

A Review of International Humanitarian Law on the Use of Artificial Intelligence (AI) and Autonomous Weapons in Modern Warfare

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Abstract

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This study aims to analyze the use of Artificial Intelligence (AI) and autonomous weapons in modern warfare from the perspective of the principles of International Humanitarian Law (IHL), as well as to examine the legal accountability framework applicable to the use of autonomous weapons that results in violations of IHL. The development of AI technology in the military domain has facilitated the emergence of Autonomous Weapons Systems (AWS), which are increasingly capable of detecting, identifying, selecting, and engaging targets with limited human intervention. This development raises significant legal concerns, as the use of force in armed conflict must remain subject to the principles of distinction, proportionality, precautions in attack, and humanity, as well as the obligation to conduct legal reviews of new weapons, means, and methods of warfare. This study employs a normative juridical method using statutory, conceptual, and case approaches. Legal materials are analyzed qualitatively and prescriptively to formulate legal arguments concerning the legality of AI and autonomous weapons and accountability for the consequences arising from their use. The findings indicate that the use of AI and autonomous weapons is neither automatically prohibited nor inherently permitted under IHL. Rather, their legality depends on the capabilities of the systems and the manner in which they are developed and employed to ensure compliance with the fundamental principles of IHL. The deployment of systems that are unpredictable, incapable of distinguishing between lawful and unlawful targets, or incompatible with effective human supervision and intervention may potentially violate IHL. Legal accountability remains attributable to states and individuals who possess relevant authority, knowledge, or roles in the development, procurement, control, activation, and deployment of such systems. Accordingly, meaningful human control, weapons reviews, effective oversight, and traceability are essential to preventing an accountability gap in the use of autonomous weapons.

Keywords

Artificial Intelligence, Autonomous Weapons, International Humanitarian Law.

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INTRODUCTION

The development of Artificial Intelligence (AI) technology has brought about fundamental changes in various areas of human life, including the fields of defense and security. Advances in computing capabilities, data processing, pattern recognition, sensor systems,

machine learning, and algorithm-based decision-making have encouraged the integration of AI into modern weapons systems. In the context of armed conflict, AI is no longer used merely as an administrative or information-analysis tool but has increasingly become involved in the processes of detecting, identifying, tracking, selecting, and engaging targets.¹ This development has given rise to Autonomous Weapons Systems (AWS), namely weapons systems capable of independently performing certain critical functions after being activated by humans.

This technological transformation provides strategic advantages to states that employ such systems. AI-based systems can process vast amounts of information at speeds beyond human capabilities, respond rapidly to threats, and enable military operations while reducing direct personnel involvement in high-risk combat environments. These capabilities may enhance operational effectiveness, reduce risks to military personnel, and accelerate decision-making processes.² However, such strategic advantages simultaneously raise legal concerns when autonomous systems are employed to determine targets and apply force that may result in death or damage to human beings and civilian objects.

Within the framework of International Humanitarian Law (IHL), the use of force in armed conflict cannot be separated from the obligation to limit the suffering caused by war and to provide protection to persons who are not, or are no longer, taking part in hostilities. IHL applies to all means and methods of warfare, including new technologies that have not been specifically regulated by a particular legal instrument.³ The development of AI and autonomous weapons does not place states in a legal vacuum. Rather, the use of such technologies remains subject to the applicable principles and rules of IHL, including the principles of distinction, proportionality, precautions in attack, and the prohibition of certain means and methods of warfare that are contrary to international law.

The *ius cogens* in the use of weapons technology essentially requires that every action undertaken in armed conflict continue to respect the principle of humanity. The principle of distinction requires parties to the conflict to distinguish between combatants and civilians, as well as between military objectives and civilian objects. The principle of proportionality prohibits attacks that may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated. Meanwhile, the principle of precautions in attack requires the attacking party to take all feasible measures to avoid or, at a minimum, minimize civilian casualties and damage to civilian objects.

¹ Teguh Yuwono, Rahayu Repindowaty Harahap, and Bernard Sipahutar, "Artificial Intelligence Dalam Autonomous Weapon Systems: Masalah Teknis Atau Masalah Hukum?," *Utī Possidetis: Journal of International Law* 3, no. 3 (2022): 293–319, <https://doi.org/10.22437/up.v3i3.19412>.

² Lorenzo Cotino Hueso and Ángel Gómez de Ágreda, "Ethical and International Humanitarian Law Criteria in the Use of Artificial Intelligence-Powered Military System," *Novum Jus* 18, no. 1 (2024): 249–83, <https://doi.org/10.14718/NovumJus.2024.18.1.9>.

³ Ahmad Khalil and S Anandha Krishna Raj, "Assessing the Legality of Autonomous Weapon Systems: An In-Depth Examination of International Humanitarian Law Principles," *LAW REFORM* 19, no. 2 (2024): 372–92, <https://doi.org/10.14710/lr.v19i2.58497>.

The *das sollen* is also reflected in the obligation of states to conduct legal reviews of new weapons, means, and methods of warfare. Article 36 of Additional Protocol I of 1977 requires a State Party, in studying, developing, acquiring, or adopting a new weapon, means, or method of warfare, to determine whether its employment would, in some or all circumstances, be prohibited by the Protocol or by any other rule of international law applicable to that state. This provision is particularly significant for AI and autonomous weapons because technological development does not eliminate the obligation of states to ensure that new weapons can be employed in compliance with international humanitarian law.⁴

From a normative perspective, these issues demonstrate that human beings remain the subjects bearing legal obligations in the conduct of military operations. IHL does not transfer legal responsibility to machines, software, or algorithms. Those who plan, decide upon, and execute attacks remain obligated to ensure that attacks are conducted in accordance with the principles of distinction, proportionality, and precautions. Accordingly, the existence of AI as a technological instrument does not, in itself, eliminate the obligation of human actors to ensure the legality of the use of force.

