

**THE USE OF ARTIFICIAL INTELLIGENCE TECHNOLOGY IN
AUTONOMOUS WEAPON SYSTEM UNDER INTERNATIONAL
HUMANITARIAN LAW**

A BACHELOR DEGREE THESIS



By:

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Student Number: 14410255

**INTERNATIONAL PROGRAM
FACULTY OF LAW
UNIVERSITAS ISLAM INDONESIA
Yogyakarta**

2018

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A BACHELOR DEGREE THESIS

Submitted in Partial Fulfillment of the Requirement to Obtain Bachelor's Degree
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Yogyakarta



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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

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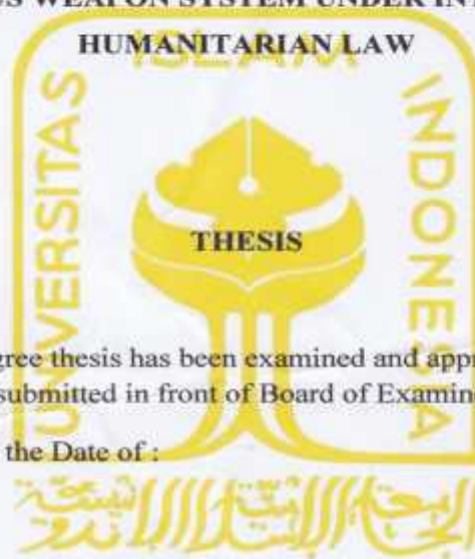
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“To Improve is to change, to be perfect is to change often”

- Winston Churchill

“Sic Parvis Magna”

- Sir Francis Drake

DEDICATION

I, with ‘All of My Hard Work and Commitment’, dedicate this magnificent thesis to:

ALLAH SWT.

As the only reason of our wholly-life-existence on earth.

The Toughest Knights in This World,

Abah & Mama,

Ir. Arbainsyah & Ir. Isnaniah

Another Musketeer in Aris Family ,

Aris Pramana Rahman & Aris Dwi Rahim

All the people in This World

For all their inspiration, support, and motivation in every aspect of my tough yet a beautiful life.

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As well as its citizen that can use this thesis for the purpose of a world peace

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ABBREVIATION

A.I. : Artificial Intelligence

AWS : Autonomous Weapon System

IJCAI : International Joint Conference on Artificial Intelligence

CCW : United Nation Convention on Certain Conventional Weapon

IHL : International Humanitarian Law

BAE : British Aerospace

AP I : Additional Protocol I of Geneva Convention

LAWS : Lethal Autonomous Weapon System

ICRC : International Committee of the Red Cross

I.T : Information and Technology

UAV : Autonomous Aerial Vehicle

ANI : Artificial Narrow Intelligence

AGI : Artificial General Intelligence

ASI : Artificial Super Intelligence

SGR : Smart Green Resilient

CDE : Collateral Damage Estimation

CDM : Collateral Damage Methodology

DoD : Department of Defense

SWARMS : Scalable sWarms of Autonomous Robots and Mobile Sensors

ABSTRACT

Nowadays, a modern weapon system is more developed than before, for example are autonomous weapon system and remote weapon system, which included weapons such as unmanned aerial vehicle (UAV); unmanned underwater vehicle (UUV); and unmanned ground vehicle (UGV). However in late 2015, a problem was arise from autonomous weapon system; presently autonomous weapon system only consider as semi-autonomous weapon system, but there are many states with a modern technology which wanted to increase the “autonomous” characteristic in their weapon to satisfied the definition of autonomous weapon (fully autonomous weapon system). One of the way to increase autonomous characteristic is to applied artificial intelligence technology within autonomous weapon system; the nature of artificial intelligence which has capabilities to independently – without human intervention – learn, adapt, and making a decision. Problems was appeared in the use of artificial intelligence technologies in autonomous weapon system; since artificial intelligence weapon are categorizes as a new technology, it compliance with general principle of international humanitarian law is unclear and the legality of artificial intelligence-based weapon which capable to attack without any control from human. Present operation of weapon system which involving artificial intelligence are not intended to violates international humanitarian law, like CDM involvement in drone operation, it used to make an estimation of collateral damage raising from a weapon system, therefore the attacks did not violate general principles of international humanitarian law. Weapon developers are ought to determine the technical operation and impact of these weapon will comply with international humanitarian law, to realize that obligation, human control are become compulsory inside this weapon to make an unforeseeable event that would occur from this weapon become foreseeable, therefore a violation to international humanitarian law could be anticipated.

Keyword: Artificial Intelligence, Autonomous Weapon System, and International Humanitarian Law.

