

# Lethal Autonomous Weapons Systems (LAWS)

## An Analysis

*Sandeep Bhattacharjee\**

*With the introduction of high-speed Internet, the need for defence against hostile attacks has become a challenge. In this article, an effort has been made to understand the sentiments of researchers, academicians and related parties for LAWS, also known as Lethal Autonomous Weapons Systems. The findings of the research have been aided through analysis using open ended R4.2.2 console programming. Frequency word table, WordSpace and bar plot, word association based on correlation analysis were generated, which led to the understanding of the potential existence of LAWS in present and future scenarios. The findings of the research can be useful for academicians, researchers, policymakers and in other related domains.*

**Keywords:** *Autonomous, Human, Military, System, Technology, Weapons*

### INTRODUCTION

#### Advanced Targeting Systems

In present times, there exist systems for autonomous weaponry and combat vehicles that use sensor technology developed by the United States (US)

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\* Dr Sandeep Bhattacharjee is Assistant Professor at Amity University, Kolkata, India.

Army and machine vision to locate targets. According to Ashley Roque, the US Army is currently studying proposals from multiple defence companies to create a fully autonomous ground vehicle capable of battle alongside human soldiers.<sup>1</sup> This design has been named as Advanced Targeting and Lethality Automated System (ATLAS). The first demonstration of its kind as well as the most recent test of ATLAS happened in 2017, under the ATLAS development project (NVESD), which is monitored by the US Army's Night Vision and Electronic Sensors Directorate.<sup>2</sup> The US Army is more likely to incorporate its sensor technology into the project to help machine vision and provide trustworthy readings.

### **Use of Artificial Intelligence for Advanced Targeting Systems**

#### *The United States of America*

One of the proposed architecture for advanced targeting systems is the Integrated Sensor Architecture (ISA). This approach allows sensors and human-operated computers to share information without the need for point-to-point hardware connections.<sup>3</sup> N. Mejia mentioned how different aspects of such technology necessary to develop ATLAS were highlighted at a US Army industry day. Despite the fact that each aspect has its own potential applications for the technology, only a handful of them referenced Artificial Intelligence (AI) or Machine Learning (ML) approaches.<sup>4</sup> Some major segments that included AI and ML were discussed, including:

1. Image Processing Topics, which primarily included AI/ML algorithms and concepts related to automated image search.<sup>5</sup>
2. Data Collection, including managing that data, organising it within databases and using it to train ML algorithms.<sup>6</sup>
3. Fire Control mechanism, also known as advanced targeting algorithms.<sup>7</sup>

#### *China*

M. Abadicio highlighted the use of AI by the Chinese military, demonstrating the disruptive and unpredictable character of the technology.<sup>8</sup> AI is changing the rules of the game and China seems to be in a position to take full advantage of such technology, surpassing conventional combat tactics in today's battlefield. Due to the lack of regulation around AI research and development, China is operating in a grey area that may be difficult for other countries to imitate.<sup>9</sup> According to Allen, China is leading the race as the global leader in a number of AI-related indicators, such as the volume of scholarly articles, patent filings and start-up funding. This dominance has

been credited to significant technological developments and easy access to foreign capital.

The AI sword seems to have the ability to cut in both directions. Many affluent countries are trying to be careful while managing the usage of AI and ML, especially in the military domain, because this seems to be a grey area where much learning is still needed. While creating such ML-based defence systems, there isn't much time for testing for accuracy and dependability, thus China's ambitious pursuit of AI supremacy could have severe negative effects worldwide.<sup>10</sup>

### **Latest Drone Market**

The military drone market is predicted to increase at a CAGR of 11.7 per cent, reaching US\$ 26.0 billion by 2028, from its estimated value of US\$ 13.4 billion in 2021. The industry is growing as more and more military organisations have begun the use of tactical drones that seem to uphold international law.<sup>11</sup> The demand for military drone production has also increased due to increased government spending on military drones to improve the efficacy of military operations. As a result, the market for military drones is being driven by rising government spending on unmanned aircraft.<sup>12</sup>

The increased desire for better surveillance systems, growing military budgets and technological improvements are now considered as prime factors that have an impact on the global market for military drones. In both industrialised and developing nations, a broad product selection has dominated the market for military drones. General Atomics Aeronautical Systems Inc. (GA-ASI) (US), Thales Group (France), Northrop Grumman Corporation (US), Israel Aerospace Industries Ltd. (Israel), Elbit Systems Ltd. (Israel), Lockheed Martin Corporation (US), AeroVironment Inc. (US) and Boeing (US) are the leading businesses that dominate the global military drone market.<sup>13</sup>

## **LITERATURE REVIEW**

Lethal Autonomous Weapons Systems (LAWS) are military platforms that use AI to autonomously locate and engage targets without human intervention, as defined by Christopher J. Coyne and Yahya Alshamy.<sup>14</sup> Rayn Yanez discussed how a rapidly developing technology, that is, AI, is propelling the creation of so-called LAWS. While scientists perform their own research to make sure that the growth of weapon technology responds

to the laws of war, the use of these weapons has raised worries for the United Nations' involvement in international security.<sup>15</sup> A study by Mariarosaria Taddeo and Alexander Blanchard in 2021 focused on the definition of Autonomous Weapon Systems (AWS). The definition covers the different aspects of AWS and leads to various approaches to addressing the ethical and legal issues raised by these weapons systems, according to a comparison of the official definitions of AWS currently provided by states and international organisations such as the International Committee of the Red Cross and North Atlantic Treaty Organization (NATO). This strategy may be viewed as detrimental in improving AWS understanding, which can help to facilitate consensus on deployment conditions and rules, including the fundamental consideration of using AWS.<sup>16</sup> According to an article by Chris Jenks, LAWS have been around for a while, although they have mostly been defensive and anti-material. But when more sophisticated defensive LAWS, such as complex swarming systems flourish, governments will definitely create countermeasures. The process of transformation from being a defensive manoeuvre to a full-scale counter-offensive inclusion cannot be ruled out.<sup>17</sup>