Nevertheless, technological developments indicate a shift from weapons systems that are fully controlled by humans toward systems possessing increasingly high levels of autonomy. In conventional weapons systems, humans can generally determine the target and timing of the use of force directly. By contrast, in autonomous systems, humans may provide certain parameters or target profiles, while the system subsequently uses sensors and algorithmic processing to search for, identify, select, and engage targets without further human intervention. This transformation raises a fundamental question concerning the extent to which decisions regarding the use of force may be delegated to technological systems without eliminating meaningful human control.⁵

The *das sein* demonstrates that the development of AI in the military domain has progressed more rapidly than the emergence of international legal consensus concerning the limits of its use. AI technology has become increasingly integrated into military processes, while the international community continues to face divergent views regarding the definition, characteristics, levels of autonomy, and appropriate regulatory framework for Autonomous Weapons Systems.⁶ To date, there is no comprehensive international agreement establishing a single definition of autonomous weapons systems. This situation creates room for differing interpretations among states regarding the extent to which autonomous systems may lawfully be employed in armed conflicts.

⁴ Daniele Amoroso, "Autonomous Weapons Systems and International Law: A Study on Human-Machine Interactions in Ethically and Legally Sensitive Domains," *Journal of International Criminal Justice* 19, no. 1 (2021): 227–29, <https://doi.org/10.1093/jicj/mqaa063>.

⁵ Priscille Mabwa Mbongo, "Artificial Intelligence and International Humanitarian Law: Regulating Autonomous Weapons on the Battlefield," *Russian Law Journal*, 2025.

⁶ Federico Chesini, "«Terminator Scenario»? Intelligenza Artificiale Nel Conflitto Armato: Lethal Autonomous Weapons Systems e Le Risposte Del Diritto Internazionale Umanitario," *BioLaw Journal* 3 (2020): 441–47, <https://doi.org/10.15168/2284-4503-715>.

The issue becomes increasingly complex because compliance with IHL is determined not only by the technical characteristics of a weapon but also by the manner, circumstances, environment, targets, duration, and context in which it is employed. A system capable of operating in a relatively controlled manner in a particular environment may not necessarily satisfy legal requirements when deployed in complex and dynamic battlefields. Changes in circumstances on the ground may cause a system to encounter objects or individuals that do not correspond to previously established target patterns. The technical ability to recognize an object is not necessarily equivalent to the ability to make a legal assessment concerning the status of that object or individual.

The principle of distinction constitutes one of the principal challenges in the use of autonomous weapons. IHL requires parties conducting attacks to distinguish military objectives from civilians and civilian objects. In modern conflicts, such distinctions cannot always be made solely on the basis of physical characteristics or predetermined patterns because combatants may be intermingled with civilian populations, individuals may change their status during hostilities, and battlefield conditions may change within a very short period.⁷ Therefore, the issue is not merely whether AI can technically recognize an object, but whether the system can generate decisions that satisfy legal standards in a concrete situation.

Similar concerns arise in the application of the principle of proportionality. Proportionality assessments require consideration of the relationship between the expected civilian harm and the concrete and direct military advantage anticipated. Such assessments are highly dependent on the circumstances and information available at the time the attack decision is made. Accordingly, the legal question is whether an algorithmic system can conduct such a contextual assessment in an accountable manner or whether the decision must ultimately remain with a human decision-maker. This challenge becomes even greater when a system operates at a speed that exceeds the human capacity to intervene effectively.

In addition to distinction and proportionality, the principle of precautions in attack presents significant challenges. An attacking party is required to take all feasible measures to avoid or minimize civilian casualties, including verifying targets and cancelling or suspending an attack when it becomes apparent that the target is not a military objective or that the attack is expected to be disproportionate.⁸ This obligation demonstrates that decision-making in an attack is not completed merely when a weapon is activated. In autonomous systems, the ability of humans to supervise, intervene, cancel, or terminate an attack becomes a determining factor in assessing the legality of their use.

These circumstances give rise to the issue of meaningful human control. The mere presence of a human within a weapons system does not automatically establish meaningful human control. Such control must be understood in terms of the human operator's ability to understand the system, determine the conditions under which it may be used, anticipate its

⁷ Marco Sassòli, "Autonomous Weapons and International Humanitarian Law: Advantages, Open Technical Questions and Legal Issues," *International Law Studies* 90 (2014): 308–40.

⁸ Michael N Schmitt and Jeffrey S Thurnher, "Out of the Loop: Autonomous Weapon Systems and the Law of Armed Conflict," *Harvard National Security Journal* 4 (2013): 231–81.

consequences, exercise supervision, and intervene in a timely manner when the use of the weapon may violate IHL. Therefore, the debate surrounding autonomous weapons concerns not merely whether a human is present within the weapons-use chain, but also the quality and effectiveness of such human control.