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CHAPTER I

INTRODUCTION

A. Context of Study

The development of civilization, international law is also changes from time to time. The relation among states has also been developed and complicated. This matter affects the mechanism of cooperation which potentially causes a dispute. Generally, the dispute settlement mechanism under the international law could be divided into two mechanisms, peaceful dispute settlement, and settlement by force. Peaceful dispute settlement is divided into two mechanisms, first is political mechanism, such as Negotiation, Inquiries, Good Offices, and Mediation; and the second is through judicial settlement such as arbitration and international court.¹ The second mechanism is by force mechanism, it is divided into two ways, armed conflict and non-armed conflict.²

The dispute settlement mechanism by force through armed conflict is the last resort if all the peaceful settlement mechanism is deadlocked and did not reach any deal among states. Naturally, armed conflict is a dispute settlement mechanism that should be avoided as a mechanism to settle a dispute because it is not in accordance with the international community obligation to uphold peace and order. However,

¹ J.G. Starke, 1989, *Introduction to International Law (Pengantar Hukum Internasional, Diterjemahkan oleh Bambang Iriana Djajaatmadja)*, Jakarta, Sinar Grafika. p. 646

² *Ibid*, p. 649.

armed conflict still recognize as an exception when a peaceful mechanism is failing to settle the dispute.³ In armed conflict, the use of force in a military to defeat and to gain a victory is permitted, as long as it is in accordance with the humanity principle. One of the factors to achieve the interest of the military is through weapons equipment. At the present time, a weapon which uses in armed conflict has already developed. The rapid development of technology has affected the development of weapon in armed conflict, it makes the states in every corner of the world are competing to develop new kind of weapon.⁴

It can be seen from some of science-fiction movies, such as star wars, transformers, terminator, Interstellar and other science-fiction movies using a modern weapon in their movie. It was proven that people in this modern age yearn for the existence of such kind of advance technologies.

However, it might not be fictions anymore, at this time, many states and corporation, develop robotic-like weapon system, which called Autonomous Weapon System (AWS). Such kind of weapon system means a system that once activated, it is able to select and engage targets without

³ Sefriani, 2014, *Hukum Internasional : Suatu Pengantar*, Rajawali Pers, Jakarta, p. 358

⁴ International Commission of The Red Cross, *New technologies and the modern battlefield: Humanitarian perspectives*, < <http://e-brief.icrc.org/issue/new-technologies-and-the-modern-battlefield-humanitarian-perspectives/introduction/>> , accessed at 28 November 2017

further intervention of human. Furthermore, AWS has also designed which allow human operators to override/supervise its operation.⁵

From the explanation above, AWS is divided into two systems, Fully Autonomous Weapon System and Semi-Autonomous Weapon System. In specific circumstances, Semi-Autonomous Weapon System could override by a human and decrease its Autonomous characteristic. While Fully Autonomous Weapon System is a weapon system once activated, it will independently conduct its function and is free to human intervention.⁶

There are some countries in the world which implement the AWS in their military forces, for example U.S. forces have operated two human-supervised autonomous systems for many years such as the Aegis at sea and the Patriot on land both are designed to defend against missile attacks.⁷ Another example of human supervised autonomous weapon system such as Israel's Iron Dome, received a great attention because of its effectiveness to destroy incoming rockets.⁸

Based on the explanation above, the practice of states in using AWS is merely in form of defensive system. However in 2017, Russian

⁵ Michael N. Schmidt, *Autonomous Weapon System and International Humanitarian Law : A Reply to Critics*, Harvard National Security Journal feature (2013), p. 4. See Also, Human Right Watch, 2012 *Losing Humanity : The Case Against Killer Robots*, p.2

⁶ Human Rights Watch, *Loc.cit.*

⁷ Schmidt, *Op.cit* ; Lockheed Martin, *Aegis Combat System*, <http://www.lockheedmartin.com/us/products/aegis.html> accessed at 24 October 2017

⁸ Michael N. Schmidt, *ibid*; Rafael, *Iron Dome*, available at http://www.rafael.co.il/marketing/SIP_STORAGE/FILES/6/946.pdf accessed at 24 October 2017

weapons maker Kalashnikov is working on an automated gun system that uses artificial intelligence to make "shoot/no shoot" decisions. Kalashnikov "combat module" will include 7.62-millimeter machine gun coupled with a camera attached to a computer system. According to Tactical Automated Security System, Kalashnikov's module uses "neural network technologies which enable to identify targets and make decisions". An important part of neural networking technology is the ability to learn from past mistakes.⁹

In regard to the new development of AWS, almost every new AWS are using Artificial Intelligence technology. Artificial Intelligence (AI) system is a computer which could engage human-like thought processes like reasoning, learning, and self-correction.¹⁰

Contrary to information about perception AI technology, actually AI is not a new technology. Many of its concepts made on over 2000 years in the aspect of philosophy, logic, mathematics, theories of reasoning, cognitive psychology and linguistics.¹¹ In practice, however, AI truly came into its own in the direct wake of the Second World War. The perception of AI as a study occurred in wartime research in areas such as

⁹ Kyle Mizokami, *Kalashnikov will make an A.I. Powered Robot*, <http://www.popularmechanics.com/military/weapons/news/a27393/kalashnikov-to-make-ai-directed-machine-guns/> accessed at 24 October 2017

