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FROM DETERRENCE TO DISRUPTION: INTERROGATING THE ROLE OF ARTIFICIAL INTELLIGENCE IN CHALLENGING TRADITIONAL ARMS CONTROL PARADIGMS IN MODERN WARFARE

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ABSTRACT

The advent of artificial intelligence (AI) has disrupted traditional arms control paradigms, established in the 20th century. The development of autonomous and automated weapons has transformed the conduct of warfare, challenging the international arms regime. This research investigates the impact of AI on traditional arms control paradigms, its implications for deterrence strategies, and opportunities for international cooperation in addressing the weaponization of AI. Using a consequentialism and deterrence theoretical framework, this exploratory study analyses secondary data from peer-reviewed articles and books. A systematic thematic review methodology was employed to examine the interplay between consequentialist frameworks, arms control measures, and deterrence of violence in the international system. The findings reveal significant risks and opportunities associated with AI deployment in weaponry. This study concludes that existing arms control paradigms must be adapted to accommodate AI and its implications for modern warfare, highlighting the need for international cooperation in establishing frameworks to address these emerging challenges.

KEYWORDS: Artificial Intelligence, Traditional Arms Control, Modern Warfare, War.

1. INTRODUCTION

The evolution of technology has led to divergent manifestations across numerous fields of endeavour. The impact of technology on weapons development and warfare could be traced from the evolution from using sticks and swords to the discovery of gunpowder and the use of firearms. Innovation in the field of technology also impacted defence and military industries, leading to the development of more advanced weapons such as bombs and nuclear weapons.

This was witnessed at the end of the Second World War, which evolved the conduct of warfare across the globe. Increased technical advancements in weaponisation led to the space and arms races, which characterised the Cold War era, a period marked by extreme volatility in the international system. Since the disintegration of the Soviet Union, global efforts at maintaining the international peace architecture have incorporated various strategies to ensure compliance and prevent another cold war (Osimen, Fulani, Chidozie & Dada, 2024).

However, the emergence of Artificial Intelligence (AI) has led to the development of novel technologies in the field. AI is a new technology that incorporates big data, large language learning models and advanced algorithms to perform tasks previously considered exclusive to humans. The AI wave has led to increased funding in industrialised countries for research and development in this field, and certain countries have begun developing national AI strategies with specific objectives for the future. The potential benefits of AI-enabled systems in the field of warfare and strategy are enormous (Erdem & Özbek, 2023).

The application of AI in national defence and security is a very sensitive area. Incorporating AI into military systems has revolutionised weapons. It has led to the development of autonomous systems and other modern artillery which encompass a broad spectrum of lethal and non-lethal weaponry, such as lethal autonomous systems like unmanned aerial vehicles (UAVs) capable of autonomous flight to AI-powered cyber weapons and unmanned ground vehicles (UGVs) with advanced navigation capabilities among others (Osimen, Newo & Fulani, 2024).

The advent of these autonomous systems and other automated weapons has changed the landscape of modern warfare.

While they may appear to be similar, these weapons serve different functions. AI-powered weapons, i.e. autonomous systems, are built to perform tasks without human intervention. However, humans remotely control automated weapons, including missiles, drones, and other remotely powered systems and weapons (Erdem & Özbek, 2023). While remote control allows for human oversight, AI systems can exhibit unpredictable behaviours or errors that are not fully understood (Osimen, Newo & Fulani, 2024).

Aside from this grave concern, it is pertinent to note that the increased employment of AI technology in weaponisation may result in a new arms race that could topple the international peace architecture. As a result of the emergence of these novel technologies in defence and warfare, there is a need to incorporate them into contemporary arms control paradigms, to prevent a new Cold War in a dynamic international system with multiple actors.

Arms control is a generic term that encompasses different manifestations in strategic studies. Broadly speaking, it refers to arrangements made by national actors to curtail the "research, development, production, fielding, or employment of certain weapons, features of weapons, applications of weapons, or weapons delivery systems" (Scharre & Lamberth, 2022). Some manifestations of arms control include "legally binding treaties, customary international law arising from state practice over time, or non-legally binding instruments" (Scharre & Lamberth, 2022). Arms control necessitates trust and coordination between states.

Unfortunately, the situations where arms control is most needed, i.e. violent conflict or war, are the ones in which coordination and trust are most problematic. Some arms coequipment,mes specifically ban the use of specific equipment; for instance, the Geneva Convention bans the use of landmines and other munitions powered by radiation and advanced nuclear technology. On the other hand, the Nuclear Non-proliferation Treaty (NPT) seeks to ban the use of weaponised nuclear technology outrightly and thus is focused on research and development in that specific area and is not a ban like the previous example (Rasheed & Sultan, 2023).

For several reasons, AI technology presents difficulties for arms control. AI is a pervasive technology with many dual-purpose applications. The fact that this technology is still in its infancy may make attempts to regulate it more difficult. It would also be difficult to verify any AI arms control pact; governments would probably have to devise ways to make sure other states follow the rules, so they feel safe limiting their capabilities.

For some military AI applications, arms control might be possible under specific circumstances.

States should look for ways to lower the hazards associated with military AI, including, when practical, through arms control measures, even as they compete in this field (Scharre & Lamberth, 2022).

AI is a general-purpose enabling technology; it applies to numerous fields of endeavour across military and defence, media and communications, politics and advocacy, etc. However, AI must be regulated when applied to weaponisation and arms control. The neutral nature of AI makes arms control measures challenging, as the application of AI is contingent on the actors employing it for use.

However, this study aims to contribute to the existing body of research on artificial intelligence (AI) and arms control paradigms. Specifically, it explores the multifaceted challenges of integrating AI in warfare, the opportunities and risks associated with its use in modern warfare, and its impact on traditional arms control frameworks.

By exploring the complex relationships between AI, warfare, and arms control, this study aims to provide a comprehensive understanding of the emerging challenges and opportunities in this critical area of research. This study aims to answer the following questions: What is the impact of artificial intelligence (AI) on traditional arms control paradigms in modern warfare? What are the implications of AI's integration into weaponry for existing deterrence strategies? What opportunities exist for international cooperation in addressing the weaponisation of AI and its associated challenges?