Another equally important issue concerns the nature of AI systems, which may generate decisions based on complex data, models, and algorithms. Such systems may encounter circumstances that cannot be fully predicted by their developers or operators. Data errors, environmental manipulation, changes in battlefield conditions, and system vulnerabilities may produce outcomes different from those anticipated. In the context of armed conflict, such uncertainty has particularly serious consequences because system errors may result not merely in technical failures but in death, injury, or damage to civilians and civilian objects.⁹ The International Committee of the Red Cross (ICRC) has also highlighted the risk of increased uncertainty and diminished human control arising from the use of AI in military operations.

Such uncertainty is directly connected to the issue of legal accountability. If an autonomous weapon conducts an attack that subsequently proves to violate IHL, the machine, as a technological device, cannot be treated as a legal subject to which responsibility can be attributed in the same manner as a human being or a state. The question therefore shifts to determining who should bear responsibility when a decision resulting in a violation emerges from the interaction between humans, software, data, algorithms, operators, commanders, and weapons systems. This situation is often understood as a potential accountability gap, namely a gap between the occurrence of a violation and the ability of the legal system to clearly identify the party responsible.

States remain obligated to ensure that their armed forces are capable of conducting operations in accordance with international law. The development, procurement, testing, and deployment of autonomous weapons systems cannot be separated from the state's obligation to ensure compliance with IHL. At the same time, individual responsibility may arise where human acts or omissions satisfy the elements of violations of international criminal law. The issue of autonomous weapons therefore needs to be analyzed through the relationship between state responsibility and individual criminal responsibility, rather than by assuming that the autonomous nature of a weapon automatically eliminates human responsibility.

The *das sein* demonstrates a tension between technological developments that increasingly confer decision-making capabilities upon machines and the fundamental principles of IHL, which continue to place human actors under an obligation to conduct legal assessments concerning the use of force. Technological developments may produce systems that are increasingly rapid, complex, and autonomous, whereas IHL requires assessments concerning targets, effects on civilians, proportionality, and precautions in concrete circumstances.¹⁰ The

⁹ Rebecca Crootof, "War Torts: Accountability for Autonomous Weapons," *University of Pennsylvania Law Review* 164, no. 6 (2016): 1347–1402.

¹⁰ Merel Ekelhof, "Moving Beyond Semantics on Autonomous Weapons: Meaningful Human Control in Operation," *Global Policy* 10, no. 3 (2019): 343–51.

imbalance between technological development and the clarity of standards concerning human control indicates the existence of legal issues requiring further examination.

International debates concerning Autonomous Weapons Systems also demonstrate that the existing rules of IHL do not yet fully resolve all issues arising from increasing levels of weapons autonomy. In 2026, the ICRC reaffirmed that IHL applies to autonomous weapons systems, while also emphasizing that existing rules do not provide complete answers to all humanitarian, legal, and ethical concerns arising from such technologies. Consequently, efforts are required to clarify the limitations and conditions governing the use of autonomous systems, including the possibility of developing new international rules that complement the existing framework of IHL.

This situation demonstrates that the challenges posed by AI and autonomous weapons cannot be addressed solely through a technological approach. They constitute issues of international law because they concern the limits of the use of force in armed conflict, the protection of civilians, state obligations, individual responsibility, and the continued application of humanitarian principles in the face of changing forms of warfare. Regulation of such technologies must also take into account the principle that technological advancement must not become a means of circumventing legal obligations that previously rested upon human decision-makers in the use of armed force.

Accordingly, there is a gap between the *das sollen*, which requires IHL to ensure that every attack is conducted in a measured, predictable, supervised, and accountable manner, and the *das sein*, characterized by the development of weapons systems capable of performing target-selection and target-engagement functions with increasingly limited human intervention. This gap becomes particularly significant when an autonomous system produces a decision resulting in civilian casualties or a violation of IHL, while the relationship between human conduct and algorithmic output may not always be readily established. This situation requires a legal framework capable of ensuring that technological development does not create an accountability vacuum in the conduct of armed conflict.

Based on the foregoing, this study is important to analyze the status and use of Artificial Intelligence and autonomous weapons in modern warfare from the perspective of the principles of International Humanitarian Law, while also examining the construction of legal accountability where the use of such systems results in violations of IHL. This study examines whether the principles of distinction, proportionality, precautions in attack, the obligation to review new weapons, and the principle of humanity provide an adequate legal basis for the use of autonomous technologies, as well as how legal accountability can be established when decisions concerning the use of force involve AI systems. Accordingly, this study aims to analyze the use of Artificial Intelligence and autonomous weapons in modern warfare based on the principles of International Humanitarian Law. It also aims to analyze the legal accountability framework applicable to the use of autonomous weapons that results in violations of International Humanitarian Law, including the identification of parties who may be held responsible for the use of such systems and the consequences arising from their deployment.

METHODS

This study employs a normative juridical research method aimed at analyzing the legal norms and principles governing the use of Artificial Intelligence (AI) and Autonomous Weapons Systems (AWS) in armed conflicts, as well as the construction of legal accountability for their use where such deployment may result in violations of International Humanitarian Law (IHL).¹¹ The study applies three approaches: the statutory approach, the conceptual approach, and the case approach.

