution	0.001
14	Med Univ Graz	0.013	Harvard Law School	0.088	Geneva Centre for Security Policy	0.00
15	S. Rajaratnam School of International Studies	0.013	Jadavpur University	0.088	AI Ethics Lab	0.00

Table 6. Centrality Comparison of Academic Conferences and Long-Term Projects on Military AI Governance Network

	Degree Centrality		Closeness Centrality		Betweenness Centrality	
No.	Institution	Value (Normalised)	Institution	Value (Freeman Normalisation)	Institution	Value (Normalised)
1	Stockholm International Peace Research Institute	0.846	United Nations Institute for Disarmament Research	0.437	Center for a New American Security	0.055
2	Geneva Centre for Security Policy	0.780	Stockholm International Peace Research Institute	0.435	United Nations Institute for Disarmament Research	0.044
3	United Nations Institute for Disarmament Research	0.766	Geneva Centre for Security Policy	0.433	Geneva Centre for Security Policy	0.036
4	Center for a New American Security	0.657	Center for a New American Security	0.431	Stockholm International Peace Research Institute	0.034
5	United Nations Office for Disarmament Affairs	0.615	International Committee of the Red Cross	0.417	International Committee of the Red Cross	0.023
6	Article 36	0.609	Future of Life Institute	0.416	Future of Life Institute	0.019
7	International Committee of the Red Cross	0.597	Article 36	0.414	Johns Hopkins University	0.018
8	Campaign to Stop Killer Robots	0.580	Campaign to Stop Killer Robots	0.411	International Research Center for AI Ethics and Governance, Institute of Automation, Chinese Academy of Sciences	0.017
9	Amnesty International	0.513	Amnesty International	0.408	RAND Corporation	0.015
10	Human Rights Watch	0.510	University of California, Berkeley	0.407	University of California, Berkeley	0.015
11	Future of Life Institute	0.505	United Nations Office for Disarmament Affairs	0.406	Center for Strategic and International Studies	0.014
12	Women's International League for Peace and Freedom	0.502	Johns Hopkins University	0.405	S. Rajaratnam School of International Studies	0.013
13	International Committee for Robot Arms Control	0.481	International Research Center for AI Ethics and Governance, Institute of Automation, Chinese Academy of Sciences	0.403	United Nations Office for Disarmament Affairs	0.013
14	Center for International Security and Strategy, Tsinghua University	0.475	University of Oxford	0.403	Carnegie Endowment for International Peace	0.012
15	European Union	0.463	Human Rights Watch	0.402	Center for International Security and Strategy, Tsinghua University	0.012

remain the most authoritative institutions in underlying research within the epistemic community. However, many institutions have dual or even multiple identities. They engage in both theoretical research and practical application, simultaneously contributing to knowledge production and policy recommendations. The process of constructing these multiple identities varies across regions.

Fourth, the role of Chinese institutions in military AI governance is complex. Their performance varies based on government hosting—universities generally operate more independently, while institutions like CAS rely more on official platforms. Despite strong direct networks, Chinese institutions are less effective than their Western counterparts at influencing information flow and coordinating cooperation. Contrary to expectations, Chinese epistemic community members do not have strong ties with the government. In fact, government support for these players is relatively sparse, limiting their international influence.

Moreover, China's epistemic community actors are less influential on the global stage. In the area of knowledge production and supply, China's role does not match with that of its rapidly advancing AI research. Compared to their Western counterparts, Chinese actors participate less in global knowledge networks, limiting their role in socialising practices. In addition, while Chinese epistemic community players are active in building direct networks, they are weaker in information flow and acting as intermediaries in the global network.

These discrepancies suggest that Chinese institutions face challenges in interdisciplinary knowledge development, international collaboration, and other areas related to military AI, likely due to factors such as sensitivity, specialisation, and language barriers. Although Chinese institutions and scholars are increasingly involved in this field, their scale and visibility lag behind Western institutions. The following sections utilise case studies to explore the different roles and impacts of members within the military AI governance epistemic community.

Epistemic Community in Cases: China and Others

This section presents an analysis of illustrative case studies on the role of the Chinese members of the epistemic community and compares its role with its counterparts in the USA, Europe, the non-Western world, and NGOs. We begin by outlining the overall development of Chinese players and examining how they employ knowledge production and the construction of cooperative mechanisms to engage in global military AI governance. Following this examination, we conduct a comparative analysis between Chinese actors and their counterparts in the USA, Europe, the non-Western world, and NGOs, exploring how Chinese institutions interact with these groups and identifying major differences in knowledge production and the development of cooperative mechanisms in the context of military use of AI.

China's Practices

Chinese institutions have acted as active stakeholders in the network of epistemic communities of military AI governance. Several features characterise their participation and contributions. First, many players from China hold a significant role in terms of their direct connections with other stakeholders. Second, this pattern is especially vivid after we eliminate events or activities organised by governmental actors—representing a relatively low level of coordination between epistemic community players and governmental actors. Third, Chinese actors significantly fall behind their Western counterparts in terms of knowledge production, innovation, and supply.

Since 2018, Chinese experts from research institutes, think tanks, and universities have increased their contribution to international governance of military AI by participating in

Track 2 dialogues and other government-hosted initiatives. For instance, from 2018 to 2019, CACDA and CISS took the leading role in establishing ties with foreign institutions, inviting their peers to several forums and meetings concerning military AI. Beyond the institutional contributions achieved by CACDA and CISS, individual Chinese scholars have also been involved in international discussions on issues related to the military use of AI since 2019.