2. METHOD AND MATERIALS

This study examines the role of AI in arms control paradigms by identifying the trends and detailing the challenges, ethical issues, opportunities and risks associated with the weaponisation of artificial intelligence. The research aims to provide a systematic thematic review of the relevant literature, observing trends and synthesising insights on the topic.

To achieve its objectives, this study adopts a quantitative-leaning secondary research method. Specifically, it employs thematic analysis to synthesise findings from prior studies, ensuring a robust examination of variables pertinent to artificial intelligence, weaponisation and arms control paradigms.

The literature reviewed was selected using a set of predefined inclusion criteria, prioritising studies that demonstrate methodological rigour and provide substantial empirical data relevant to the subject matter. The research design follows a descriptive and exploratory framework structured to facilitate a comprehensive analysis of the identified variables.

The descriptive approach aids in cataloguing and detailing trends in green growth, while the exploratory aspect delves into underlying drivers and challenges. This dual approach ensures that the research captures both the breadth and depth of the topic.

The methodological steps entailed a systematic literature search involving the search of relevant literature on academic databases, focusing on peer-reviewed articles, reports, and policy documents published within the last five years. Keywords such as "artificial intelligence," "arms control," "weaponised artificial intelligence," "benefits of AI in warfare" and "risks of AI in warfare" guided the search.

Inclusion and exclusion criteria were used to select the works used in this research. Non-English studies, publications with limited methodological transparency, or those outside the scope of the study were excluded. A six-step thematic analysis was conducted on the selected studies, starting with data familiarisation, followed by systematic coding and iterative theme development.

The coding process involved labelling text segments that highlighted key concepts about AI's impact on warfare, including benefits, risks, and arms control implications, using both inductive and deductive methods for comprehensive theme understanding. This iterative coding refined categories into themes, such as challenges of AI in warfare, potential benefits and risks of AI-enhanced warfare, and its effects on arms control frameworks.

3. THEORETICAL FRAMEWORK – DETERRENCE THEORY AND CONSEQUENTIALISM

Deterrence theory posits that the mass acquisition of weapons by countries is primarily to prevent attacks from adversaries. The prospect of reprisal during an arms race is a strong deterrent to aggression whenever countries want to go to war. Deterrence theory became popular during the Cold War when the two nuclear powers went head-to-head with the development of new artillery.

The heavy armament of the two powers in the international system and the idea of a Third World War that could potentially destroy half of the continent due to mutually assured destruction (MAD) was a central assumption of the deterrence theory. The immense destructive capability

inherent in nuclear arms led to the formulation of deterrence theory. This theory suggests that the mere possession of nuclear weapons can avert conflict through the threat of overwhelming retaliatory force (Sagan, 1996).

Advocates of this perspective, such as Waltz (2012), argue that nuclear deterrence contributes to global stability by preventing wars. This perspective implies that Iran's efforts to develop nuclear capabilities may be driven by the goal of deterring regional foes and protecting itself against aggression from nations with more powerful conventional military forces (Waltz, 2012).

Under this framework, there are different manifestations of deterrence: nuclear deterrence and conventional deterrence are two types of deterrence relevant to the study. However, critics have observed that the increase of actors in the international system has upset the MAD treatise, as certain states or non-state actors can provoke conflict regardless of the threat of MAD.

This raises questions about the effectiveness of deterrence when it comes to AI-driven weaponry, since AI systems are capable of producing swift military reactions that surpass human decision-making, thereby complicating the ability to anticipate rational responses among different parties. This limitation spurs the need to employ another theoretical background.

Consequentialism on the other hand, is a theoretical framework that evaluates actions based on their outcomes, classifying them as right, wrong, or neutral. It is based on the following assumptions: defining what makes consequences justify actions, establishing criteria for determining moral status, and specifying the scope of application for these criteria (Jamieson & Elliot, 2009). Consequentialism is an ethical doctrine that believes the morality of an action is based on its consequences.

There is no detailed definition of good or evil, but it emphasises the importance of upholding societal principles, such as human rights. Moreover, it advocates for the protection of such rights under both municipal and international laws (Caws, 1995; Shaw, 2014).

Thus, by merging the theories of deterrence and consequentialism, this study posits that the deterrence of AI-powered weapons can best be achieved by employing consequentialist approaches such as laws, treaties and other relevant arms control measures.

Traditional arms control paradigms have been instrumental in building the current structure of the international peace architecture, and employing deterrence via this strategy will reduce the risks of conflict escalation on a global scale. Due to the dynamic nature of the contemporary international society, the goal is to ensure that states and non-state actors will be deterred from creating "killer robots" owing to the presence of moral, ethical and legal frameworks under the arms control regime. These measures will ensure transparency and verifiability among states and will guarantee the humanistic use of AI in warfare to prevent potential risks and stimulate its latent benefits.

3.1. Traditional Arms Control Paradigms

Throughout history, political powers have consistently sought to control disruptive weaponry. As early as the 5th century BC, Greek city-states implemented demilitarisation agreements to mitigate the escalation of conflicts. In modern times, states continue to regulate weapons that have the potential to destabilise crises, such as intermediate-range ballistic missiles, anti-ballistic missile systems, and space-based weapons of mass destruction (WMD). Due to their potential to provoke an arms race, weapons perceived as destabilising are often subject to regulation (Nye, 1991).

Arms control measures have evolved to encompass three core objectives: reducing the risk of war, restricting its impact should it occur, and limiting the consequences of weaponry use. Various international arms control frameworks, some subsumed under international humanitarian law (IHL), guide these efforts. Two key codified documents are the United Nations Charter and the Geneva Conventions which is properly explained in figure 1 below.

The Geneva Conventions and their Additional Protocols serve as the cornerstone of IHL, governing the conduct of armed conflicts and safeguarding those not involved in hostilities. These conventions mandate that parties to a conflict differentiate between combatants and civilians and between military objectives and civilian objects.