The term 'new form of technology weapon' was coined by Kristen Eichensehr who observes that most law-of-war principles apply mostly to newly developing technologies and any new laws specific to a new technology should be a fairly tiny fraction of the laws of war applying to such existent technology.<sup>18</sup> LAWS are autonomous weapons systems that, once activated, are either entirely or almost entirely free of human control. These costs must be taken into account as part of the overall assessment of LAWS because such capabilities have the potential to revolutionise policing and warfare with possible significant, detrimental consequences to human welfare. Another paper by Asif Khan and Maseeh Ullah reviewed recent writings on the enactment of an international ban on AWS. The study responds to certain academics' concerns that such a prohibition would be difficult for a number of different reasons. It makes a case for a theoretical foundation for such a ban based on moral and legal considerations for human rights as well as humanitarian concerns. Prior to the development of a wide array of automated and autonomous weapons systems that are likely to pose serious threats to people's fundamental rights, the authors argue that it would be preferable to establish this duty as an international standard and express it through a treaty.<sup>19</sup> In his 2020 study, Eric Talbot Jensen focused on the opinions of states, many of which have been made public as a result of discussions among States Parties to the Certain Conventional Weapons Convention. He looked at views stated by academics and Non-Governmental Organisations (NGOs),

with an emphasis on the opinions of governments. The results of this analysis indicate that governments have not yet agreed on the legal significance of human decision-making in the Law of Armed Conflict (LOAC) compliance. One may only draw the conclusion that the law at this time does not require a human choice for choosing and engaging targets to be valid given the lack of consensus. The international community might come to this conclusion, but as of now it still seems a faraway sight of an actual goal, maybe more of a theoretical goal.<sup>20</sup> According to Udani Gunawardena, automatic warfare, which includes airborne drones that are frequently used in ongoing armed conflicts, is now a well-established part of military technology worldwide.<sup>21</sup> One of the most terrifying stages of anticipation is when people are completely cut off from the decision-making process and the task is turned over to AI. In such a situation, the question of criminal responsibility for individuals and states for flagrant violations of International Humanitarian Law (IHL) and International Humanitarian Rights Law (IHRL) in the implementation of LAWS has equal importance.<sup>22</sup>

In one of the discussions by Thompson Chengeta the argument over AWS has centred on the implications of AWS for IHL rather than other aspects of international law. The assumption is based on the fact that AWS will be used in the context of an armed conflict, making IHL the relevant regime. To that purpose, researchers have debated whether AWS can adhere to important and conventional IHL standards such as humanity, military necessity, distinction, proportionality and precaution.<sup>23</sup> Bryant Walker Smith's argument on 'meaningful human control' of lethal weapons omitted any discussion of the function of a human in an otherwise automated weapon system. Instead, the roles of the human and the machine were reversed to take into account automated technologies that reduce fatal force initiated by people. Arguments were made that a predisposition towards human authority could prevent future constraints on that power and that there might be a blurring of the lines between automated systems that use lethal force and automated systems that restrict that use.<sup>24</sup> The most recent instances of this LAWS are remotely piloted vehicles (drones), cyber-weapons and AWS, according to Jens David Ohlin. Each of these weapons allows the opposing force to cause military harm while shielding the weapon's operators from the area of operations. The main goal is to create a system that offers the operator total risk immunity while also doing the enemy the most amount of harm possible.<sup>25</sup> According to Nathan Reiting, the ability of LAWS to choose and engage targets without human intervention or authorisation is seen to put IHL in danger, leading to an increase in international conflict

and unethical or 'unjust' combat decisions. This method lays the framework for abiding by the principles of IHL by allowing a commander to act as a link between accountability and 'use'.<sup>26</sup> The 2016 book by Thompson Chengeta, *Dignity, Ubuntu, Humanity and Autonomous Weapon Systems (AWS) Debate: An African Perspective* discussed the African idea of 'ubuntu', or humanity, and its applicability to the current Amazon debate. Additionally, according to the author, African nations ought to contribute more to the continuing discussion on AWS and tell the rest of the world about their experiences with the ubuntu philosophy.<sup>27</sup>

The concept of a complete ban on AWS, also known as 'killer robots', has advanced from a suggestion in an NGO report to the subject of an international symposium attended by delegates from over 80 countries, according to Rebecca Crootof. However, no one has yet put out a coherent definition of autonomy in terms of the law of armed conflict, which frequently causes legal, ethical, policy and political issues to be mixed up. In a research article authored by Crootof, an autonomous weapon system is defined as 'a weapon system capable of independently selecting and engaging targets based on conclusions derived from acquired information sources' in order to resolve this problem and assist future treaty negotiators.<sup>28</sup> A 2017 study on killer robots by Stephanie Carvin, includes questions of responsibility as well as legal, moral and ethical difficulties. Even while anything could go wrong, there doesn't seem to be as much worry about how it will go wrong. The main distinction between LAWS and our current weaponry is the freedom of action they will have on the battlefield, which will give rise to special regulatory challenges. It is possible to investigate LAWS issues via the lens of system failure using the natural accident theory (and others who disagree with it). The emphasis on failure leads to fresh perspectives on issues involving risk mitigation strategies (such the appraisal of weaponry) and responsibilities (chain of command).<sup>29</sup> Chris Jenks reaffirmed the Campaign to Stop Killer Robots (The Campaign) in 2016, which has prompted greater discussion in favour of a prohibition on LAWS by imagining so-called killer robots in the far-off future. After outlining the theoretical and practical flaws in The Campaign's approach, an alternate that calls for a moratorium on LAWS primarily intended to lethally target personnel was proposed.<sup>30</sup> Eliav Lippich and Eyal Benvenisti examined the debate over the legality of autonomous weapons (killer robots) under international law with the aim of providing a new lens to discuss the difficulties that such systems pose with the view that modern warfare is an exercise of executive power by states against individuals, and as such should be subject to fundamental notions of administrative

law, most notably the obligation to exercise proper care. The need to use reasonable administrative discretion can be correlated with the delegation of the power to 'decisions' impacting basic rights to computer systems, such as autonomous weaponry.<sup>31</sup>