The statutory approach is employed to examine relevant provisions of International Humanitarian Law, particularly the 1949 Geneva Conventions, Additional Protocol I of 1977, and other applicable rules of international law concerning the means and methods of warfare. The conceptual approach is used to analyze the principles of distinction, proportionality, precautions in attack, military necessity, and humanity, as well as the concept of meaningful human control and the principles governing state and individual responsibility under international law.¹²

Meanwhile, the case approach is employed to examine the application of legal principles and accountability in armed conflicts involving the use of AI-based technologies and autonomous weapons systems, insofar as relevant legal issues can be identified and analyzed. The legal materials consist of primary legal materials, including international legal instruments; secondary legal materials, including books, scholarly journal articles, and documents and reports issued by international institutions; and tertiary legal materials providing explanations of terms and concepts relevant to the subject of the research.

Legal materials are collected through a literature study by identifying, inventorying, and classifying relevant legal materials according to their relationship to the research questions.¹³ The collected materials are subsequently analyzed qualitatively using a prescriptive analytical method. This analysis involves interpreting applicable legal norms and relating them to developments in the use of AI and autonomous weapons in modern warfare in order to formulate legal arguments concerning the compatibility of their use with the principles of International Humanitarian Law and to construct a legal accountability framework for parties whose acts or omissions cause or contribute to violations of International Humanitarian Law.

RESULTS AND DISCUSSION

A. The Use of Artificial Intelligence and Autonomous Weapons in Modern Warfare from the Perspective of the Principles of International Humanitarian Law

The findings of this study indicate that the use of Artificial Intelligence (AI) and autonomous weapons in armed conflicts does not, in principle, fall outside the scope of

¹¹ I Made Pasek Diantha, "Normative Legal Research Methodology in Legal Science Development," *Kertha Patrika* 41, no. 1 (2019): 1–15.

¹² Yati Nurhayati, Ifrani, and M Yasir Said, "Metodologi Normatif Dan Empiris Dalam Perspektif Ilmu Hukum," *Jurnal Penegakan Hukum Indonesia* 2, no. 1 (2021): 1–20, <https://doi.org/10.51749/jphi.v2i1.14>.

¹³ Nur Solikin, "Legal Research Methods in Developing Legal Science," *Journal of Law and Legal Reform* 1, no. 2 (2020): 193–206.

International Humanitarian Law (IHL). IHL applies to the means and methods of warfare employed in armed conflicts, including weapons technologies that develop alongside technological advancement. Therefore, the absence of an international instrument specifically regulating all forms of AI and Autonomous Weapons Systems (AWS) cannot be interpreted as granting states unrestricted freedom to use such technologies.¹⁴ The legality of their use must continue to be assessed on the basis of the applicable principles and rules of IHL.

The use of AI in weapons systems must be distinguished from the use of AI as a decision-support tool in military operations. AI may be employed to analyze data, identify patterns, support surveillance, process intelligence information, or assist humans in determining military actions. The legal issues become more complex when such systems possess the capability to independently perform critical functions after being activated by humans, including searching for, selecting, tracking, and engaging targets. At this stage, the technology no longer functions merely as a decision-support tool but begins to participate directly in processes that have immediate consequences for human life.

From the perspective of the principle of distinction, the use of autonomous weapons must ensure the ability to distinguish between persons taking part in hostilities and civilians, as well as between military objectives and civilian objects. This principle constitutes one of the fundamental foundations of IHL because the protection of civilians depends substantially on the ability of parties to an armed conflict to identify lawful targets.¹⁵ In the context of autonomous systems, the issue is not merely whether the technology is capable of detecting an object, but whether the system can determine whether that object constitutes a lawful military objective under the circumstances prevailing at the time.

The technical capability of AI to perform object recognition cannot, by itself, be equated with the ability to conduct a legal classification. AI systems operate on the basis of data, parameters, patterns, and algorithms that have been previously designed or trained. Meanwhile, the status of a person or object in an armed conflict may change depending on circumstances and actions occurring on the battlefield. An individual may be a combatant, cease to take part in hostilities, or become hors de combat. Likewise, an object may change its characteristics or function, requiring contextual assessment to determine whether it constitutes a military objective. This demonstrates that technical identification does not necessarily result in a legally accurate assessment.

The issue becomes increasingly serious in armed conflicts conducted in urban environments or densely populated areas. In such circumstances, combatants and civilians may occupy the same geographical space, while civilian objects may be located in close proximity to military objectives. An autonomous system operating on the basis of predetermined parameters may encounter difficulties when actual conditions differ from those anticipated when the system

¹⁴ Stuart Casey-Maslen, "Artificial Intelligence, Autonomous Weapons Systems and International Humanitarian Law: A Legal Review," *International Review of the Red Cross* 102, no. 915 (2020): 1357–80.

¹⁵ Ingvild Bode and Hendrik Huelss, "Autonomous Weapons Systems and Changing Norms in International Relations," *Review of International Studies* 45, no. 3 (2019): 393–413.

was designed or activated.¹⁶ Accordingly, the use of autonomous weapons must take into account the operational environment, characteristics of the target, duration of operation, and the possibility of changes in circumstances that may affect the system's ability to distinguish lawful targets.

The principle of proportionality provides a further limitation on the use of AI and autonomous weapons. An attack cannot be justified merely because the intended target constitutes a military objective. IHL requires the attacking party to assess whether the attack may be expected to cause incidental civilian harm or damage to civilian objects that would be excessive in relation to the concrete and direct military advantage anticipated. Accordingly, proportionality assessments are contextual in nature and require consideration of the concrete circumstances prevailing at the time the attack is conducted.