The Martens Clause, found in the preamble to the Hague Conventions and incorporated into the Additional Protocols of the Geneva Conventions, protects in circumstances not explicitly covered by legal agreements. It is based on the "principles of humanity and the dictates of public conscience". It has become increasingly relevant as a moral guide in deploying emerging technologies, such as

artificial intelligence (AI), in warfare (Rasheed & Sultan, 2023).

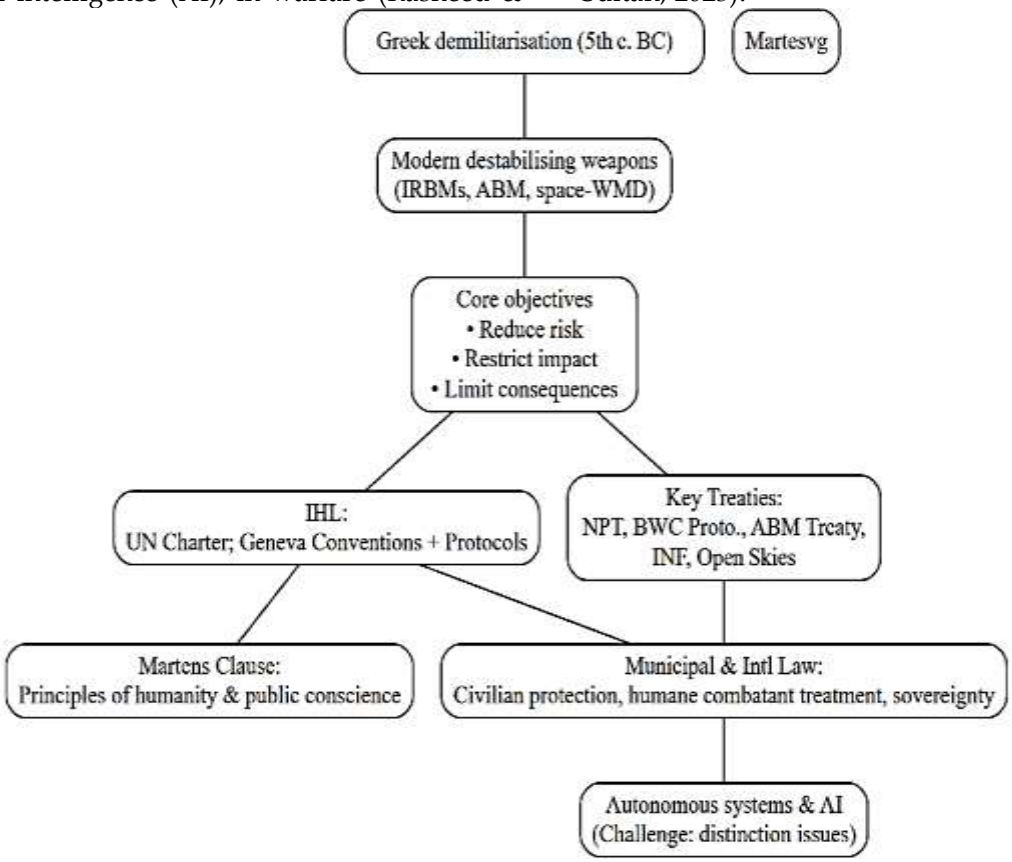

Figure 1: Traditional Arms Control Pattern.
Source: Authors Research Work, 2025.

These legal instruments codify the laws governing the conduct of war and its initiation. Additionally, significant international agreements and treaties, including the Non-Proliferation Treaty, the 2001 Biological Weapons Convention Verification Protocol, the Anti-Ballistic Missiles (ABM) Treaty, the Intermediate-Range Nuclear Forces (INF) Treaty, and the Open Skies Treaty, play critical roles in arms control. Arms control paradigms operate within municipal and international law. These frameworks are designed to protect civilians, ensure the humane treatment of combatants, and uphold state sovereignty during armed conflict. However, applying these principles to autonomous systems remains problematic, as AI may struggle to distinguish between these critical distinctions reliably (Scharre & Lamberth, 2022).

3.2. The Humanity to Use Artificial Intelligence in Modern Wars

The influence of nations in recent years was associated with military strength, fundamentally reliant on conventional warfare techniques that emphasised the availability of personnel and combat capability, supplemented by military assets including light and heavy weaponry, tanks, artillery, and armoured vehicles. Despite this, this conventional military approach to warfare has resulted in significant human tragedies, adversely affecting numerous countries, causing famine, and decimating nations. An illustrative example of this is the two world wars and the magnitude of the devastation they inflicted, along with the significant human tragedies; nonetheless, this approach has commenced in contemporary times. The military's role in conducting warfare is evolving progressively, particularly during the Cold War and the subsequent era, as innovative technologies have emerged that enhance military capabilities, broaden their impact, and amplify their lethality, such as electronic warfare, drones, and other intelligence-driven systems.

Emerging weapons technologies may enhance the efficiency and speed of lethality in warfare, potentially destabilising the international system (Haney, 2020). Currently, military applications of artificial intelligence are regarded as comparable to weapons of mass destruction (Morgan, Boudreaux, Lohn, Ashby, Curriden, Klima, & Grossman, 2020). Autonomous weapons and technologies that utilise

artificial intelligence to independently identify, select, and eliminate human targets, devoid of human involvement or minimal human intervention, are regarded by certain researchers as a significant threat to humanity (Surber, 2018). This concern arises from potential errors that could result in targeting inaccuracies, particularly with systems that operate without human oversight, such as autonomous defensive mechanisms reliant on artificial intelligence.