Peter Margulies analyses how AWS, in which a computer chooses targets without human input, could complicate the application of IHL. Liability for autonomous IHL infractions is the most obvious challenge. An AWS that violates IHL is not liable to military punishment or war crimes trials. Dynamic evaluation should include routine reviews of the AWS's learning process to make sure that an AWS in the field does not pick up IHL-violating behaviour. Dynamic targeting decisions made by AWS are easier to understand. Successful evaluation requires a thorough, oral explanation rather than buried layers of computer calculations.<sup>32</sup> According to Mary Ellen O'Connell, technological advancement in completely autonomous weapon systems is fast. Without human near-term judgements, accountability becomes difficult, and without accountability, the potential of law and ethics to restrain is gone. At the current rate of discovery, such fully autonomous systems will be accessible to military arsenals within a few decades, if not a few years. Years before a potentially fatal procedure is performed, the computer of a fully autonomous system can be created.<sup>33</sup> According to Nicholas Mull, LAWS are a threat to humanity and are often prohibited after an impartial analysis without bias towards a certain goal. The article argues that natural law, which is unrestricted by existing codifications, is the source of the law of war. To support the conduct of a government attorney, a thorough legal analysis of the LAWS concept was also conducted. This analysis fairly weighs the common defences and objections to LAWS from the perspectives of history, concepts of honour, morality and ethics, military science and an understanding of warrior culture.<sup>34</sup> According to Laura Dickinson, the spread of LAWS presents a number of difficulties for legal systems intended to assure public accountability for unlawful uses of force. The enforcement of IHL has historically relied on individual criminal responsibility, which is complicated by autonomous weapons, which divide responsibility for using violence. In addition, because administrative bureaucracies are not rigid, merely establishing administrative procedures to look into and impose non-criminal sanctions for transgressions of international norms can lead to the development of a cadre of specialists within governments who correlate these values and promote a culture of greater compliance.<sup>35</sup>

According to Kenneth Anderson and Matthew C. Waxman, deadly autonomous vehicles will undoubtedly appear in future battlefields, but they

might appear gradually and incrementally. In addition to complex strategic and operational problems, the mix of inevitable growth and incremental advancement raises important legal and ethical questions. Due to supply-side and demand-side factors, some technologies will become unavoidable. In addition to the need for ongoing research, development and deployment due to the escalating pace of military operations and political pressures to protect civilians as well as one's own personnel and property, advances in sensor and computational technologies will make it possible for 'smarter' machines to be programmed to kill or destroy. The formation of standards regarding appropriate systems and applications will proceed incrementally, much like the development of AWS.<sup>36</sup> On 9 September 2013, Kenneth Anderson and Matthew C. Waxman noted that the public debate over the potential creation of autonomous armed weapons is becoming more heated. Some worried critics portray the future as a straightforward choice between a society in which specific institutions are officially forbidden and a world of legal emptiness and ethical breakdown on the battlefield, frequently employing science-fiction imagery. However, even if an outright ban on AWS is put into place, it would trade any potential dangers that these systems may present for the real, albeit less obvious, danger of failing to develop automation that could make the use of force more precise and less harmful to the civilians caught in its path.<sup>37</sup> Another study by Matthijs M Maas, Kayla Matteucci and Di Cooke found that there has been a surge in interest in the use of AI technology in combat. While this field is rapidly developing, it may also increase the risk of global catastrophe. After reviewing the limited historical engagement of the Global Catastrophic Risks (GCR) field with military AI and outlining recent developments in military AI, two risk scenarios have been established. A research programme that will enable a more full and multidisciplinary understanding of the potential risks posed by military-level AI today and in the future is required, according to the authors' conclusions.<sup>38</sup>

Lethal Autonomous Robots (LARs) were mentioned as one of the future asymmetric dangers by Jeffrey S. Thurnher. LARs can be used to tackle the growing number of threats, including China's powerful jamming capabilities, widespread cyberattacks and swarms of Iranian patrol boats; these robots may act more quickly than people and have catastrophic impact even when communications lines are down. Since other players are expected to be interested in LARs, the US should move rapidly to develop a controlling capability in fully autonomous targeting.<sup>39</sup> As highlighted in one of the study papers by Maziar Homayounnejad, the lethality of LAWS may be understood from the fact that, once activated, it can select and engage targets without



further human interaction. Some states and defence companies are currently creating LAWS for potential deployment, although neither are they in use nor are they officially a part of any nation's defence strategy.<sup>40</sup> The author also suggests outlawing the usage of such devices in another paper.<sup>41</sup> The failure of the UN-assembled Groups of Experts (GCE) to look at the technological, legal and moral issues surrounding the use of LAWS was noted by Shane Reeves, Ronald T. P. Alcala and Amy McCarthy. Their paper covers the challenges that states face while creating global legal regulatory frameworks. Some of these challenges include the complexity of defining terms related to LAWS, disagreements over potential substantive restrictions and the uniqueness of the weapon systems themselves, which may affect nations' willingness to be bound by international law.<sup>42</sup> In his article from 2013, Tyler Evans examined how the Martens Clause has been interpreted and made suggestions on how countries seeking to develop autonomous armed systems may move forward to safeguard their interests.<sup>43</sup> According to Alonso Dunkelberg, military technology is moving towards developing autonomy, for example, enabling drones to choose and engage targets on their own. This development presents substantial problems for human rights advocates, legislators and the entire international legal community in light of the requirements of IHL and human rights generally. These two policies have serious drawbacks. Total prohibition might be politically unfeasible, whereas small regulatory reforms run the risk of inciting an arms race between rival governments and reducing the incentives for self-regulation. Based on a thorough assessment of LAWS' capacity to adhere to IHL, this paper recommended a method for controlling permissible and forbidden applications of this technology on a case-by-case basis.<sup>44</sup>

From the above literature review, we can observe the facts on LAWS, discussions on LAWS, LAWS-based dangers, future of LAWS-based systems and the reason for their gradual acceptance as means of freedom and sustainability. Based on the above-discussed facts, we also need to ascertain certain associations for which certain alternate assumptions have been drawn:

1. H1: There is a strong relationship between the words 'lethal' and 'government'.
2. H2: There is a strong relationship between the words 'autonomous' and 'weapons'.
3. H3: There is a strong relationship between the words 'weapons' and 'autonomous'.
4. H4: There is a strong relationship between the words 'systems' and 'autonomous'.