Regarding knowledge production, Chinese players in the epistemic community do not actively cooperate with international peers in endeavours, such as publishing journal articles on military AI. Much of this collaboration is restricted to the domestic level. The situation is better in terms of research reports and edited volumes,[72] though still limited in terms of scale and magnitude.

Other than publications, Chinese epistemic community members produce knowledge by constructing databases and conducting basic research on issues related to the regulation of military AI. Previously, the Center for Long-Term AI and the International Research Center for AI Ethics and Governance at the CAS created the "Defence AI and Arms Control (DAIAC) Network." This platform displays reports, commentaries, and analyses on the use of AI in defence and arms control.[73] The CAS is the leading developer of the database system. However, members of the DAIAC group derive from various organisations, such as the University of Southern Denmark, the Global AI Ethics Institute, and the University of Cambridge.[74] Recently, a research team at Peking University has been working on a database on the enabling effects and risks of AI's military applications.[75]

A prominent contribution is the "Interim Findings on Artificial Intelligence Terms," published in August 2024 by the CISS Working Group on AI Glossary Research. The report touches upon important and basic terminologies related to critical issues such as autonomy platforms, autonomy technology, human–machine interaction, and command and control.[76] Overall, the development of Chinese players in producing knowledge internationally on military AI for a global audience is still in the early stages of maturation.

Chinese actors play a more active role in constructing cooperative mechanisms compared to involvement in knowledge production. For instance, CACDA is one of the participants that has been proactively constructing cooperative mechanisms with SIPRI, Nuclear Threat Initiative, Atlantic Council, and others.[77] Another top institution in this area is CISS. CISS has constantly facilitated dialogues concerning military AI at both domestic and international levels. Domestically, CISS regularly invited experts from various institutions such

[72] Experts from certain Chinese institutions contributed to edited volumes organised by think tanks and research institutions in the USA and European countries, for further information please see Lora Saalman, ed., *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk, Volume II, East Asian Perspectives*, October 2019, https://www.sipri.org/publications/2019/research-reports/impact-artificial-intelligence-strategic-stability-and-nuclear-risk-volume-ii-east-asian; Patricia M. Kim, ed., *Enhancing US-China Strategic Stability in an Era of Strategic Competition*, April 2021, https://www.usip.org/events/enhancing-us-china-strategic-stability-era-strategic-competition#:~:text = Enhancing%20strategic%20stability%20by%20lowering%20the%20risks%20of, that%20the%20United%20States%20and%20China%20can%20com.

[73] Defence AI and Arms Control Network, "About Defence AI and Arms Control Network," http://www.defence-ai-and-arms-control.network/about/.

[74] Defence AI and Arms Control Network, "Defence AI and Arms Control (DAIAC) Expert Group," http://www.defence-ai-and-arms-control.network/expert_group/.

[75] PKU Analytics Lab for Global Risk Politics, "The First 'Artificial Intelligence and Chinese International Relations Studies' Joint Laboratory Forum Was Successfully Held," https://riskalab.pku.edu.cn/news/380 271.htm.

[76] CISS Working Group on AI Glossary Research, "Interim Findings on Artificial Intelligence Terms," *International Security and Strategy Report* 2024, No. 2, https://ciss.tsinghua.edu.cn/info/eyjdt/7404.

[77] Center for International Security and Strategy, "The Eighth World Peace Forum 'International Security' Panel Discussion," http://ciss.tsinghua.edu.cn/info/rgzn_yjdt/5585; Guancha Net, "AI Governance Was Discussed in the Eighth World Peace Forum," https://www.guancha.cn/ChanJing/2019_07_12_509241.shtml; Huanqiu, "The Sixteenth Arms Control Seminar Will Be Organized at Shenzhen," https://mil.huanqiu.com/article/7QLEIO3Ouli; CACDA, "The First International Collaboration on AI seminar," http://www.cacda.org.cn/a/xiehuihuodong/20 190 710/4135.html.

as CICIR, CACDA, National University of Defense Technology (NUDT), Peking University, Beijing University of Posts and Telecommunications, and Renmin University of China to discuss issues about AI's impact on security and strategic stability.[78] Internationally, CISS has initiated China–U.S. and China–Europe Track 2 Dialogue with leading institutions from the USA and European countries. This initiative has encountered several setbacks over the past few years. However, thanks to the efforts and perseverance of both sides, it has overcome the most challenging period and started delivering concrete results, providing support for the Track 2 dialogue between China and the USA.

In addition to CISS, Chinese epistemic community members have become active participants in cooperative mechanisms developed by other countries. Experts from Peking University, Tsinghua University, and Carnegie China joined the Normandy P5 Initiative—organised by GCSP and Strategic Foresight Group—to discuss AI in nuclear command and control with experts from the USA, UK, Russia, and France during the 2022–23 period.[79] In 2023, an expert from CAS participated in the REAIM Summit and the United Nations Security Council session on AI and international security.[80] In 2024, a delegation of Chinese experts acquired a more prominent standing at REAIM. These combined efforts underscore the growing function of Chinese players in facilitating conversations with various stakeholders beyond academia.

In short, the involvement of Chinese members of the epistemic community in producing knowledge and building cooperative mechanisms has increased since 2018. The role of Chinese players as a source of knowledge production on the governance of military AI remains nascent. The community has also demonstrated increased proactivity in developing cooperative mechanisms with stakeholders.