We deduce from those contemporary technologies introduced by the revolution, particularly advanced technology and machine learning systems informed by artificial intelligence, have transformed the structure and essence of nations. Consequently, this has influenced the strategies employed by countries to bolster their international security and peace at all levels, instigating fundamental changes in alignment with technological advancements. This evolution has significantly impacted the modernisation of military thought, specifically the evolving military doctrines of each nation and the revision of their plans and strategies for managing warfare in accordance with current realities. The United States of America has developed a strategy to attain superior advancements in artificial intelligence over the coming years by creating cutting-edge innovative weapons and leveraging the security infrastructure of artificial intelligence. Meanwhile, China has persistently pursued its efforts in this domain, to the extent that it has begun to surpass the United States (Sullivan, 2021). Conversely, amid the ongoing conflict between Russia and Ukraine, and in accordance with the advancement of these technologies, Russia has sought to fortify its strategy against Ukraine by augmenting state power through the utilisation of modern automated systems to enhance real-time decision-making capabilities during the war (Suzen, 2024). Nonetheless, despite the significance, these technologies encountered obstacles, including political challenges that influenced shifts in the balance of power and posed threats to stability due to the escalating risks associated with their use in international security (Favaro & Williams, 2023). Economic challenges manifested in the substantial investments required for effective implementation. Additionally, legal challenges arose as international humanitarian law struggled to establish a coherent legal and legislative framework for addressing these systems. Ethical challenges were evident in the biases inherent in algorithms and their unethical applications. Lastly, humanitarian challenges emerged regarding the implications of these systems on human security and safety.

3.3. Opportunities for Ai in Modern Warfare

Artificial Intelligence (AI) is reshaping modern warfare in profound ways, particularly in its impact on traditional arms control paradigms. Historically, arms control agreements have focused on creating frameworks prioritising transparency, mutual restraint, and verification among states (DiNanno, 2021). These frameworks categorise weapons systems distinctly, establishing clear definitions and restrictions. The operational advantages conferred by AI, such as improved data analysis and enhanced surveillance capabilities, facilitate a more profound comprehension of enemy actions and objectives.

Proponents of AI in warfare argue that AI technologies, when integrated responsibly, have the potential to enhance strategic stability (Depp & Scharre, 2024). For example, advancements in AI for predictive analysis and situational awareness can equip nations with a clearer understanding of their adversary's capabilities and intentions, which can inform better strategic decisions and crisis management procedures.

1. Ai for Detection

Anti-submarine warfare represents a crucial application of this technology. AI use can enhance the detection of submerged objects by improving the management of capabilities. These capabilities encompass low-frequency active sonar, ambient noise, and non-acoustic sensors (such as reflected laser beams). Moreover, AI is essential in seafloor mapping and current tracking, both of which enhance the visibility and accessibility of marine environments (Loureiro et al 2024). A notable use is the analysis of satellite imagery, which can be utilised, for example, to detect the construction of military installations, the movement of mobile launchers, or alterations in military bases (Pratomo et al 2024). Nuclear-armed states' ability to obscure their nuclear arsenals is a major method for ensuring the survivability of their nuclear weapons (Lieber & Press, 2017). This is an essential element of the policies regulating nuclear deterrence. The United States, the United Kingdom, and Russia depend on submarine-class ballistic missile submarines (SSBNs), which are challenging to detect underwater, to ensure their capability for a second strike (Brixey-Williams, 2016). Conversely, enhanced detection capabilities in naval and aerial domains may compromise concealment strategies. A nation is more likely to initiate a first strike if it perceives the

capability to locate and eliminate the nuclear assets of its opponent, or if it apprehends that its adversary would annihilate its own assets in a 'use it or lose it' situation. Both variables enhance the probability that the nation will initiate a first strike (Rickli, 2020).

2. Ai for Decision Making

The application of AI is expected to profoundly influence decision-making processes in the military sector. The incorporation of AI into military logistics planning software could substantially reduce the time needed for troop deployment. The inaugural exhibition of this capability was during the Gulf War of 1990-1991 (Hedberg, 2020). This suggests that military options can be obtained expeditiously, as evidenced by historical documentation. As the intensity of the conflict increases, the ability of civilian decision-makers to engage in mutual consultation and offer their perspectives will decline. Military leaders may fail to thoroughly assess all options, allowing foes who display superior reason and composure to achieve victory.

3. Ai for Precision

AI-generated counterfeit images exhibit a striking degree of authenticity, capable of misleading both the military and the public. These manipulated images, including satellite imagery depicting the structure or the movement of mobile launchers, can deceive viewers (Tucker, 2019). In response, some individuals may exhibit more anger and pursue retribution from the grassroots level. This anger may be exacerbated by huge botnets spreading disinformation, so generating a false perception of more public outrage than exists. While AI cannot be exclusively blamed, its existence may exacerbate the challenge of preventing possible calamities inside the current internet infrastructure. The use of AI can significantly elevate the stress levels of decision-makers. A perilous strategic environment, potentially global in scope, might emerge from either hasty actions or flawed decision-making, both of which can accelerate the start of a crisis (Tucker, 2019).

4. Ai for Combat Domain Access

Moreover, AI enables access to previously unreachable domains of armed conflict. The aquatic domain was previously noted as potentially more accessible due to artificial intelligence. Severe conditions encompass both Polar Regions and outer space. The regions of space and the ocean floor next to the Arctic ice cap present significant hazards to human life; nonetheless, these settings are ideally conducive for the operation of unmanned instruments. Artificial intelligence renders this achievable. Satellites can more effectively evade space debris and other impediments while conducting real-time geographical analysis through the utilisation of AI. Autonomous sensors in the Arctic are capable of monitoring vessels, aircraft, and submarines. (Zainab, Ambreen, 2023) The application of AI in any industry can enhance mission planning, system monitoring, and the execution of solutions. Nuclear states frequently depend on the inaccessibility of these planets to protect their nuclear arsenals. The United States use satellites for its nuclear NC3 infrastructure, but Russia allocates a significant portion of its SSBN fleet to the Arctic. The heightened accessibility jeopardises the nuclear installations located there. Artificial intelligence is integral to cyber warfare and electromagnetic warfare because of the significant convergence among these three technologies. Malicious software can now adapt to bypass continuously enhanced cyber defences, facilitated by the capabilities of AI. It is evident that cyber technologies are essential for maintaining strategic balance. Cyberattacks targeting air defence systems or missiles diminish the reliability of nuclear arsenals (Kayali, Yavuz, et al. 2023).