## DATA COLLECTION

The content data was gathered from 20 online websites on AWS from Google News and other relevant news sources and put together in a '.txt' file. This '.txt' file was later mined using open licensed console R4.2.2 program.

## DATA ANALYSIS AND INTERPRETATION

### Lethal Autonomous Weapons Systems (LAWS) Text Mining Using R 4.2.2

A text mining was conducted on the articles content generated on 20 websites on AWS from Google News and other relevant news sources. Further, analysis revealed the following:

#### *Frequency Table of Words*

```

> head(d, 10)
      word freq
weapons weapons 142
systems systems 137
military military 127
human human 124
autonomous autonomous 118
will will 112
use use 108
technology technology 106
also also 97
technologies technologies 96
> head(d, 20)
      word freq
weapons weapons 142
systems systems 137
military military 127
human human 124
autonomous autonomous 118
will will 112
use use 108
technology technology 106
also also 97
technologies technologies 96
cyber cyber 94
states states 80
international international 78
new new 73
development development 71
system system 65
rights rights 64
intelligence intelligence 61
" " 59
national national 59

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**Figure 1** Frequency Table of Words from Content

Source: Author's own.

As seen in Figure 1, some of the most popular words with the highest frequencies present in the content included *weapons* (142), *systems* (137), *military* (127), *human* (124), *autonomous* (118), *will* (112), *use* (108), *technology* (106), *also* (97), *technologies* (96) and so on.

### *Frequent Terms with Associations*