Our analysis also reveals varying levels of activity among Chinese institutions and their engagement with different stakeholders, as shown by a comparative case analysis of the CAS and CISS. CAS has significantly influenced knowledge production, mainly through its contributions to AI defence databases. It regularly engages with governmental institutions and IGOs, as evidenced by its participation in the REAIM Summit and the 2023 UN Security Council meeting. In contrast, CISS has played a key role in building cooperative networks domestically and internationally, facilitating discussions among scholars and experts from leading American and Chinese institutions on AI and international security. Business representatives, including those from Anthropic, have also participated in CISS and Brookings-led dialogues.[81]

This comparison highlights varying development patterns between government-affiliated and non-governmental institutions. Government-affiliated research institutions, like CAS, often have more connections with foreign governments and IGOs, while university like CISS exhibit limited stakeholder engagement, restricting their influence on multilateral platforms. A general gap exists in the depth and width of the engagement network among diverse

[78] CISS, "CISS Organised the Third AI and International Security Project Seminar," https://ciss.tsinghua.edu.cn/info/yw/5739; CISS, "CISS Organised the Second AI and International Security Project Seminar," https://ciss.tsinghua.edu.cn/info/yw/5657; CISS, "The 53rd Session of the Strategy and Security Forum—Seminar on Artificial Intelligence and International Security," https://ciss.tsinghua.edu.cn/info/yw/5435; CISS, "CISS Organised AI and International Security Project Seminar," https://ciss.tsinghua.edu.cn/info/yw/4034.

[79] Strategic Foresight Group, "P5 Experts' Roundtable on Nuclear Risk Reduction- Co-Convenors' Summary," https://www.strategicforesight.com/conference_pdf/Geneva%20Roundtable%20Report.pdf; Strategic Foresight Group, "Report on Roundtable on Global Security and Catastrophic Risks," https://www.strategicforesight.com/conference_pdf/Report%20on%20RT%20revised.pdf.

[80] Government of the Netherlands, "Explore the REAIM 2023 Programme," https://reaim2023.org/programme/#programme; United Nations, "International Community Must Urgently Confront New Reality of Generative, Artificial Intelligence, Speakers Stress as Security Council Debates Risks, Rewards," https://press.un.org/en/2023/sc15359.doc.htm.

[81] CISS, "CISS Organized the Eighth Round of China-U.S. Artificial Intelligence and International Security Dialogue," http://ciss.tsinghua.edu.cn/info/yw/6488.

stakeholders beyond academia. This shortfall will be explored in our comparative analysis with community members from other countries.

US and European Actors

Members of the US and European epistemic community have actively participated in the global governance of military AI. Since 2014, many American and European think tanks, universities, and research institutes, such as SIPRI, GCSP, German Institute for International and Security Affairs, the Royal United Services Institute (RUSI), the International Institute for Strategic Studies (IISS), CNAS, Yale University, and the University of California, Berkeley, have taken part in UN CCW meetings of experts on lethal autonomous systems (a discussion platform that shifted to the Group of Governmental Experts on lethal autonomous weapons in 2018).[82] These consistent appearances underline the widely respected expertise of American and European epistemic community members in military use of AI and disputes over autonomy.

The interactions between Chinese and American members of the epistemic community on military AI governance have steadily grown since 2018. In that year, experts from American think tanks such as CNAS and the EastWest Institute participated in the "Artificial Intelligence and the Evolution of Warfare" panel discussion at the eighth Beijing Xiangshan Forum.[83] Subsequently, experts from various American think tanks and universities participated in the CISS-Brookings-led "China-U.S. Track 2 Dialogue on AI and International Security" in the past few years, such as CNAS, the Brookings Institution, the Freeman Spogli Institute for International Studies at Stanford University, the Hoover Institution, the Stanford Institute for Human-Centered Artificial Intelligence, MIT, and the Berggruen Institute.[84]

Beyond the CISS-Brookings dialogue, Chinese and American experts have used international conferences to discuss the risks of military AI and its impact on international security. For example, at the International AI Cooperation and Governance Forum—organised by Tsinghua University—a CNAS expert joined Chinese scholars from Tsinghua University and CACDA to explore AI's impacts on strategic stability.[85] These collaborations show that Chinese and American players have successfully built cooperative mechanisms, particularly through Track 2 dialogues and multilateral conferences. However, cooperation in knowledge production remains limited, aside from contributions to edited volumes and efforts to standardise AI terminology during the CISS-Brookings-led Track 2 Dialogue.

Compared to the Chinese institutions, the US counterparts are more active in producing and diffusing knowledge related to military AI activities at both the domestic and international levels. On the Chinese side, there are very few cases of collaboration with international peers in publishing articles on the regulation of military AI; most publishing

[82] Please see list of attendee in UN CCW meetings from 2014–2024 in Chairperson of the Meeting of Experts, *Report of the 2014 informal Meeting of Experts on Lethal Autonomous Weapons Systems (LAWS)*, Geneva, June 2014, p. 2; United Nations Office of Disarmament Affairs, "Convention on Certain Conventional Weapons-Informal Meeting of Experts (2015)," https://meetings.unoda.org/meeting/29 748/statements?f%5B0%5D = author_type_statements_%3ANon-governmental%20organization; Chairperson of the Informal Meeting of Experts, *Report of the 2016 Informal Meeting of Experts on Lethal Autonomous Weapons System (LAWS)(Advanced Version)*, 2016, p. 2 ; Group of Governmental Experts of the High Contracting Parties to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects, *Report of the 2017 Group of Governmental Experts on Lethal Autonomous Weapons Systems*, Geneva, 2017, p. 2; Group of Governmental Experts on Emerging Technologies in the Area of Lethal Autonomous Weapons Systems, *List of participants*, November 2019, pp. 23–9.