AI is essential for determining the optimal frequency for operating inside an already congested spectrum for electromagnetic weapons. Leaders may be more predisposed to utilise these weapons if they perceive that such action will lead to a reduced rate of escalation compared to the deployment of kinetic impact weapons. A potential application could involve disrupting satellite-based command, control, and communications. Consequently, interactions between the conventional and nuclear domains are increasingly prone to entanglement. It possesses numerous features alongside other technologies, and its efficacy is contingent upon the quality of its integration into current systems. It possesses greater potential uses than nuclear technology and is simpler to deploy. The influence of AI on strategic stability transcends the nuclear armament and security sectors. The integration of AI with nonnuclear technology can enhance detection capabilities, hence complicating the concealment of nuclear assets and fortifying defences against a first attack. Moreover, it improves the precision of traditional armaments, enabling their utilisation against submarine-launched ballistic missile (SSBN) launchers and armoured missile launchers. It accelerates the decision-making process, heightening the likelihood that nations may hastily escalate a confrontation.

According to Delcker, Heil, et al. (2024), artificial intelligence generates new arenas of conflict, both tangible and digital, potentially compromising nuclear assets and increasing the probability of retaliation.

3.4. Risks of Ai in Modern Warfare

The growing prominence of AI technology is projected to heighten the danger of escalation due to the rising frequency of interactions between humans and robots. AI technologies impact decision-making at all levels, irrespective of an individual's involvement, hence altering the dynamics between humans and computers. Artificial intelligences must comprehend not just the objectives and strategies of human commanders but also the activities of their human and maybe machine adversaries.

A Cold War-era idea was employed to analyse how third-party access to artificial intelligence technologies could provoke nuclear hostilities or potentially initiate a nuclear conflict. Non-state actors could employ AI-enhanced cyber strategies to distort information and disseminate conspiracy theories. They may also disrupt command and control systems, early warning satellites, radar systems, and communications (Johnson, 2020). The risk of technological malfunction or the illicit deployment of AI-driven military systems heightens the probability of an inadvertent escalation into nuclear conflict (Rahman, Sabbir, et al., 2023).

Artificial intelligence has brought forth advancements such as autonomous weapon systems, which can operate with minimal human intervention and exemplify the ethical and operational dilemmas posed by AI in military contexts. The rise of lethal autonomous weapons (LAWs) raises serious questions about accountability in warfare, especially regarding decision-making processes that can lead to unintended escalations (Bo, Bruun, & Boulanin, 2022). Traditional deterrence models, which rely on predictability and rational responses between actors, face disruption as AI systems can generate rapid military responses that exceed human deliberation. As noted by ethicist Robert Sparrow, the intrinsic difficulty in ascribing accountability for the outcomes of AI-powered systems is concerning in terms of compliance with international humanitarian law. He went further to state that,

"Any weapon or other means of war that makes it impossible to identify responsibility for the casualties it causes does not meet the requirements of jus in bello, and, therefore, should not be employed in war" (Sparrow, 2007).

Bo, Bruun, and Boulanin (2022) also stated that it is widely accepted that humans must maintain accountability for the creation and deployment of autonomous weapon systems (AWS), as machines themselves cannot be held liable for breaches of international humanitarian law (IHL).

There are numerous challenges associated with using AI in warfare. These challenges range across the spheres of politics, economics, legal and ethical dimensions.

3.5. Political Challenges

According to Johnson (2023), who consistently addressed the ramifications of AI technology on nuclear deterrence and the potential for catastrophic nuclear conflict during his statements. He commenced by delineating the many methods via which enemies can employ AI-driven cyber weapons to target nuclear assets, command and control systems, communications networks, and drone swarms to strike military objectives. Determining whether to exacerbate a potential nuclear catastrophe or to "recede from the precipice" may prove more challenging. Optimised AI systems may misinterpret an adversary's signals (Johnson, 2020). In this respect, states rely on AI to conduct rapid strikes, which may not explicitly breach arms control agreements but circumstantially undermine the agreements' intent by shifting the norms of acceptable military engagements. It is not anticipated that conflict will revert to historical frameworks; instead, we are likely witnessing the emergence of a new paradigm (Vaynman, 2021).

The interactions among international entities are the primary catalyst of global politics, particularly those characterised by competition. The foremost arenas of rivalry among these entities are advanced technology and artificial intelligence, which have emerged as critical components of national power. Possessing these elements confers significant advantages, as technology is valuable in isolation and plays a substantial role in enhancing various facets of life and amplifying other power elements (Naseeb, 2024). Consequently, these factors have driven competing nations to engage in the application of artificial intelligence techniques, coupled with significant financial investment and the attainment of scientific breakthroughs, facilitating advancements in this domain of knowledge and technology, positioning the country among the leading nations in this field or potentially allowing it to dominate (Jensen, et.al, 2020).

The primary emphasis on developing artificial intelligence capabilities is the acquisition of substantial quantities of appropriate data, wherein

nations possessing larger data sets have a competitive edge in creating advanced applications. Consequently, the Economist magazine asserted in 2017 that data had supplanted oil. Designated as "the world's most valuable resource," providing appropriate data will empower artificial intelligence to enhance the national power of nations capable of identifying, acquiring, and utilising extensive data sets of significant economic and military relevance to develop advanced artificial intelligence systems. Given the integration of artificial intelligence into contemporary operations, both civil and military, many analysts anticipate ongoing advancements in artificial intelligence, driven by substantial financial and intellectual investments, numerous technological breakthroughs, and the proliferation of data (Jensen, et.al, 2020).