```

findFreqTerms(dtm, lowfreq = 20)
[1] "autonomous"      "lethal"          "weapons"         "defence"
[5] "systems"         "weapon"          "will"            "operations"
[9] "system"          "artificial"      "aws"             "committee"
[13] "future"          "intelligence"    "use"             "air"
[17] "defense"         "information"     "can"             "human"
[21] "war"             "without"         "control"         "level"
[25] "within"          "said"            ""                "area"
[29] "international"  "law"             "well"           "armed"
[33] "civilian"        "requirements"    "may"            "advanced"
[37] "capabilities"   "development"     "legal"          "technologies"
[41] "one"             "new"             "process"        "security"
[45] "also"           "countries"       "data"           "military"
[49] "report"         "research"        "technology"     "global"
[53] "like"           "national"        "drone"          "drones"
[57] "even"           "make"            "across"         "nuclear"
[61] "-"              "challenges"     "combat"         "ethical"
[65] "forces"         "risks"           "ensure"         "act"
[69] "application"    "responsible"     "strategy"       "emerging"
[73] "first"          "group"           "laws"           "including"
[77] "many"           "warfare"        "however"        "used"
[81] "made"           "navy"            "efforts"        "software"
[85] "states"         "united"          "need"           "rights"
[89] "army"           "china"           "government"     "russia"
[93] "speakers"      "cybersecurity"  "general"        "political"
[97] "part"           "summit"         "applications"   "special"
101 "india"          "country"        "quantum"        "cyber"
105 "belief"         "freedom"        "rapporteur"     "religion"
109 "terrorism"      "service"        "force"          "says"
113 "communications" "services"       "indian"         "trust"

```

**Figure 2** Frequent Terms with Associations from Content

Source: Author's own.

As seen in Figure 2, some of the frequent terms with other word associations included words such as 'autonomous', which was found to be associated with 'lethal', 'weapons' and 'defence'. Similarly, another popular word 'systems' was associated with 'weapon', 'will' and 'operations'. The word 'future' was associated with 'intelligence', 'use' and 'air' and so on.

### *WordSpace and Bar Plot*

As seen in Figure 3, a WordSpace has been generated along with a bar plot that clearly highlights the dominance of the words 'weapons', 'systems', 'military', 'human', 'autonomous', 'will', 'use', 'technology', 'also' and 'technologies' respectively in the report content as available.

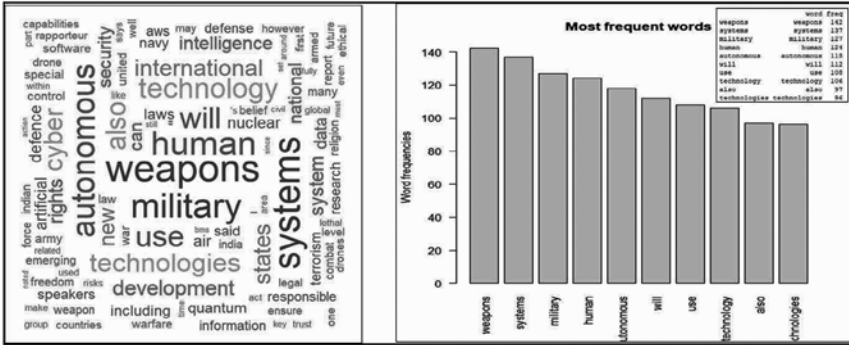


Figure 3 WordSpace and Bar Plot Based on Content Appearances

Source: Author's own.

Word Associations Based on Correlation

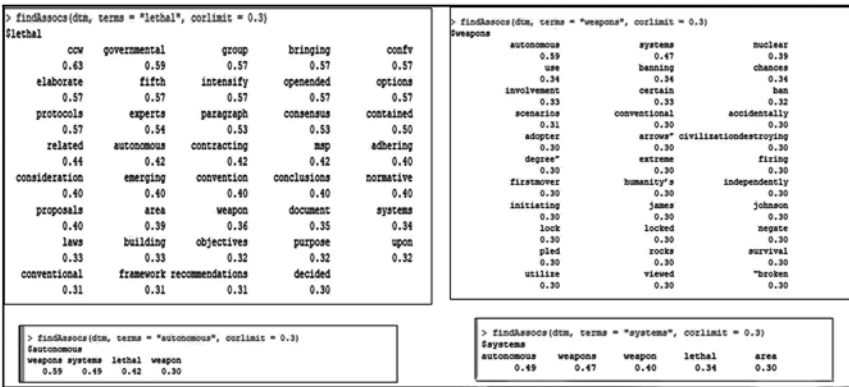


Figure 4 Word Associations Based on Word Correlation for Keywords in LAWS

Source: Author's own.

As seen in Figure 4, co-relational analysis for keyword 'lethal' with higher correlation (correl> 30 per cent), was found in 'ccv', 'governmental', 'group', 'bringing', 'confv', 'elaborate' and others respectively. Similarly, 'autonomous' word had 59 per cent correlation with 'weapons', 'systems' (49 per cent), 'lethal' (42 per cent) and 'weapon' (30 per cent).

Also, another keyword 'weapons' was found to have highest correlation with 'autonomous' (59 per cent), 'systems' (47 per cent), 'nuclear' (39 per cent), 'use', 'banning', 'enhance' (34 per cent) respectively. The keyword

'systems' was highly correlated with the word 'autonomous' (49 per cent), 'weapons' (47 per cent), 'weapon' (40 per cent), 'lethal' (34 per cent) and 'area' (30 per cent) respectively.

### Discussion on Advantages and Disadvantages of LAWS

Table 1. Advantages and Disadvantages of Lethal Autonomous Weapon Systems (LAWS)

SI No.	Advantages	Disadvantages
1	Force Multiplication	Possibility of large-scale violence
2	Expanded Battlefield	Less chances of abandonment once adopted
3	Credible deterrent	Lack of human control
4	Reduced Casualties	Over dependence on artificial intelligence
5	Operational efficiency	Internal security threats
6	Cost Savings	Long-term implementation
7	Technological Advantages	Chances of random or frequent uses

Source: Author's own.

#### *Possible Advantages of LAWS*

1. *Force Multiplication*: Deployment of LAWS and training humans to use them can lead to needing fewer human soldiers and higher efficiency in terms of each mission.
2. *Expanded Battlefield*: It allows access to unmanned and difficult terrains, ensuring supervision and control in previously unmanageable or unexplored areas, both within and outside borders.
3. *Credible Deterrent*: Possession of LAWS can also act as a deterrent against hostile activities and potentially act as a means for counter-offensive actions in applicable situations.
4. *Reduced Casualties*: Human casualties could reduce significantly both in terms of manpower casualties and precision targeting, reducing potential civilian casualties.
5. *Operational efficiency*: Mission results can improve significantly with faster data management and decision-making capabilities arising from the use of AI algorithms.

6. *Cost Savings*: Although initial development including manufacturing, assembling and experimentation costs might be higher, but these can significantly reduce over a long period of time as compared to fully human managed missions where training costs on humans might be much higher over similar period.
7. *Technological Advantages*: Continuous experimentation with the possibility of viable improvements can lead to high quality innovation that can edge past other nations or parties that are involved in similar scale of technological development. It can also be used in high chemical or radiation zones, leading to better results from mission outcomes.