These characteristics raise significant concerns when proportionality assessments are delegated to AI systems. Algorithms may be designed to process certain parameters, but proportionality is not merely a mathematical calculation involving the number of potential casualties and the anticipated military advantage. It requires an assessment of the circumstances at hand, the reliability of available information, the nature of the target, the potential impact on civilians, and the anticipated military advantage. Therefore, the greater the authority delegated to an autonomous system to determine the use of force, the greater the requirement for humans to retain the ability to assess and intervene in the system's decisions.

The principle of precautions in attack is also an important measure for determining the legality of the use of autonomous weapons. The attacking party is required to take feasible measures to avoid or, at a minimum, minimize civilian casualties and damage to civilian objects. This obligation includes the need to verify targets and consider the possibility that the circumstances underlying the decision to attack may have changed.¹⁷ In systems possessing a high degree of autonomy, the ability to conduct supervision and undertake corrective action becomes particularly important because system decisions may develop rapidly after the weapon has been activated.

Based on the principle of precautions in attack, the use of AWS cannot be assessed solely at the point when the weapon is programmed or activated. Its legality must be considered throughout the weapons-use process, beginning with the determination of parameters, selection of the operational environment, designation of targets, and monitoring of operations, through to the ability to cancel or terminate an attack when circumstances change. This demonstrates that the higher the level of autonomy of a system, the more important effective human supervision becomes. The deployment of a system that does not enable operators to understand operational conditions or intervene in a timely manner may raise serious concerns regarding compliance with the obligation to take precautions.

¹⁶ Dapo Akande, "International Law and the Regulation of Autonomous Weapons Systems," *International and Comparative Law Quarterly* 68, no. 4 (2019): 895–925.

¹⁷ Heather M Roff, "The Strategic Robot Problem: Lethal Autonomous Weapons in War," *Journal of Military Ethics* 13, no. 3 (2014): 211–27.

In addition to the principles of distinction, proportionality, and precautions, the use of AI and autonomous weapons must also take into account the principle of humanity and limitations on the means and methods of warfare. This principle emphasizes that advances in military technology must not be used as a basis for removing the protection afforded to human beings under IHL.¹⁸ Greater technological sophistication does not mean that the applicable standards of legal protection should be reduced. Rather, increasingly sophisticated technological capabilities must be accompanied by adequate safeguards to ensure that the use of force remains within the limits established by humanitarian law.

The obligation to conduct reviews of new weapons, as reflected in Article 36 of Additional Protocol I of 1977, is particularly relevant to the use of AI and AWS. When a state studies, develops, acquires, or adopts a new weapon, means, or method of warfare, it is required to determine whether its employment would, in some or all circumstances, be prohibited under the Protocol or any other applicable rule of international law. The development of AI-based weapons systems therefore cannot be assessed solely on the basis of technological effectiveness or defense interests but must also undergo an assessment of their compatibility with international law.

An AWS weapons review under Article 36 should not be understood merely as a formal examination of the physical characteristics of a weapon. The assessment should consider the system's autonomous characteristics, the types of targets it may select, the environment in which it will be employed, the predictability of its behavior, the possibility of error, and the operator's ability to exercise supervision and intervention.¹⁹ A legal review of autonomous weapons should consider not only whether the weapon is prohibited per se, but also whether its operational characteristics and conditions of use enable the state to fulfill its obligations under IHL in concrete circumstances.

The findings further demonstrate that meaningful human control constitutes an important element in assessing the use of autonomous weapons. The presence of a human within the weapons-use chain does not automatically establish meaningful human control. Meaningful control requires humans to possess the ability to understand the functions and limitations of the system, determine the parameters governing its use, select the operational conditions, monitor its operation, and intervene when circumstances require. Human control must therefore be substantive rather than merely formal.

The concept of meaningful human control becomes increasingly important because AI systems may generate outputs that cannot be fully predicted by their operators. Systems employing machine learning or complex models may encounter novel circumstances that differ from the data or environments used during their development. Data errors, changes in

¹⁸ Maria Fátima Pinho de Oliveira and Alexander Bueno Montilla, "Theoretical Contributions on the Use of Artificial Intelligence in Autonomous Weapons Systems from the Perspective of International Humanitarian Law," *Derecho Global. Estudios Sobre Derecho y Justicia* 10, no. 29 (2025): 479–511, <https://doi.org/10.32870/dgedj.v10i29.809>.

¹⁹ Kobi Leins, "Artificial Intelligence and the Limits of International Humanitarian Law," *International Journal of Law and Information Technology* 29, no. 2 (2021): 121–45.

battlefield conditions, sensor disruption, information manipulation, or changes in human behavior may affect system outputs. Humans must retain the ability to assess whether the system's outputs can lawfully be acted upon. If humans merely activate a system without the ability to understand or control its subsequent decisions, their presence may not satisfy the requirement of meaningful human control.

Another issue concerns the operational speed of autonomous systems. AI can process data and generate decisions within extremely short periods, potentially exceeding the human capacity to follow the entire decision-making process. Such speed provides military advantages but may simultaneously reduce the opportunity for human verification and intervention. Under IHL, speed cannot serve as a justification for reducing the obligation to distinguish targets, conduct proportionality assessments, and take precautions.²⁰ Accordingly, the design and deployment of such systems must allow for a level of human supervision proportionate to the risks and consequences associated with the use of force.