The numerous political issues that could arise are:

1. The state is no longer the exclusive arbiter of power capabilities (Wilson, 2020). Artificial intelligence and computing technologies have attained the ability to deliver state-owned military capabilities at a reduced cost and to facilitate their dissemination, extending beyond state control to non-governmental organisations and terrorist factions, making comprehensive arms control more challenging.
2. The technological arms race and the advancement of a new generation of artificial intelligence in warfare have spurred the creation of diverse and sophisticated weaponry that surpasses the speed of sound, utilising lasers and predominantly robots for manufacturing and operation, leading to an escalation of the global arms race that undermines existing arms limitation treaties. The development of new devastating conventional and unconventional weapons, upgraded ballistic missiles, air defence systems, and drones by the United States, China, and Russia directly challenges the effectiveness of traditional arms control agreements designed for a less technologically advanced landscape (Ahmad, 2023).
3. Artificial intelligence has emerged as a significant factor in the geopolitical conflict among major powers, with the United States accusing Russia of election interference. During the Obama administration, the U.S. government specifically alleged that Russia meddled in the 2016 presidential elections to benefit one candidate over another through hacking (Özdemir, 2024). The Democratic Party experienced a data breach, resulting in the exposure of member information and email discussions, which adversely affected candidate Hillary Clinton's prospects versus Trump. Russia refuted these allegations.
4. Alteration in the equilibrium of power and destabilisation. Artificial intelligence systems can influence the functionality of weapons, particularly nuclear arms, potentially escalating their deployment, even if not directly associated with nuclear launch facilities, thus fundamentally shifting the balance of power and complicating nuclear arms control frameworks that have historically relied on stable deterrence. In other words, including artificial intelligence into nuclear systems poses significant risks, as permitting AI systems to manage nuclear defence mechanisms could heighten the likelihood of nuclear weapon deployment, directly impacting strategic stability and existing nuclear non-proliferation efforts (Ahmad, 2023).

Consequently, access to AI by third-party actors could conceivably incite a nuclear war or at least nuclear conflicts among nuclear states. James Johnson's book suggests that adversaries might employ AI-driven cyber weapons to assault nuclear command, control, and communications systems, utilise swarms of drones to strike military targets, and perhaps aim at nuclear assets. He asserts that a nuclear disaster would be further complicated by the potential for AI systems to misread signals from an opponent (Jalil, 2023).

3.6. Economic Challenges

The digital and economic shift, including diverse artificial intelligence algorithms, poses challenges for economic development in the twenty-first century. In recent years, contemporary technology has emerged as a significant factor in manufacturing, with information being systematically obtained, collected, processed, and used (Chidozie, Osimen, Bhadmus, & Newo, 2024). The continuous improvement of intelligence algorithms and procedures has also become an important aspect of production. Artificial intelligence is a basic requirement for national economies. Despite the benefits, implementing AI technologies presents several hurdles, particularly in terms of development and operating expenses. Smart technologies across a variety of industries entail major investments in research and development, as well as significant costs associated with system management and maintenance, all of which require significant financial resources (Horowitz, 2018).

The effective use of current technology in combat may provide obstacles, notably due to their sensitivity to climatic and environmental circumstances. Furthermore, the use of technology in military operations can reduce the need for human resources, posing economic challenges for nations that rely heavily on labour. In some sectors, it also raises cybersecurity concerns, as the use of technology in warfare necessitates robust cyber infrastructure protection, which presents challenges for information security domains. In contrast, artificial intelligence technologies may exacerbate global economic and technological conflicts by increasing competition among nations for information security access (Johnson, 2021).

The integration of artificial intelligence technology and systems inside the military poses economic concerns. Investment challenges arise when nations allocate appropriate finances to develop and operate artificial intelligence systems in their military forces, which aligns with national security goals and necessitates a deliberate effort to quadruple defence expenditures. The armed forces must improve their ability to absorb and integrate modern technology across multiple disciplines by obtaining new research and development equipment (Horowitz, 2018). Current inventions and innovations, particularly those involving artificial intelligence systems, are becoming more influential. There is an increasing number of smaller, commercially focused firms compared to those traditionally used by various nations' armed forces, resulting in a lack of commercial interest in certain specialised, military-related areas (Chukwudi, Osimen, Dele-Dada., Ahmed,2024).

This rapid technological improvement in artificial intelligence poses a serious challenge and threat to the labour market and workforce rights, as robots are currently being used in a variety of military sectors, displacing human workers. For example, robots intended to dispose of explosive ordnance. Although such jobs were previously performed by specialised soldiers, they have now become an intrinsic part of military operations. The negative consequences of artificial intelligence on the workforce are significant, as advances in this field result in job displacement and economic disparities. Artificial intelligence possesses the power to automate several vocations and sectors, thereby worsening unemployment and amplifying social and economic inequities. Low-skilled soldiers, already subject to exploitation, are likely to be the most harmed, demanding compensation and the rectification of this disparity (Horowitz, 2018; Chukwudi, et al, 2024).

3.7. Legal Challenges

Artificial intelligence poses significant legal issues across numerous dimensions, owing to a lack of regulatory frameworks and international rules controlling such systems. This covers the application of current laws to a variety of legal challenges arising from artificial intelligence, such as intellectual property rights, contractual liability, and personal data protection, among others. Today's military environment demands continual monitoring of systems that may retaliate or escalate conflicts autonomously. Technologies such as AI-driven drones and self-operating artillery enhance operational flexibility but complicate tracking and transparency measures. As AI enhances the capability to conceal activities through new forms of electronic warfare, ensuring compliance becomes increasingly challenging. This results in a notable trade-off between transparency and security, as heightened monitoring demands can reveal weaknesses that adversaries may exploit (Vaynman, 2021).

Numerous individuals in the artificial intelligence business have asked legal experts to create new legal frameworks expressly for artificial intelligence, pushing for the elimination of old restrictions. Their main rationale is the existing technology landscape (Bilgin, 2025). As time passes, artificial intelligence systems may stop responding to directions or directives, potentially causing malfunctions and posing hazards. If a product based on artificial intelligence systems commits a crime or causes an accident, who is responsible? Who will be held accountable if a self-driving vehicle kills someone? The legislator's continual difficulty is with the legal personality and status of artificial intelligence which complicates legal enforcement within arms control. The essential issue of how humans would be held accountable for IHL violations related to AWS has not been a prominent topic in the policy discussions surrounding these systems. This highlights a major challenge for consequentialist ethics: ensuring positive outcomes and accountability when there is less human oversight.