[83] Xiangshan Forum, "The 8th Beijing Xiangshan Forum," https://xiangshanforum.org.cn/agenda.html?sessions = %E7%AC%AC%E5%85%AB%E5%B1%8A%E5%8C%97%E4%BA%AC%E9%A6%99%E5%B1%B1%E8%AE%BA%E5%9D%9B&code = 9f0SSShAADB58ghh&titleen = The%208th%20Beijing%20Xiangshan%20Forum.

[84] CISS, "CISS Organised China-U.S. Artificial Intelligence and International Security Dialogue," http://ciss.tsinghua.edu.cn/info/rgzn_yjdt/5554.

[85] CISS, "CISS Organised Thematic Seminar Artificial Intelligence and International Security," https://ciss.tsinghua.edu.cn/info/rgzn_yjdt/5548.

collaborations remain confined to the domestic sphere. In contrast, American institutions regularly collaborate with international peers in publishing articles related to AI-enabled technology in combat and lethal autonomous weapons systems.[86]

Regarding building cooperative mechanisms, both Chinese and American institutions utilise Track 2 dialogues and conferences to engage stakeholders in discussions; the key difference is the types of stakeholders involved. As noted earlier, regime-based argumentation, though overly dichotomous, captures certain distinctions between different players. There is no evidence that Chinese members of the epistemic community engage the government and the People's Liberation Army (PLA) in the governance of military AI. In contrast, American players are more influential in the perceptions of civilian and military officials as well as congressional members on the military use of AI. For instance, researchers from CNAS frequently present their views through congressional testimony or policy commentary, particularly on autonomous weapon policy.[87] Apart from CNAS, experts from the Center for Strategic and International Studies (CSIS) hold regular dialogue with officials from Chief Digital and Artificial Intelligence and DARPA,[88] the departments primarily responsible for coordinating AI adoption across sectors. It is clear that the practices of the epistemic community in China still lag behind American counterparts in both contributing knowledge and developing robust cooperative mechanisms that include stakeholders at the policymaking level.

Compared to European epistemic community members, Chinese institutions have gradually engaged with SIPRI and GCSP between 2018 and 2019. CACDA is one of the most prominent Chinese institutions to have connected with European institutions. In 2019, CACDA participated in the workshop "Mapping the Impact of Machine Learning and Autonomy on Strategic Stability and Nuclear Risk," hosted by SIPRI and the EastWest Institute.[89] In the same year, CACDA co-organised a seminar on international AI cooperation with the Centre for Humanitarian Dialogue (HD). This event brought together experts from Chinese institutions such as NUDT and China Institute of International Studies (CIIS) for discussions.[90] In recent years, CISS and HD co-organised a series of "China-EU Dialogue on AI and International Security" talks that gathered experts from prestigious universities in China and European countries, including Peking University, Tsinghua University, SIPRI, and Leiden University, among others. Throughout these dialogues, Chinese and European experts addressed critical issues, including the integration of AI in command and control and factors leading to inadvertent escalation.[91]

[86] For instance, Jonathan Moreno et al., "The Ethics of AI-Assisted Warfighter Enhancement Research and Experimentation: Historical Perspectives and Ethical Challenges," *Frontiers in Big Data*, Vol. 5, No. 9 (2022), pp. 1–11; Noreen Herzfeld and Robert H. Latiff, "Can Lethal Autonomous Weapons Be Just," *A Journal of Social Justice*, Vol. 33, No. 2 (2021), pp. 213–9.

[87] Paul Scharre, "Preserving U.S. Military Advantage Amid Rapid Technological Change," CNAS, 12 March 2024, https://www.cnas.org/publications/congressional-testimony/preserving-u-s-military-advantage-amid-rapid-technological-change; Paul Scharre, "NOTEWORTHY: DoD Autonomous Weapons Policy," CNAS, 6 February 2023, https://www.cnas.org/press/press-note/noteworthy-dod-autonomous-weapons-policy.

[88] CSIS, "The DARPA Perspective on AI and Autonomy at the DOD," 27 March 2024, https://www.csis.org/events/darpa-perspective-ai-and-autonomy-dod; CSIS, "Scaling AI-Enabled Capabilities at the DOD: Government and Industry Perspectives," 28 March 2024, https://www.csis.org/analysis/scaling-ai-enabled-capabilities-dod-government-and-industry-perspectives; CSIS, "AI Transformation at the DOD: A Conversation with Chief Digital and AI Officer, Dr. Radha Plumb," 15 July 2024, https://www.csis.org/analysis/ai-transformation-dod-conversation-chief-digital-and-ai-officer-dr-radha-plumb.

[89] SIPRI, "SIPRI Co-Hosts Workshop in New York on Impact of Emerging Technologies on Nuclear Risk," 10 May 2019, https://www.sipri.org/news/2019/sipri-co-hosts-workshop-new-york-impact-emerging-technologies-nuclear-risk; CACDA, "AI Impacts on Strategic Stability and Nuclear Risk," http://www.cacda.org.cn/a/xiehuihuodong/20191230/4165.html.

[90] CACDA, "The Second International Cooperation on AI Governance," 23 December 2019, http://www.cacda.org.cn/a/xiehuihuodong/20191223/4163.html.

[91] CISS, "CISS and HD Hold the Second Round of China-EU Dialogue on Artificial Intelligence and International Security," 20 May 2024, https://ciss.tsinghua.edu.cn/info/event/7188.