Taken together, these principles demonstrate that IHL does not prohibit AI technology and autonomous weapons merely because they are novel technologies or employ algorithms in decision-making processes. The legal issue concerns whether the concrete use of such technologies can satisfy the obligations imposed by IHL. In other words, legality is not determined solely by labeling a weapon as "autonomous," but by the system's capabilities and the manner in which it is employed to comply with the principles of distinction, proportionality, precautions, and other applicable rules governing armed conflict.

Nevertheless, certain circumstances may arise in which the degree of system autonomy results in increasing legal uncertainty. Where a system cannot be adequately predicted, is deployed in complex environments, possesses broad target-engagement capabilities, and does not allow effective human intervention, there is a significant risk that its use may fail to satisfy IHL requirements. This risk becomes greater where a system can continue operating after losing communication with its operator or where battlefield conditions change substantially from those prevailing when the system was activated. In such circumstances, the central issue is no longer merely technological effectiveness but the ability to ensure compliance with the law.

Accordingly, the use of AI and autonomous weapons in modern warfare may be considered lawful insofar as their deployment remains within the framework of IHL and the state is able to ensure that the systems are employed under conditions that permit compliance with humanitarian principles. Conversely, the use of systems that eliminate the human capacity to conduct legal assessments, cannot adequately distinguish targets, generate unforeseeable risks of civilian casualties, or do not permit effective precautionary measures and intervention raises serious concerns regarding compliance with IHL. These findings demonstrate that IHL remains relevant to technological developments, although its application requires more concrete regulatory and control mechanisms.

Ultimately, the development of AI and AWS demonstrates that the principal challenge for IHL lies not in the absence of legal norms but in the capacity of those norms to be applied to

²⁰ Elsa Kania, "Battlefield Singularity: Artificial Intelligence, Military Revolution, and China's Future Military Power" (Center for a New American Security, 2017).

increasingly autonomous technological systems. IHL continues to place legal obligations concerning the use of armed force upon human actors, meaning that the delegation of certain functions to machines cannot be understood as a delegation of legal responsibility. The principles of distinction, proportionality, precautions in attack, the obligation to review new weapons, and the need for meaningful human control must therefore serve as legal constraints on the development of weapons autonomy.

Based on these findings, the use of Artificial Intelligence and autonomous weapons in modern warfare is neither automatically prohibited nor automatically permitted under International Humanitarian Law. Its legality depends on the ability of states and other relevant actors to ensure that such technologies continue to comply with the principles of distinction, proportionality, precautions in attack, humanity, and the obligation to conduct legal reviews of new weapons. The most fundamental concern arises when system autonomy reaches a level at which humans lose the ability to understand, predict, supervise, and effectively control the use of force. At that point, the use of AI and autonomous weapons ceases to be merely a matter of technological innovation and becomes a question of compliance with International Humanitarian Law and the protection of human beings in armed conflict.

B. Legal Accountability Framework for the Use of Autonomous Weapons Resulting in Violations of International Humanitarian Law

The findings of this study indicate that the use of autonomous weapons resulting in violations of International Humanitarian Law (IHL) does not eliminate legal accountability merely because certain operational decisions are made by Artificial Intelligence (AI)-based systems. Autonomous weapons are, in essence, means employed by humans and states in the conduct of military operations.²¹ Accordingly, the autonomous nature of such technology cannot serve as a basis for eliminating the legal obligations of those involved in developing, controlling, activating, ordering, or deploying the system. When the use of autonomous weapons results in conduct contrary to IHL, the legal inquiry must focus on the parties having a legal and factual connection to the deployment and operation of the system.

The legal accountability framework applicable to autonomous weapons must fundamentally be based on the principle that technology cannot become a legal subject replacing human beings in bearing legal responsibility. Algorithms, software, sensors, and weapons systems do not possess legal capacity in the same manner as states or individuals.²² Therefore, even where an attack decision is generated through an algorithmic process, its legal consequences must ultimately be traced to the human beings and institutions exercising authority over the system. This approach is consistent with the nature of IHL, which imposes legal obligations upon parties involved in armed conflicts rather than upon the instruments used in warfare.

²¹ Michael C Horowitz, "Artificial Intelligence, International Competition, and the Balance of Power," *Texas National Security Review* 1, no. 3 (2018): 36–57.

²² Nehal Bhuta et al., *Autonomous Weapons Systems: Law, Ethics, Policy*, *Cambridge Journal of International and Comparative Law*, vol. 5, 2016.

Legal accountability may be divided into two principal domains: state responsibility and individual responsibility. This distinction is important because the deployment of an autonomous weapon may occur as part of a state's military operation while simultaneously involving the acts or omissions of particular individuals. State responsibility concerns violations of international obligations attributable to the state, whereas individual responsibility concerns conduct by natural persons that satisfies the elements of an international-law violation or crime.²³ These two forms of responsibility may arise concurrently without necessarily excluding one another.

With regard to state responsibility, the use of autonomous weapons by armed forces constitutes, in principle, conduct undertaken in the institutional capacity of the state. A state cannot evade its obligations under IHL by asserting that the harmful conduct was determined by an algorithm. When a weapons system is employed by a state organ in a military operation, the deployment of that system remains attributable to the state. Accordingly, where such use constitutes a breach of an international obligation binding upon the state, the consequences of state responsibility may arise in accordance with the law of state responsibility.