The inherent challenge is rooted in the dual-use characteristics of AI, which complicate the ability to enforce blanket bans on military applications and efforts to develop regulations (Biden, 2023). While the intentions behind AI-driven defence advancements may be presented as enhancing security through superior targeting and strategy optimisation, these technologies can also be misused. They may intensify an arms race among nations seeking to maintain strategic superiority.

Additionally, while some military AI applications could be candidates for prohibition, most applications do not fall neatly within traditional regulatory scopes. As countries race to deploy advanced systems, the likelihood of non-compliance with arms control agreements increases (Scharre, 2021). For example, potential adversaries may misinterpret AI capabilities and take aggressive stances based on perceived threats, leading to pre-emptive strikes or escalatory actions without solid intelligence about adversary capabilities.

On October 19, 1962, three days into the Cuban Missile Crisis, General Curtis LeMay advised President John F. Kennedy, stating, "I just do not see any other solution except direct military action right now" (Weiner, 1997, as cited in Davis, 2019). Ten days later, a diplomatic resolution was achieved. While one of the benefits of AI is its ability to enhance the speed of decision-making, this same speed could pose a risk by hastening the transition from crisis to conflict, potentially leading to war or even nuclear confrontation (Scharre, 2018). The tactical advantages of AI-driven intelligence, surveillance, and reconnaissance (ISR) and autonomous systems may reduce the time available for diplomatic efforts to prevent or manage crises.

Globally, if not restricted by these principles, the most significant constraints and conditions that can be applied to prevent the creation of new weapons in compliance with international humanitarian law are as follows:

i. The criterion for harm, injury, or unjustified suffering. Autonomous weapons evolve with time, becoming more unique and accurate in their offensive and defensive capacities, perhaps causing injury and justifying their prohibition.
ii. The criterion for using weapons in an indiscriminate manner may result in a violation of international humanitarian law standards.
iii. The requirement for widespread and rapidly spreading damage, which may cause environmental impact.

As a result, it is critical to establish a legal framework governing the deployment of autonomous weapons, which requires all nations involved in the development and production of such weaponry to adhere to the provisions outlined in Article 36 of the First Additional Protocol to the Geneva Conventions of 1977, concerning new weapons. This Article establishes the Contracting Parties' responsibility to determine whether the study, development, or acceptance of a new weapon, instrument of war, or method of warfare is forbidden in whole or in part by this Protocol or any other international legal requirements. However, international humanitarian law is currently experiencing a delay in establishing and codifying fundamental regulations governing the advancement of technology in autonomous weaponry, which has proliferated and been integrated into the military strategies of numerous nations, particularly major powers indicating a significant operational gap in arms control. Although existing agreements may not directly apply to this type of weaponry, they can be cited because they fundamentally adhere to the principles of international humanitarian law, particularly the Convention, which prohibits or limits the use of certain conventional weapons deemed excessively harmful and indiscriminate.

Among the fundamental concepts supporting the Convention are:

a) The principle of proportionality regarding the loss of civilian lives proportionally to the anticipated and direct military aims in the conflict.
b) The principle of distinguishing between civilians and combatants, as well as civilian property and military objectives; and
c) The principle of caution, which requires vigilance against attacking civilians (Pérez, 2024).

Due to the numerous applications of artificial intelligence in a variety of fields, as well as its inclination to displace human-executed work, legal control has become critical. The European Union suggests that advanced robots have an electronic personality formed from artificial intelligence systems, endowing them with special rights and obligations in circumstances where they make autonomous decisions; nevertheless, this proposal is still under consideration (Siegmann, & Anderljung, 2022). No agreement was reached among the countries involved.

The widespread use of technology, as well as the incorporation of artificial intelligence, pose substantial challenges to data protection and cybersecurity. The widespread use of technology leads to electronic attacks and data misuse connected with artificial intelligence, and as artificial intelligence advances, so does the risk to privacy. Given the significance of cybercrime and personal data, governments have implemented a variety of measures and legislation to address these concerns. Legal initiatives in this domain have started progressively. Saudi Arabia led the earliest

initiatives, conferring citizenship on the robot Sophia in 2017, while the European Parliament passed specific civil legislation for robots in early 2015. There is currently no dedicated legislation. To govern machines equipped with artificial intelligence systems, existing legislation fails to keep up with the ongoing advances in artificial intelligence methodologies, creating a regulatory void in arms control. In 2012, some American states enacted specific legislation governing the use of self-driving cars, but the most significant legislation for the states The United States of America is currently discussing the "Self-Driving Law," which has been adopted by the House of Representatives and is awaiting final approval by the Senate. This legislation allows for the testing and collection of data on around 100,000 autonomous vehicles.

The United States of America drafted a draft bill in accordance with the 2018 strategic plan (Vellinga, 2017). This project offers a challenge because legislative efforts have constantly sought to strike a balance between encouraging innovation and development and confronting impediments while protecting rights and freedoms. The legislation aims to regulate artificial intelligence at the federal level, with the goal of standardising methods among nations in the regulation of research and development in this domain. The Artificial Intelligence Initiative Law marks the US Congress' most ambitious effort to promote artificial intelligence capabilities. Regarding China, the plan I submitted in 2017 included legal aspects. The strategy's goal is to construct a legal framework and laws for artificial intelligence, along with ethical norms and policy frameworks, while also creating capabilities for assessing and regulating AI. The Russian Federation has a legal and regulatory framework in place to manage a variety of issues related to cybersecurity, including hacking, data spoofing, acquisition by terrorist organisations, and information distribution. The notion involves creating a legislative framework to govern human-machine interaction, ensuring data and technology security (Cath, 2018).