#### *Possible Disadvantages of LAWS*

1. *Possibility of large-scale violence*: There can be some probabilities where LAWS can be misdirected and large-scale impact on human population may be possible, which may be regulated using strict supervision control mechanisms.
2. *Less chances of abandonment once adopted*: Once LAWS becomes a part of common utility platform, the chances of abandoning it might considerably reduce as benefits of usage may outweigh costs of manufacturing, assembling or deployment costs.
3. *Lack of human control*: Higher degree of machine control due to usage of AI can result in gradual loss of total human control on LAWS, which may lead to undesired situations.
4. *Over dependence on AI*: Long-term usage of AI-based LAWS can lead to obsolescence of other conventional weapon systems, which in the long term may reduce the stockpile of a variety of weapon systems at the disposal of armed forces.
5. *Internal security threats*: There might be some sleek chances of LAWS being misguided or mis-utilised, which may pose some kind of internal security threats in the future and maybe controlled with improved supervision.
6. *Long-term implementation*: Continuous persistence of LAWS can lead to continuous dependency on AI and less dependency on human creativity and values.
7. *Chances of random or frequent uses*: LAWS at ready disposal with ease of use can lead to more frequent uses of such systems, which can range from normal control environments to highly dangerous environments.

## FINDINGS AND CONCLUSION

Some of the major findings from text mining analysis using R4.2.2 can be listed as follows:

1. The words with the highest frequencies identified in the content included *weapons* (142), *systems* (137), *military* (127), *human* (124), *autonomous* (118), *will* (112), *use* (108), *technology* (106), *also* (97), *technologies* (96) and so on.
2. Frequent terms with other word associations included words such as 'autonomous', which was associated with 'lethal', 'weapons' and 'defence'. Similarly, another popular word 'systems' was associated with 'weapon', 'will' and 'operations'. The word 'future' was associated with 'intelligence', 'use' and 'air', and so on.
3. A WordSpace has been generated along with a bar plot, which clearly highlights the dominance of the words 'weapons', 'systems', 'military', 'human', 'autonomous', 'will', 'use', 'technology', 'also' and 'technologies' respectively in the report content as available.
4. Co-relational analysis for the keyword 'lethal' with higher correlation (correl > 30 per cent) was found in 'ccv', 'governmental', 'group', 'bringing', 'confv', 'elaborate' and others respectively.
5. Similarly, the word 'autonomous' had 59 per cent correlation with 'weapons', 'systems' (49 per cent), 'lethal' (42 per cent) and 'weapon' (30 per cent) respectively.
6. Also, another keyword 'weapons' was found to have highest correlation with 'autonomous' (59 per cent), 'systems' (47 per cent), 'nuclear' (39 per cent), 'use', 'banning', 'enhance' (34 per cent) respectively.
7. The keyword 'systems' was highly correlated with the word 'autonomous' (49 per cent), 'weapons' (47 per cent), 'weapon' (40 per cent), 'lethal' (34 per cent) and 'area' (30 per cent) respectively.

Therefore, as inferred from the above findings, there exists a strong relationship between the words 'lethal' and 'government', 'autonomous' and 'weapons', 'weapons' and 'autonomous', and 'systems' and 'autonomous'. These findings further prove that our alternate hypotheses, that is, H1, H2, H3, H4 stand as true and cannot be denied in the present circumstances. Also, the necessity and usage of LAWS lies in the control of governments around the world, but there is strong evidence based on literature review and author analysis that it may not be difficult to control LAWS once full

autonomy is granted for its precision or widespread usage for both defensive and offensive platforms.

### IMPLICATIONS OF THE RESEARCH AND SUGGESTIVE MODEL

Based on the understanding from the literature review and data analysis using text mining, there seems to be an urgent need for the development and deployment of LAWS for India as it needs to secure and safeguard its borders from many neighbouring countries that have already conceptualised and are walking on the path of indigenous development of LAWS since the last few years. Some of the major reasons why policymakers need to consider it as a necessity and not merely an option are mentioned below:

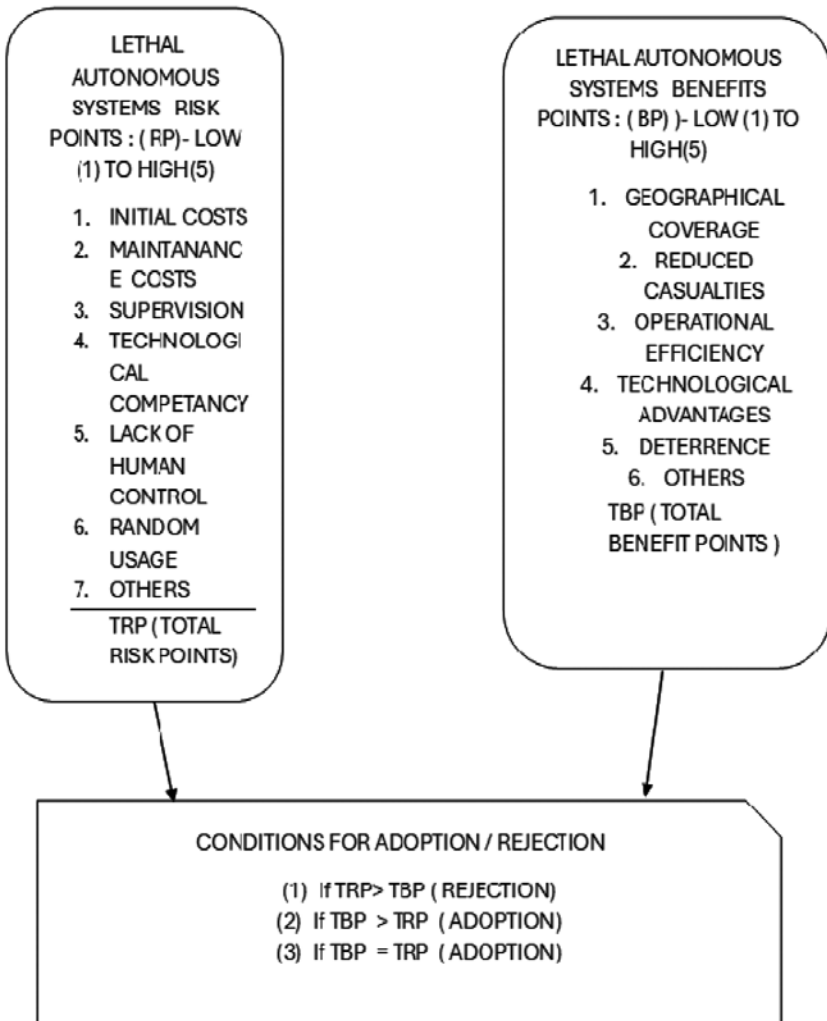
1. Technology upgradation is what makes a country self-reliant both in terms of defence as well as seeking offensive responses to threats posed by potential threats both within and outside our country.
2. Reduction in human casualties can be a prime motivating factor that can accelerate the pace of increased budget induction and collaboration with other parties for seeking innovation in terms of both quality and quantity for such LAWS.
3. Such systems can also be utilised for faster information gathering of hostile movements both within and outside Indian borders and can contribute in increasing the knowledge base and decision making.
4. Dependence on human inputs can decrease, thereby leading to more dependence on technology for gathering vital data related to weather, better vision and capturing and recording of sensitive intelligence inputs.
5. The strength of our forces will multiply in terms of broader area coverage with adequate human-machine distribution for both offensive and defensive manoeuvres.
6. New jobs and skill-sets in terms of human-machine interaction can become a reality with more dependence on training of users for superior control on such systems as deemed necessary.
7. Precision targeting can be normalised by reducing mass casualties of civilians or population as compared to other traditional methods of defensive or offensive operations.

Based on the above analyses, a model for adoption for LAWS is proposed, which is discussed next.



### Lethal Autonomous Weapon System Adoption or Rejection Model (LAR Model)

A new model has been developed, which can assist policy makers to decide which lethal autonomous systems can be developed and deployed for usage in real-life circumstances.