Similar to their American counterparts, European institutions are more active in producing knowledge at both regional and transnational levels. Experts from many European institutions have deep connections with peers from other countries through publishing journal articles, such as those from the Center for War Studies at the University of Southern Denmark, the University of Turin, University of Oxford, and SIPRI. In fact, SIPRI led efforts to continuously coordinate experts from the USA, China, Russia, South Korea, Japan, India, Sri Lanka, Pakistan, and other European countries in producing a series of reports on the impact of AI on strategic stability and nuclear risk from Euro-Atlantic, East Asian, and South Asian perspectives.[92]

Chinese and European players differ in how they develop cooperative mechanisms, particularly in their interactions with stakeholders. European research institutes are more inclined than their Chinese counterparts to involve representatives from IGOs in discussions or to collaborate with them on shaping the governance of military AI. For instance, SIPRI has collaborated with the United Nations Office of Disarmament Affairs (UNODA) to initiate capacity-building workshops on "Responsible AI for Peace and Security," bringing together participants from 17 countries to explore how AI research and innovation can contribute to peace and security. The workshop continued in 2024 with participants from 13 countries, examining the role of AI research and innovation in promoting peace and security.[93] Conversely, there is no identifiable evidence of concrete cooperation between Chinese members of the epistemic community and IGOs. To conclude, European institutions possess broader connections than their Chinese counterparts in presenting ideas and initiating cooperative mechanisms on issues related to the governance of military AI.

Non-Western Institutions

Chinese players of the epistemic community have interacted with experts from the Russian Federation, Asia, Latin America, and Africa since 2018 by participating in initiatives such as the "Artificial Intelligence and the Evolution of Warfare" panel discussion at the eighth Beijing Xiangshan Forum. The panel discussions featured experts from the Russian Academy of Sciences, the Ocean Policy Research Institute in Japan, the Bangladesh Institute of Peace and Security Studies, and others.[94] This marked a significant step for Chinese experts in connecting with their non-Western counterparts on military AI-related issues.

Since 2018, the number of academics from non-Western countries participating in related forums or dialogues organised by Chinese institutions has steadily increased, particularly during the 2020–22 period. Several representatives from research institutes in Japan, ASEAN countries, and the Russian Federation have participated in AI and international security-related panel discussions at the International AI Cooperation and Governance Forum in 2021 and 2022, organised by Tsinghua University.[95]

Overall, the interaction between Chinese and non-Western players in governing military AI takes place at international conferences. However, Chinese experts seldom participated in

[92] Vincent Boulanin, ed., *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk, Volume I, Euro-Atlantic perspectives*, SIPRI, May 2019, https://www.sipri.org/publications/2019/research-reports/impact-artificial-intelligence-strategic-stability-and-nuclear-risk-volume-i-euro-atlantic; Lora Saalman, ed., *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk, Volume II, East Asian Perspectives*, October 2019, https://www.sipri.org/publications/2019/research-reports/impact-artificial-intelligence-strategic-stability-and-nuclear-risk-volume-ii-east-asian; Dr Petr Topychkanov, ed., *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk, Volume III, South Asian Perspective*, April 2020, https://www.sipri.org/publications/2020/research-reports/impact-artificial-intelligence-strategic-stability-and-nuclear-risk-volume-iii-south-asian.

[93] SIPRI, "SIPRI and UNODA Engage with Next Generation of AI Practitioners," 28 November 2023, https://www.sipri.org/news/2023/sipri-and-unoda-engage-next-generation-ai-practitioners.

[94] Xiangshan Forum, "The 8th Beijing Xiangshan Forum," https://xiangshanforum.org.cn/agenda.html?sessions = %E7%AC%AC%E5%85%AB%E5%B1%8A%E5%8C%97%E4%BA%AC%E9%A6%99%E5%B1%B1%E8%AE%BA%E5%9D%9B&code = 9f0SSShAADB58ghh&titleen = The%208th%20Beijing%20Xiangshan%20Forum.

[95] I-AIIG, "Conference Agenda," 2021, https://aiig.tsinghua.edu.cn/gjlt/n2021/ltyc.htm; I-AIIG, "Conference Agenda," 2022, https://aiig.tsinghua.edu.cn/gjlt/a2022/gylt.htm.

dialogues hosted by non-Western institutions compared to their participation in platforms led by American or European institutes. While Chinese experts have attended military AI-related conferences such as those organised by the RSIS in Singapore and GCSP,[96] similar instances remain relatively rare.

RSIS is one of the most influential non-Western academic institutions and think tanks, making notable contributions to governing military AI through research and the development of cooperative mechanisms. In terms of knowledge production, RSIS publishes related analyses more frequently and encourages scholars from other institutions to contribute commentaries on the military application of AI-related topics on its platforms.[97] Furthermore, RSIS invited experts from the USA, China, Russia, Switzerland, Japan, and Australia to collaborate on publishing academic works, such as one of the earliest edited volumes on the relevant topics, *The AI Wave in Defence Innovation: Assessing Military Artificial Intelligence Strategies, Capabilities, and Trajectories*.[98] These collaborations provide valuable insights into the development of military use of AI in different countries. However, no significant evidence indicates similar efforts among Chinese actors. RSIS is more active in producing knowledge on military AI-related issues, particularly through an ASEAN lens.

With regard to the development of cooperative mechanisms, RSIS and Chinese counterparts vary significantly in the nature of their platforms and the stakeholders involved. RSIS uses Track 1.5 dialogues as the primary cooperative mechanism to connect with various stakeholders. In addition to the RSIS AI conference in 2021 mentioned above, RSIS held a Track 1.5 conference titled "Beyond Nuclear: Disruptive Technologies and Strategic Stability in the 21st Century," which examined the impact of AI on strategic stability.[99] These events demonstrate RSIS's strong capacity to bring together diverse stakeholders, especially representatives from the governmental institutions and defence organisations. The Chinese case differs significantly, as Track 1.5 dialogue is rarely used. Participation from defence organisations is also minimal; initiatives like the Beijing Xiangshan Forum invite experts from academia and defence organisations worldwide to discuss crucial security challenges, including AI's military applications, but these conferences are government-led.