State responsibility is relevant not only once an autonomous weapon has been deployed in an attack but also from the stages of development, procurement, testing, and operational deployment. States have an obligation to ensure that new weapons can be employed in conformity with IHL.²⁴ This obligation is closely connected to the requirement to conduct legal reviews of new weapons, means, and methods of warfare. Consequently, a state's failure to conduct an adequate legal assessment of an autonomous system may constitute an important factor in determining whether the state has fulfilled its obligations under international law.

This obligation becomes increasingly significant because the level of autonomy of a system may affect the ability of humans to anticipate the consequences of its use. A state developing or acquiring an autonomous system must understand its characteristics, limitations, and operational environment. Where a state deploys the system under circumstances inconsistent with its technical capabilities and operational limitations, and such deployment results in a violation of IHL, the autonomous nature of the system cannot be invoked as a basis for avoiding responsibility. State responsibility therefore also encompasses decisions concerning when, where, and under what conditions an autonomous system is deployed.

In addition to state responsibility, individual responsibility must be established for persons who play a role in the use of autonomous weapons. Such individuals may include those issuing orders, commanders authorizing the deployment of the system, operators activating or supervising the system, and other persons who knowingly make decisions relating to its use.²⁵ However, not every consequence generated by an AI system can automatically be attributed to

²³ Rain Liivoja, "Technological Change and the Evolution of the Law of War," *International Review of the Red Cross* 97, no. 900 (2015): 1157–79.

²⁴ Vincent Boulanin and Maaïke Verbruggen, "Artificial Intelligence, Cyber Operations and Autonomous Weapons," *SIPRI Yearbook*, 2019.

²⁵ Paul Scharre, "Autonomous Weapons and Operational Risk," *Journal of Strategic Studies* 42, no. 6 (2019): 817–40.

every individual involved. Individual responsibility must be based on the relationship between the individual's act or omission, the legal obligations applicable to that individual, and the requisite elements of fault under the applicable law.

In this context, *mens rea* is of particular importance. International criminal responsibility generally requires not only the occurrence of prohibited conduct or consequences but also a particular mental element corresponding to the relevant international crime. Where an attack is conducted through an autonomous system and results in civilian casualties, it is necessary to determine whether the responsible person knew or should have known the relevant circumstances, whether the requisite intent or knowledge existed, and whether the decision to deploy the system was made while disregarding known risks. Thus, the fact that a system independently generated a decision does not, by itself, establish the criminal culpability of an individual.

This issue demonstrates the importance of distinguishing technological error from legal fault. An algorithmic error, sensor malfunction, or hardware failure constitutes a technical problem, whereas legal responsibility requires an assessment of human decisions that caused or contributed to the deployment and operation of the system. For example, where an operator knows that a system has a high error rate in a particular environment but nevertheless deploys it under those circumstances, the legal issue is no longer merely an AI malfunction.²⁶ The human act or omission involved in deploying the technology may constitute a basis for assessing legal responsibility.

The accountability framework must also consider the position of commanders within the chain of command. In military operations, decisions concerning the deployment of autonomous systems generally do not occur in isolation but within a particular structure of authority and command. Commanders may determine operational objectives, establish limitations on the use of weapons, authorize deployment, or supervise the conduct of operations. Therefore, when an IHL violation occurs, it is necessary to examine whether the commander possessed relevant authority and information, whether the commander had an obligation to prevent or stop particular conduct, and whether that obligation was breached.

The concept of command responsibility becomes relevant where a military superior exercises effective command and control over subordinates, knew or had reason to know that unlawful conduct was being committed, and failed to take the necessary and reasonable measures to prevent or punish such violations. In the context of autonomous weapons, applying this concept presents challenges because the conduct resulting in a violation may constitute an output of a system that was not fully predictable to either the operator or commander. Nevertheless, technological uncertainty does not automatically eliminate command responsibility where there was prior knowledge of the system's risks and a corresponding obligation to supervise its deployment.

The problem becomes increasingly complex where no single individual directly determines the attack that violates IHL. In autonomous weapons systems, the process of using

²⁶ Vincent Boulanin and Maaïke Verbruggen, "Mapping the Development of Autonomy in Weapon Systems" (Stockholm International Peace Research Institute (SIPRI), 2017).

force may involve technology developers, manufacturers, procurement officials, commanders, operators, intelligence analysts, and other actors responsible for determining system parameters. This creates a decision-making chain that is more complex than that associated with weapons systems under complete human control. Accordingly, determining responsibility cannot be limited to identifying the person who physically initiated the attack but must encompass the entire decision-making process that enabled the attack to occur.

This situation gives rise to what is commonly referred to as an accountability gap, namely a gap between the occurrence of a legally wrongful consequence and the ability to clearly identify the party responsible. In autonomous weapons systems, such a gap may arise because the system generates decisions through the interaction of algorithms, data, sensors, operational environments, and human-defined parameters. In the absence of adequate documentation and oversight mechanisms, it may be difficult to determine whether a violation resulted from a design defect, programming error, deployment decision, failure of supervision, or a combination of several factors.

To prevent an accountability gap, the legal accountability framework for autonomous weapons should be based on the principle of traceability, namely the ability to trace the processes and actors involved in decisions concerning the use of force. Each stage of system deployment should be traceable, beginning with development and testing, the establishment of parameters, deployment decisions, activation, supervision, and the operational outcome. Such documentation is essential for determining whether the system was used in accordance with legal and military procedures and for identifying the actors exercising authority and bearing responsibility at each stage.