**Figure 5** Lethal Autonomous Weapon System Adoption or Rejection Model (LAR model)

The model can be described in terms of

a. Total risk points:

$$\Sigma TRP = W_0 + W_1 \Sigma IC + W_2 \Sigma MC + W_3 \Sigma S + \dots \dots \dots W_n \Sigma EO$$

b. Total benefit points:

$$\Sigma TBP = W_0 + W_1 \Sigma GC + W_2 \Sigma RC + W_3 \Sigma OE + \dots \dots \dots W_n \Sigma EO$$

Where,

*$\Sigma TRP$  means total risk points*

*$\Sigma IC$  is initial costs*

*$\Sigma MC$  is maintenance costs*

*$\Sigma S$  is Supervision*

*$\Sigma EO$  is others*

*$\Sigma TBP$  is total benefit points*

*$\Sigma GC$  is geographical coverage*

*$\Sigma RC$  is reduced casualties*

*$\Sigma OE$  is operational efficiency*

$W_0, W_1, W_2 \dots W_n$  are weights for each independent factors respectively.  
Conditions:

- (1) If  $\Sigma TRP > \Sigma TBP$ , it means that total risk points are greater than total benefit points. This is an indicator of possible rejection of the associated LAWS.
- (2) If  $\Sigma TBP > \Sigma TRP$ , it means that total benefit points are greater than total risk points. This is a clear indicator of possible acceptance of the associated LAWS.
- (3) If  $\Sigma TBP = \Sigma TRP$ , it means that total benefit points are equal to total risk points. This is a clear indicator of possible acceptance of the associated LAWS.

### CONCLUSION AND RECOMMENDATION

Although most of the countries realise that such LAWS should exist as a deterrent against hostiles, an agreeable common minimum development

programme can act as a possible measure to counterbalance the negativities surrounding the development of such LAWS. Further, rules and regulations can be discussed and established, which can guide the process of LAWS development among countries that can share technology and knowledge with mutual collaboration as the essence of it.

Therefore, the LAR model when developed can help decision-makers to categorise which LAWS can be possibly adopted or rejected. We can therefore finally conclude that LAWS is an excellent weapon system that can prove to be an asset for Indian defence forces both in present and future time period to counter all possibilities, ensuring the safety of the country first at all costs.

## NOTES

1. Ashley Roque, 'Robotic Moves: Army Picks 8 Tech Companies to Compete Robotic Combat Vehicle Pieces', *Breaking Defense*, 3 April 2024, available at <https://breakingdefense.com/2024/04/robotic-moves-army-picks-8-tech-companies-to-compete-robotic-combat-vehicle-pieces/>, accessed on 23 April 2024.
2. Asif Khan and Maseeh Ullah, 'Autonomous Weapon Systems: A New Challenging for International Humanitarian Law and International Human Right Law', SSRN, 22 December 2017, available at <https://ssrn.com/abstract=3092315> or <http://dx.doi.org/10.2139/ssrn.3092315>.
3. J. Kovach and L. Sadler, *Integrated Sensor Architecture (ISA) Database/Media Storage Tool Software Package Documentation*, 2019, CCDC Army Research Laboratory.
4. N. Mejia, 'Autonomous Weapons in the Military – What's Possible and What's Legal', Emerj Artificial Intelligence Research, 10 October 2019, available at <https://emerj.com/ai-sector-overviews/autonomous-weapons-in-the-military/>.
5. Ibid.
6. Ibid.
7. Ibid.
8. M. Abadicio, 'Artificial Intelligence in the Chinese Military — Current Initiatives', *Emerj Artificial Intelligence Research*, 21 November 2019, available at <https://emerj.com/ai-sector-overviews/artificial-intelligence-china-military/>.
9. Ibid.
10. Kartik Bommakanti, 'A.I. in the Chinese Military: Current Initiatives and the Implications for India', Observer Research Foundation, 11 February 2020, available at <https://www.orfonline.org/research/a-i-in-the-chinese-military-current-initiatives-and-the-implications-for-india>.
11. 'Military Drone Industry worth \$18.2 billion by 2028', Markets and Markets, available at <https://www.marketsandmarkets.com/PressReleases/military-drone.asp>.

12. 'Military Drone Market', Fortune Business Insights, available at <https://www.fortunebusinessinsights.com/military-drone-market-102181>.
13. 'Global and China Military Drone Dynamic Monitoring and Future Investment Report 2023', Report, MarketIntellix, available at <https://www.marketintellix.com/report/global-and-china-military-drone-dynamic-monitoring-and-future-investment-report-239667>.
14. Christopher J. Coyne and Yahya Alshamy, 'Perverse Consequences of Lethal Autonomous Weapons Systems', SSRN, 16 January 2021, available at <https://ssrn.com/abstract=3767512> or <http://dx.doi.org/10.2139/ssrn.3767512>.
15. Rayn Yanez, 'La Participación De La Inteligencia Artificial En La Seguridad Internacional (The Participation of Artificial Intelligence in International Security)', SSRN, 21 August 2016, available at <https://ssrn.com/abstract=2827414>.
16. Mariarosaria Taddeo and Alexander Blanchard, 'A Comparative Analysis of the Definitions of Autonomous Weapons', SSRN, 10 May 2021, available at <https://ssrn.com/abstract=3941214> or <http://dx.doi.org/10.2139/ssrn.3941214>.
17. Chris Jenks, 'The Gathering Swarm: The Path to Increasingly Autonomous Weapons Systems', SSRN, 2017, available at <https://ssrn.com/abstract=3023410>.
18. Kristen Eichensehr, 'Cyberwar & International Law Step Zero', 50 Texas International Law J 355, UCLA School of Law Research Paper No. 15–15, 27 May 2015, available at <https://ssrn.com/abstract=2611198>.
19. Asif Khan and Maseeh Ullah, 'Autonomous Weapon Systems: A New Challenging for International Humanitarian Law and International Human Right Law', no. 2.
20. Eric Talbot Jensen, 'The (Erroneous) Requirement for Human Judgment (and Error) in the Law of Armed Conflict', SSRN, 3 March 2020, available at <https://ssrn.com/abstract=3548314> or <http://dx.doi.org/10.2139/ssrn.3548314>.
21. Udani Gunawardena, 'Legality of Lethal Autonomous Weapons AKA Killer Robots', SSRN, 20 October 2016, available at <https://ssrn.com/abstract=2892447> or <http://dx.doi.org/10.2139/ssrn.2892447>.