NGOs and TANs

NGOs and TANs play a critical role in shaping the discourse on LAWS. Since 2013, various NGOs and TANs have actively contributed their perspectives on definitions, human oversight, and preventative prohibition strategies within the UN CCW and the GGE on LAWS frameworks. CSKR and other TANs have employed diverse campaign strategies and social media platforms to educate the public and raise awareness about the dangers of "killer robots." These efforts have been controversial, with critics arguing that they

[96] The event mentioned was the 2021 RSIS AI Conference, which featured a panel discussion on AI-related military topics with experts from the Swiss Department of Defence, Peking University, the Center for Global Studies & International Relations at the Diplomatic Academy of the Ministry of Foreign Affairs of the Russian Federation, and the German Federal Ministry of Defence, please see further details published by RSIS official social media outlet: https://www.facebook.com/photo.php?fbid=10157542771831059&id=276015381058&set=a.380387876058&locale=hi_IN; Regarding relevant events organised by GCSP, please see GCSP, "P5 Experts' Roundtable on Nuclear Risk Reduction – Co-Convenors' Summary," https://www.gcsp.ch/global-insights/p5-experts-roundtable-nuclear-risk-reduction-co-convenors-summary.

[97] Andrea Gili and Mauro Gili, *Artificial Intelligence and Arms Control: What it Means for Singapore*, RSIS Commentaries No. 200, 2020.

[98] Michael Raska and Richard A. Bitzinger, eds., *The AI Wave in Defence Innovation: Assessing Military Artificial Intelligence Strategies, Capabilities, and Trajectories* (London: Routledge, 2023).

[99] Manoj Harjani, "Beyond Nuclear: Disruptive Technologies and Strategic Stability in the 21st Century," RSIS, 21 November 2023, https://www.rsis.edu.sg/rsis-event-article/rsis/beyond-nuclear-disruptive-technologies-and-strategic-stability-in-the-21st-century.

resemble science fiction more than reality, particularly regarding the use of AI in military operations.[100]

Chinese institutions rarely engage with NGOs and TANs in knowledge production or building cooperative mechanisms. NGOs and TANs typically collaborate more closely with European partners and IGOs.[101]

Chinese players of epistemic communities and NGOs or TANs also differ in their contributions to the global governance of military AI. While NGOs and TANs focus on raising global awareness of the dangers posed by lethal autonomous weapon systems, Chinese institutions contribute through domestic publishing collaborations. NGOs and TANs leverage the UN CCW as a key platform to expand their networks and influence. In contrast, Chinese players participate in Track 2 dialogues, conferences, and forums to connect with international partners.

Net Assessment of Structural Differences and Collective Practices

Through case comparisons, we can explore the roles that epistemic communities play in military AI governance and the differences among various institutions using a structure-practice approach. In the socialising and functional aspects of practices, the differences among actors within the epistemic community exhibit more complex characteristics. As previously mentioned, the differences between countries and among actors still exert influence. The epistemic community is far from indispensable, as government-led efforts and transnational mechanisms make critical differences in certain areas.

China's state-guided political-economic system means the autonomy of institutions within the epistemic community is necessarily limited. Chinese institutions have significant direct connections within their domestic networks, but they are less effective in influencing international information flows, especially compared to US and European actors. The more decentralised and open regimes of Western countries allow for greater independence of epistemic community members from government control, enabling them to play more active roles as intermediaries and shape global discourses.

An interesting dynamic emerges when the government's role is included. In cases where government-hosted initiatives dominate the agenda, Western institutions exhibit more active and influential roles. In contrast, China's institutions demonstrate a more effective and autonomous performance when government involvement is minimised. Chinese academic institutions and think tanks excel in environments where they can engage in transnational cooperation, academic research, or Track 2 dialogues without direct state oversight. This autonomy enables them to engage more freely with international counterparts, participate in knowledge-sharing activities, and contribute to global governance discussions on military AI. This contrast underscores an important fact—while Western institutions may rely on government affiliations to maintain their influence in policy-heavy environments, Chinese institutions perform comparatively better in less state-controlled settings, where socialising practices and functional collaboration come to the forefront.

Chinese institutions often function with dual identities, balancing state-directed goals with the ability to engage in international cooperation. While their institutional attributes

[100] Hitoshi Nasu and Colonel Christopher Korpela, "Stop the 'Stop the Killer Robot' Debate: Why We Need Artificial Intelligence in Future Battlefields," Council on Foreign Relations, 21 June 2022, https://www.cfr.org/blog/stop-stop-killer-robot-debate-why-we-need-artificial-intelligence-future-battlefields.

[101] Many European think tanks frequently invite representatives from NGOs or TANs to participate in conferences on military AI. For instance, the P5 Nuclear Risk Reduction Initiative, organised by GCSP, includes representatives from various TANs. See Strategic Foresight Group, "P5 Experts' Roundtable on Nuclear Risk Reduction- Co-Convenors' Summary," https://www.strategicforesight.com/conference_pdf/Geneva%20Roundtable%20Report.pdf.

reflect stronger government affiliations, these organisations play a significant role in shaping global norms through practices such as knowledge production, cross-border collaboration, and agenda-setting in the field of military AI. These practices allow Chinese actors to transcend certain limitations imposed by their structural conditions and forge meaningful links with US, European, and other international actors. Their contributions to knowledge production, while smaller in volume, reflect their ongoing integration into the collective-practice-based network.

Chinese actors' immersion in collective practices makes them not just passive recipients of global norms but active partners in shaping and negotiating those norms alongside other epistemic community members. This immersion allows Chinese institutions to engage meaningfully with their international counterparts, contributing to shared norms and governance frameworks.