3.8. Ethical Challenges

The application of artificial intelligence, which is defined by technologies such as big data, machine learning systems, and sophisticated algorithms, including various applications of artificial neural networks, has enabled significant advances in various fields, facilitated by the technological innovations and methodologies it introduced, yet also raises emerging ethical quandaries as several international bodies attempt to develop ethical norms for artificial intelligence, particularly in the context of military use. The debate of ethical problems about artificial intelligence revolves around the assumption that the use and exploitation of AI technology is being done unethically. As a result, many countries continue to face moral, economic, and military challenges, exacerbated by officials unfamiliar with artificial intelligence technology and its ramifications. This influence has helped demonstrate ethical failure in artificial intelligence, as many organisations have used machine learning algorithms illegally (Bilgin, 2025).

As a result, numerous countries have begun discussions and treatments to develop ethical principles aimed at addressing the challenges posed by the illicit use of artificial intelligence and elucidating the risks associated with autonomous decision-making systems and the possibility of biased outcomes resulting from feedback loops. The training and development of automated systems and the possible risks of their misuse were discussed at a 2018 conference in California that focused on the ethical issues surrounding artificial intelligence and steps to ensure the technology's good deployment (Shneiderman, 2020). The conference included three topics related to ethical dilemmas: Research Challenges and Concerns. Ethics, values, and long-term considerations include a mandate to prevent an arms race, protect human dignity, rights, and freedoms, and evaluate whether humans can delegate decision-making authority to artificial intelligence, all of which have been approved. The principles were developed by 1,800 University of California scholars and nearly 3,900 international leaders, including Stephen Hawking, Elon Musk, and Jan Tallinn. China established the Chinese National Governance Committee in 2017 to address the issues raised by the misuse of artificial intelligence algorithms, which endangers biological protection and the rights of users of artificial intelligence technology (Huang, Zhang, Mao, & Yao, 2022). As a result, initiatives exist to restrict the use of algorithms. This committee advocates for the incorporation of ethics into all domains of artificial intelligence must be immediately applicable, as this committee incorporated principles to increase ethical awareness about artificial intelligence and societal behavioural awareness, while also guiding responsible research to develop artificial intelligence in accordance with ethical standards that must be followed, particularly by individuals associated with government organisations. Non-governmental

organisations, corporations, management entities, and research and development centres protect privacy and security by ensuring that personal data is not illegally collected and that individual privacy rights are respected.

The United States of America has launched multiple initiatives to solve ethical challenges and study various ethical quandaries. It has formed an organisation that provides computer and network security, as well as a dedicated institute to investigate the consequences of artificial intelligence, notably in terms of rights, freedoms, and safety (Johnson, 2022).

3.9. Pathways for Ai Arms Control Policy and Regulatory Innovation

The integration of artificial intelligence into military systems presents multifaceted implications for global security and arms control, necessitating adaptive policies and further research to manage its evolving challenges and opportunities.

- **Targeted Regulations:** Rather than implementing blanket bans, arms control agreements could be tailored to address specific and problematic situations related to AI technology. This approach would focus on the technology's intended use, rather than its technical characteristics, similar to the successful ban on blinding lasers (Lamberth & Scharre, 2023).
- **Improved Verification Mechanisms:** Due to the difficulties in verifying software-based AI systems, innovative verification methods are critical. This could include intrusive inspection regimes, regulation of observable physical characteristics of AI-enabled systems, or limitations on computational infrastructure. Controlling high-end AI chips and large-scale computational resources is a particularly attractive approach, as these are physical resources that are easier to observe and control (Lamberth & Scharre, 2023).
- **International Dialogue and Standards Development:** Fostering dialogue among nations, academics, and technology companies is crucial to building mutual understanding and establishing standards for the responsible use of military AI. Unilateral policy statements, such as those from the U.S. Department of Defense, can influence state opinions, but international cooperation is essential for the widespread adoption of principles (Lamberth & Scharre, 2023).
- **Fostering Cooperation through Low-Hanging Objects:** States can promote trust and cooperation by pursuing arms control or confidence-building measures that are relatively unobjectionable, such as an international agreement on autonomous incidents for unmanned vehicles. Updating existing agreements to include autonomous systems could be a valuable first step (Lamberth & Scharre, 2023).
- **Influencing AI Development:** Policymakers can influence AI development by shaping its progression, especially in computing hardware. This includes strategies like limiting advanced semiconductor production, controlling key supply chain bottlenecks, enhancing compute monitoring, and enforcing export controls and cybersecurity for AI models. Additionally, establishing domestic regulations for large-scale computing is essential (Lamberth & Scharre, 2023).
- **Insights from Nuclear Arms Control:** While AI differs significantly from nuclear weapons, lessons from nuclear arms control, especially in verification processes, can inform AI arms control efforts. The challenges of verifying AI agreements, especially those reliant on specialised chips, might be alleviated through proactive strategies such as creating privacy-preserving verification methods and setting up initial, though incomplete, verification systems (Baker, 2023). This demonstrates a consequentialist approach by learning from past experiences to avoid severe negative outcomes.

4. CONCLUSION

This study's findings directly address key research questions by demonstrating that artificial intelligence significantly disrupts traditional arms control systems. This disruption is primarily due to AI's dual-use nature, rapid technological advancements, and the challenges it poses for verification and accountability. The theoretical principles of consequentialism and deterrence reinforce the idea that effective AI arms control must go beyond mere weapon prohibitions to include comprehensive ethical, legal, and technical safeguards. While AI enhances military capabilities and decision-making, it also brings substantial risks of miscalculation and escalation, prompting a need to reevaluate how deterrence is maintained in an increasingly automated combat landscape. Future research should continue to explore practical, actionable approaches to AI arms control and

regulatory innovation. This includes creating robust, privacy-preserving verification systems tailored to the unique characteristics of AI, fostering international dialogue to establish clear norms and principles, and strategically managing global supply chains for critical AI components like advanced semiconductors. Drawing lessons from past successes in arms control, especially in nuclear contexts, while acknowledging the specific challenges posed by AI, will be crucial. The ultimate goal is to create a unified global framework that balances innovation with safety, ensuring that AI's transformative potential in warfare is harnessed responsibly to prevent instability and uphold international peace and security.

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