22. Tyler D. Evans, 'At War with the Robots: Autonomous Weapon Systems and the Martens Clause', *Hofstra Law Review*, Vol. 41, No. 3, 21 February 2013, available at SSRN <https://ssrn.com/abstract=2347661>.
23. Thompson Chengeta, 'Measuring Autonomous Weapon Systems Against International Humanitarian Law Rules', *Journal of Law and Cyber Warfare*, Vol. 5, No. 1(c) 2012–2016, Summer 2016, available at <https://ssrn.com/abstract=2755184> or <http://dx.doi.org/10.2139/ssrn.2755184>.
24. Bryant Walker Smith, 'Controlling Humans and Machines', *Temple International & Comparative Law Journal*, Vol. 30, No. 1, 1 October 2015, available at <https://ssrn.com/abstract=2908973>.
25. Jens David Ohlin, 'Remoteness and Reciprocal Risk', in Jens David Ohlin (ed.), *Research Handbook on Remote Warfare*, Edward Elgar Press, Forthcoming, Cornell Legal Studies Research Paper No. 16–24, 18 July 2016, available at <https://ssrn.com/abstract=2811271>.

26. Nathan Reitinger, 'Algorithmic Choice and Superior Responsibility: Closing the Gap Between Liability and Lethal Autonomy by Defining the Line Between Actors and Tools', *Gonzaga Law Review*, Vol. 51, No. 1, 2015, available at <https://ssrn.com/abstract=2738052>.
27. Thompson Chengeta, 'Dignity, Ubuntu, Humanity and Autonomous Weapon Systems (AWS) Debate: An African Perspective', *Brazilian Journal of International Law*, Vol. 13, No. 2, 26 March 2016, available at <https://ssrn.com/abstract=2754992> or <http://dx.doi.org/10.2139/ssrn.2754992>.
28. Rebecca Crotoof, 'The Killer Robots Are Here: Legal and Policy Implications', SSRN, 5 December 2014, available at: <https://ssrn.com/abstract=2534567>.
29. Stephanie Carvin, 'Normal Autonomous Accidents: What Happens When Killer Robots Fail?', SSRN, 1 March 2017, available at <https://ssrn.com/abstract=3161446> or <http://dx.doi.org/10.2139/ssrn.3161446>.
30. Chris Jenks, 'False Rubicons, Moral Panic & Conceptual Cul-De-Sacs: Critiquing & Reframing the Call to Ban Lethal Autonomous Weapons', *Pepperdine Law Review*, Vol. 44, No. 1, 2016, available at <https://ssrn.com/abstract=2736407>.
31. Eliav Liebllich and Eyal Benvenisti, 'The Obligation to Exercise Discretion in Warfare: Why Autonomous Weapon Systems are Unlawful', in Nehal Bhuta et al. (eds), *Autonomous Weapons Systems: Law, Ethics, Policy 244*, Cambridge University Press, 2016, SSRN, 30 December 2017, available at <https://ssrn.com/abstract=2479808> or <http://dx.doi.org/10.2139/ssrn.2479808>.
32. Peter Margulies, 'Making Autonomous Weapons Accountable: Command Responsibility for Computer-Guided Lethal Force in Armed Conflicts', in Jens David Ohlin (ed.), *Research Handbook on Remote Warfare*, Edward Elgar Press, 2016, Forthcoming, Roger Williams University Legal Studies Paper No. 166, 19 February 2016, available at <https://ssrn.com/abstract=2734900>.
33. Mary Ellen O'Connell, 'Banning Autonomous Killing', in Matthew Evangelista and Henry Shue (eds), *The American Way of Bombing: How Legal and Ethical Norms Change*, Ithaca, NY: Cornell University Press (2013, Forthcoming), Notre Dame Legal Studies Paper No. 1445, 21 August 2013, available at <https://ssrn.com/abstract=2313737>.
34. Nicholas Mull, 'The Roboticization of Warfare with Lethal Autonomous Weapon Systems (Laws): Mandate of Humanity or Threat to It?', *Houston Journal of International Law*, Forthcoming, 1 August 2017, available at <https://ssrn.com/abstract=3123472>.
35. Laura Dickinson, 'Lethal Autonomous Weapons Systems: The Overlooked Importance of Administrative Accountability', in Eric Talbot Jensen and Ronald Alcalá (eds.), *The Impact of Emerging Technologies on the Law of Armed Conflict*, Oxford University Press 2018 Forthcoming, GWU Law School Public Law Research Paper No. 2018-42, GWU Legal Studies Research Paper No. 2018-42, 2018, available at SSRN: <https://ssrn.com/abstract=3249497>.

36. Kenneth Anderson and Matthew C. Waxman, 'Law and Ethics for Robot Soldiers', Policy Review, Columbia Public Law Research Paper No. 12-313, American University, WCL Research Paper No. 2012--2, 5 April 2012, available at <https://ssrn.com/abstract=2046375>.
37. Kenneth Anderson and Matthew C. Waxman, 'Law and Ethics for Autonomous Weapon Systems: Why a Ban Won't Work and How the Laws of War Can', Stanford University, The Hoover Institution (Jean Perkins Task Force on National Security and Law Essay Series), American University, WCL Research Paper 2013-11, Columbia Public Law Research Paper 13-351, 2013, available at <https://ssrn.com/abstract=2250126> or <http://dx.doi.org/10.2139/ssrn.2250126>.
38. Matthijs M. Maas, Kayla Matteucci and Di Cooke, 'Military Artificial Intelligence as Contributor to Global Catastrophic Risk', in S J Beard, Martin Rees, Catherine Richards and Clarissa Rios-Rojas (eds), *The Era of Global Risk* (2023), Open Book Publishers, 22 May 2022, available at <https://ssrn.com/abstract=4115010> or <http://dx.doi.org/10.2139/ssrn.4115010>.
39. Jeffrey Thurnher, 'No One at the Controls: Legal Implications of Fully Autonomous Targeting', 67 *Joint Force Q.* 77 (October 2012), SSRN, 1 October 2012, available at: <https://ssrn.com/abstract=2296346>.
40. Maziar Homayounnejad, 'Autonomous Weapon Systems, Drone Swarming and the Explosive Remnants of War', SSRN, 6 December 2017, available at <https://ssrn.com/abstract=3099768> or <http://dx.doi.org/10.2139/ssrn.3099768>.
41. Maziar Homayounnejad, 'Assessing the Sense and Scope of 'Autonomy' in Emerging Military Weapon Systems', SSRN, 24 August 2017, available at <https://ssrn.com/abstract=3027540> or <http://dx.doi.org/10.2139/ssrn.3027540>.
42. Shane Reeves, Ronald Alcalá and Amy McCarthy, 'Challenges in Regulating Lethal Autonomous Weapons Under International Law', 28 *Southwestern Journal of International Law* 101-18, 1 December 2020, available at <https://ssrn.com/abstract=3775864>.
43. Tyler D. Evans, 'At War with the Robots: Autonomous Weapon Systems and the Martens Clause', no. 22.
44. Alonso Gurmendi Dunkelberg, 'Laws for L.A.W.S.: Legal Challenges for the Use of Lethal Autonomous Weapons Systems in Times of Armed Conflict', SSRN, 29 April 2016, available at <https://ssrn.com/abstract=2772782> or <http://dx.doi.org/10.2139/ssrn.2772782>.