While structural factors such as regime type and institutional attributes undeniably play a role in shaping the behaviour of epistemic community members, it is socialisation and functional participation in collective practices that enable Chinese actors to contribute and influence global military AI governance. Structural factors may set the initial conditions for how Chinese actors participate in global epistemic communities. The socialising and functional practices they engage in serve as critical mechanisms that allow Chinese and other international actors to be better integrated into a collective-practice-based community. These practices foster a sense of shared identity and mutual understanding, enabling actors from different regimes and institutions to collaborate on common governance goals despite structural differences. This community is a space for collaboration and for building a shared foundation of governance practices, where Chinese actors are increasingly immersed alongside their global peers, contributing to military AI governance in a meaningful and evolving manner.

On the collective practice side, Chinese epistemic community members have increased their presence in the area of military AI governance by developing cooperative mechanisms. This effort highlights how dialogue has become a means for the Chinese military AI community to expand its influence on the global governance of military AI. While building cooperative mechanisms is the primary approach for many Chinese players, differences exist in the channels used and the stakeholders involved. Most interactions between Chinese experts and their international counterparts occur through Track 2 dialogues or academic conferences, with Track 1.5 dialogues being less commonly used to involve a broader range of participants. When comparing this approach with that of the USA, Europe, Singapore, and various NGOs, Chinese experts tend to engage more with think tanks and research institutes from the USA and Europe rather than collaborating with non-Western counterparts, including those in Singapore. This indicates that Chinese institutions place a stronger emphasis on building relationships with Western institutions in their efforts to influence the governance of AI's military applications. Moreover, compared to the USA, Europe, and Singapore, there is infrequent communication between Chinese academia and defence organisations in the field of military AI. This lack of interaction presents a challenge for Chinese academics in expanding their influence on policymakers when it comes to the use of AI in military contexts.

Linking both SNA and case analyses, we use different centrality measures to illustrate Chinese institutions' relative performance and contribution. Measuring and comparing the level of activity and influence allows us to have a clearer picture of where different community players stand in the current landscape of military AI governance.

We use the ranking results of degree centrality to compare the level of activity. Degree centrality measures the direct connections of nodes in a network, indicating their direct interactions with others. We also employ closeness and betweenness centrality to evaluate

Table 7. Interactions and Comparisons between Chinese Members of the Epistemic Community and Others

Actor	Overview of Ongoing Interactions with China	Comparison with China in Socialising Practice (Higher or Lower Than China in Terms of Activity and Influence)	Comparison with China in Functional Practice (Higher or Lower Than China in Terms of Activity and Influence)
USA	• Track 2 Dialogue • Academic conferences • Multilateral conferences[a] • Publishing collaborations	• Activity: higher • Influence: higher	• Activity: higher • Influence: higher
Europe	• Track 2 Dialogue • Academic conferences • Multilateral conferences • Publishing collaborations • Database construction[71]	• Activity: higher • Influence: higher	• Activity: higher • Influence: higher
Non-Western	• Academic Conferences • Track 1.5 Dialogues	• Activity: higher • Influence: higher	• Activity: lower • Influence: lower
NGOs and TANs	• No clear evidence indicating concrete cooperation	• Activity: higher • Influence: similar	• Activity: higher • Influence: lower

[a]Multilateral conference refers to a conference hosted by governments or IGOs, such as REAIM and AI Safety Summit.

different players' influence. Closeness measures influence reachability and efficiency, showing how easily a node can interact with or disseminate information to others across the network. Betweenness assesses a node's potential to control or mediate, indicating a player's capability to influence the important pathways and act as an intermediary among partners. These two metrics can effectively measure an actor's influence.

Regarding the level of activity and influence of China's players, we observe the formation of a more diverse governance environment. As shown in Table 7, Chinese actors are increasingly participating in the military AI governance process. Nonetheless, compared to their American and European counterparts, these players have a limited role in terms of both activity and influence. In both socialising and functional practices, Chinese players hold secondary positions on the global stage. Only in the case of constructing cooperative mechanisms and compared with non-Western countries or NGOs/TANs have Chinese members of the epistemic community demonstrated influence. Apart from individual cases, China's interaction with the rest of the world remains in its early stages. We believe that the global participation and contribution of China's players hold great potential and adaptability, but the process has a long way to go.

[71] As of October 2024, the only cooperative effort between Chinese and Western epistemic communities in military AI is the construction of the AI Defence and Arms Control Database, led by the Chinese Academy of Sciences.

Conclusion

This article explores how the epistemic community participates in and influences the trajectory of global governance of AI's military applications, with a particular focus on the role of the Chinese members of the epistemic community over the past decade. Epistemic community members have socialising and functional practices as the primary mechanisms through which they influence and shape not only governance but also one another. This article employs social network analysis and case studies to examine the development patterns of academic and policy collaboration on military AI-related issues among different players in the epistemic community. This analysis connects structural with practice factors. It also elucidates the differences in roles and influence of various countries' institutions within the global epistemic community. Our findings indicate a fragmented yet steadily growing global academic and policy collaboration in this field.

Research institutions and other players in Western networks exhibit significant influence in coordinating multinational academic and policy efforts to produce and disseminate military AI-related knowledge and develop robust cooperative mechanisms. Certain players actively seek to influence defence organisations' perceptions of AI's impact on future warfare and potential pathways for arms control. The major players in this network have established strong ties with both governments and IGOs to promote a more robust regime of AI governance.