The principle of human accountability is also an important foundation of the accountability framework. Meaningful human control is necessary not only to ensure compliance with IHL but also to ensure that an identifiable party can be held accountable when a violation occurs. Where humans possess genuine authority to determine the purpose of deployment, restrict the operational environment, supervise the system, and terminate an attack, the chain of accountability can be established more clearly. Conversely, where humans merely provide initial authorization without the capacity to understand, supervise, or terminate the system's actions, the risk of an accountability gap becomes significantly greater.

The accountability framework must also recognize that the use of new technologies must not lower the standards of protection established by IHL. States cannot invoke technological complexity as a justification for reducing the standard of precaution applicable to military operations. Where a system is known to have limitations in identifying targets or operating in particular environments, its deployment under those circumstances must be carefully assessed. Decisions concerning the use of autonomous weapons should be based on foreseeable levels of risk and the capacity of humans to exercise effective control over the system.

From the perspective of international criminal law, the use of autonomous weapons resulting in attacks against civilians or civilian objects may raise issues of criminal responsibility where the elements of an international crime are satisfied. However, a finding of individual criminal responsibility must not be based solely on the consequences generated by the system. It requires an assessment of the nature of the conduct, the status of the victims or objects, the

circumstances of the armed conflict, the relationship between the individual and the conduct, and the requisite mental element. Accordingly, the use of AI does not automatically create a new form of criminal responsibility; rather, the technology represents a new context in which established principles of international criminal responsibility must be applied.

Based on this analysis, the most appropriate accountability framework is one that places humans and states at the center of responsibility, while treating AI and autonomous weapons as instruments whose use must be traceable to actors possessing legal authority over them. State responsibility concerns the deployment of such systems by state organs and failures to comply with international obligations, including the obligation to conduct weapons reviews and ensure that weapons are employed consistently with IHL. Individual responsibility concerns persons whose acts, orders, decisions, or omissions cause or contribute to violations, provided that the applicable requirements for responsibility are satisfied.

The autonomous nature of a weapon cannot be treated as an exculpatory mechanism. Rather, technological autonomy should increase the requirements for supervision, testing, documentation, and human control. The greater the capacity of a system to independently determine targets and employ force, the greater the need to ensure that humans can understand the system's behavior, restrict its deployment, intervene when necessary, and remain accountable for decisions concerning its use. This principle is essential to prevent technological development from creating a legal space in which responsible parties can shield themselves behind algorithmic decisions.

Ultimately, the legal accountability framework governing autonomous weapons must be constructed through a layered approach connecting state responsibility, individual responsibility, command responsibility, weapons-review obligations, and meaningful human control. Such an approach enables the law to respond to technological complexity without compromising the fundamental principle of IHL that the use of armed force must remain subject to human control and accountability. When autonomous weapons are deployed and result in violations of IHL, legal analysis must not stop at identifying who operated the machine. Instead, it must examine who possessed the authority, knowledge, capacity to prevent the violation, and legal obligations at each stage of the system's deployment.

The findings of this study demonstrate that the principal challenge of legal accountability concerning autonomous weapons does not lie in the need to recognize Artificial Intelligence as a legal subject, but rather in establishing a chain of human and state accountability capable of following technology-based decision-making processes. This framework must ensure that an IHL violation does not occur without an accountable party merely because the use of force involved an algorithm. The fundamental principle is that weapons autonomy must not become autonomy of responsibility. As long as humans and states remain the actors responsible for developing, procuring, controlling, activating, and deploying autonomous weapons, the obligation to ensure compliance with IHL and accountability for resulting violations remains attached to them according to their respective roles, authority, and degree of fault.

CONCLUSION

The use of Artificial Intelligence (AI) and autonomous weapons in modern warfare is fundamentally subject to the application of International Humanitarian Law (IHL). Although developments in weapons technology have not yet been fully accompanied by specific and comprehensive international legal instruments governing Autonomous Weapons Systems (AWS), the legality of their use must nevertheless be assessed in accordance with the principles of IHL, particularly the principles of distinction, proportionality, precautions in attack, and humanity, as well as the obligation to review new weapons, means, and methods of warfare. The findings of this study indicate that the principal issue does not lie in the use of AI as a technology itself, but rather in the degree of autonomy granted to a system in determining and carrying out the use of force. The greater the authority delegated to an autonomous system to select and engage targets, the greater the requirements for human capacity to understand, supervise, control, and intervene in the system. Accordingly, the use of autonomous weapons can only be justified where their characteristics and the circumstances of their use enable compliance with IHL obligations and where meaningful human control remains present throughout the use-of-force process. The legal accountability framework for the use of autonomous weapons resulting in violations of IHL must continue to place states and human beings at the center of responsibility, rather than transferring responsibility to Artificial Intelligence or algorithms. Accountability may encompass state responsibility for the conduct of state organs or for failures to comply with international obligations, as well as individual responsibility for persons whose orders, decisions, actions, or omissions cause or contribute to violations, including command responsibility where its requisite elements are satisfied. The autonomous nature of a system cannot serve as a basis for eliminating or diminishing legal responsibility. Accordingly, an accountability framework based on meaningful human control, traceability, supervision, documentation, and the ability to reconstruct the decision-making chain is required, extending from the stages of development, testing, and procurement to authorization, deployment, and post-operation evaluation. Such a framework is essential to prevent the emergence of an accountability gap and to ensure that advances in military technology do not create areas of unaccountability in the conduct of armed conflict.

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