China, a key player in AI development, has also developed a network of expertise and has linked this network to the global epistemic community. While many Chinese institutions have sought to foster connections with international counterparts, the influence of these players remains limited. Most participants in cooperative mechanisms led by Chinese institutions are from the academic sector, with some representation from the business sector. Their participation from IGOs and defence organisations is less active compared to their Western or Singaporean counterparts. Our analysis suggests that Chinese institutions are more inclined to participate in dialogues or conferences organised by the USA or European countries rather than those led by non-Western nations. Limited engagement with defence organisations and the non-Western world is a critical area for improvement if Chinese epistemic community aims to position itself as a bridge in global military AI collaboration.

In addition, China's role in global governance, particularly the interactions between the epistemic community and the government, needs strengthening. How China's players in the epistemic community can align with the government's global governance objectives and strengthen their international voice and influence remains an ongoing challenge.

This study has revealed some new dimensions that have not yet been addressed in the existing research. Certain findings deserve more focused exploration, such as the impact of different communication platforms on the influence of specific players. This research underscores the existing gaps and limitations that hinder the Chinese player's participation and contribution to global governance of AI's military applications. Considering the uncertainties, complexities, and risks associated with technological advancement and its strategic and military impact, the world requires an active and effective epistemic community, with China being an indispensable stakeholder.

Conflict of interest statement None declared.

Appendix

Table A.1 SNA Glossary Table

Key Term	Definition	Significance
Degree Centrality	• Degree centrality measures the number of direct connections a node has within a network. It counts the adjacent nodes linked to a specific node, reflecting its level of direct communication activity. A higher degree indicates that the node is regarded as more central within the network.[102]	• Degree centrality looks at the number of direct connections a node has. It does not consider where that node sits within the broader network or the node's potential to control the flow of information.[103]
Closeness Centrality	• Closeness centrality assesses how close a node is to all other nodes in the network based on the shortest paths, or geodesics that connect them. A node is considered more central if it can reach other nodes with fewer intermediary steps, effectively minimising the distance to them.[104]	• Nodes with a high degree of centrality are recognised for their numerous direct connections. They may not always offer efficient pathways to others in the network. Unlike betweenness centrality, which assesses a node's influence in controlling information flow, closeness centrality primarily emphasises the speed of information dissemination rather than the potential for exerting control.[105]
Betweenness Centrality	• Betweenness centrality measures the extent to which a node lies on the shortest paths (geodesics) between other nodes in a network. It indicates the node's potential to control communication and influence the flow of information within the network. A node with high betweenness centrality acts as a bridge or intermediary, connecting disparate groups and facilitating communication between them.[106]	• In contrast to degree and closeness centrality, betweenness centrality offers a deeper understanding of a node's ability to control the flow of information and resources within a network. While degree centrality counts direct connections and closeness centrality emphasises the efficiency of communication, betweenness centrality reveals how nodes serve as crucial links between others. This positioning allows them to influence the distribution of resources and information throughout the network.[107]
Network Density	• Network density refers to the proportion of potential connections in a network that are actual connections. It is calculated by dividing the number of edges in the network by the number of possible edges between nodes. The higher the density, the more interconnected the nodes are.[108]	• While density provides a broad overview of connectivity across the entire network, the clustering coefficient gives a more nuanced picture of local interactions. Specifically, it notes that in many large networks, there can be a high degree of clustering (indicating that friends of friends are also friends) alongside relatively short average distances between nodes.[109]

(continued)

[102] Freeman, "Centrality in Social Networks," pp. 220–1.
[103] Ibid., p. 221.
[104] Ibid., pp. 224–5.
[105] Ibid., pp. 225–6.
[106] Ibid., p. 222.
[107] Freeman, "Centrality in Social Networks," pp. 222–3.
[108] Imai, *Quantitative Social Science*, p. 239.
[109] Hanneman and Riddle, "Concepts and Measures for Basic Network Analysis," pp. 346–7.

Table A.1 (Continued)

Key Term	Definition	Significance
Network Clustering Co-efficient	• The clustering coefficient measures the degree to which nodes in a graph tend to cluster together. It is calculated by examining the local neighbourhood of an actor (node), which consists of all actors directly connected to that node. The density of this neighbourhood is then calculated, and the clustering coefficient is determined as the average density of all neighbourhoods in the entire graph.[110]	
Network average shortest path	• The average shortest path in a network refers to the mean length of the shortest paths (geodesic distances) connecting all pairs of nodes. This measurement indicates how efficiently information can travel through the network, highlighting the average distance between nodes.[111]	• A shorter average shortest path suggests that the network is more interconnected, allowing for faster communication and information diffusion among its members.[112]
Network nodes	• In network analysis, nodes represent the actors within the network. These actors can be individuals, organisations, or states.[113]	• The behaviour of nodes is not independent. It is influenced by the ties that connect them to other nodes. This interdependence shapes both cooperation and competition within the network.[114]
Network ties(edges)	• Ties are the links between actors in the network. These links can facilitate the exchange of tangible and intangible resources, including materials, norms, and beliefs.[115] • The number of ties an individual has can significantly influence their social capital and access to information.[116]	• The number of ties measures direct connections but does not provide further insights into the dynamics within the network compared to density or clustering coefficient.

[110] Hanneman and Riddle, "Concepts and Measures for Basic Network Analysis," pp. 345–7.
[111] Ibid., p. 358.
[112] Ibid., p. 359.
[113] Hafner-Burton et al., "Network Analysis for International Relations," p. 563.
[114] Hafner-Burton et al., "Network Analysis for International Relations," pp. 562–3.
[115] Ibid., p. 562.
[116] Hanneman and Riddle, "Concepts and Measures for Basic Network Analysis," p. 225.

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