¹⁰ Joost N. Kok, Egbert J. W. Boers, Walter A. Kusters, Peter van der Putten and Mannes Poel, *Artificial Intelligence: Definition, Trends, Techniques, and Cases*, Encyclopedia of Life Support Systems

¹¹ Stephan De Spegeleire, Matthijs Maas, and Tim Sweijjs, 2017, *Artificial Intelligence And The Future Of Defense : Strategic Implications for Small and Medium-Sized Force Providers*, Netherland, HASS, p.31. See also, Russell and Norvig, 2010, *Artificial Intelligence: A Modern Approach.*, New Jersey, Pearson Education Inc., p. 8-15

cryptography and ballistic firing table's calculation for artillery,¹² and it was encouraged by the research of Alan Turing,¹³ as well as the attempt on simple neural networks by Warren McCulloch and Walter Pitts.¹⁴ AI first became a particular field of study during the small Dartmouth Summer Project held in 1956, an event which was considered as a 'spring' for AI research.¹⁵

In the present time, many scientists refuse the development of artificial Intelligence as one of the weapon systems. Over 100 robotics experts, including Elon Musk¹⁶ and Mustafa Suleyman¹⁷, have signed an open letter asking the United Nations to ban the development and use of killer robots.

The letter states that "lethal autonomous weapons threaten to become the third revolution in warfare," emphasizing the development of

¹² Spegeleire, Maas, and Weijs, *ibid.* In the shape of ENIAC, the first electronic general-purpose computer, which was developed from 1943-1945 (though not delivered until the end of the war) by John Mauchly and J. Presper Eckert. Cf. Harry L. Reed Jr., "Firing Table Computations on the Eniac," in *Proceedings of the 1952 ACM National Meeting* (Pittsburgh), ACM '52 (New York, NY, USA: ACM, 1952), 103–106.

¹³ Spegeleire, Maas, and Weijs, *ibid.* See also, A.M. Turing, "Computing Machinery and Intelligence," *Mind* 59, no. 236 (October 1950): p. 433

¹⁴ Spegeleire, Maas, and Weijs, *ibid.* See also, Warren S. McCulloch and Walter Pitts, "A Logical Calculus of the Ideas Immanent in Nervous Activity," *Bulletin of Mathematical Biophysics* 5 (1943): p. 115

¹⁵ Spegeleire, Maas, and Weijs, *op.cit.*

¹⁶ Elon Musk is an inventor, explorer, and engineer, a South African entrepreneur. Elon Musk is known for founding Tesla Motors and SpaceX, which launched a landmark commercial spacecraft in 2012. 'Elon Musk' (*Biography.com*, 2017) <<https://www.biography.com/people/elon-musk-20837159#synopsis>> accessed 7 November 2017.

¹⁷ Mustafa Suleyman is co-founder and Head of Applied AI at DeepMind, where he is responsible for integrating the company's technology across a wide range of Google products. In February 2016 he launched DeepMind Health, which builds clinician-led technology in the NHS. Mustafa was Chief Product Officer at DeepMind Technologies, before the company was bought in 2014 by Google. 'Mustafa Suleyman - Co-Founder, Head Of Applied AI @ Google Deepmind | Crunchbase' (*Crunchbase*, 2017) <<https://www.crunchbase.com/person/mustafa-suleyman>> accessed 7 November 2017.

automatic and atomic weapons. "Once developed," the letter warns, "they will permit armed conflict to be fought at a scale greater than ever, and at timescales faster than humans can comprehend. These can be weapons of terror, weapons that despots and terrorists use against innocent populations, and weapons hacked to behave in undesirable ways."¹⁸

The letter was delivered at the opening of the International Joint Conference on Artificial Intelligence (IJCAI) in Melbourne, Australia. It determines about the ban of lethal autonomous weapons systems as weapons under the UN's convention on certain conventional weapons (CCW) ratified in 1983, which includes chemical and intentionally blinding laser weapons.¹⁹

AI technology as one of system in AWS²⁰ used to avoid casualties among combatants. With this kind of weapon system,²¹ a state which conducted an arm-conflict does not need to deploy a huge amount of troop in the battlefield.²² The use of AI has to be analyzed whether its

¹⁸ David Grossman, *Elon Musk, Robotist Demands Bans of AI Weapons*, <http://www.popularmechanics.com/military/weapons/a27851/elon-musk-ban-ai-weapons/> accessed at 24 October 2017.

¹⁹ *Ibid.*

²⁰ Alan L. Schuller, 2017, At the Crossroads of Control: The Intersection of Artificial Intelligence in Autonomous Weapon Systems with International Humanitarian Law, *Harvard National Security Journal* Vol.8, p. 393

²¹ Dodik Setiawan Nur Heriyanto, 2015, *Penerapan Prinsip Proporsionalitas Terhadap Penggunaan Pesawat Tanpa Awak Dalam Konflik Bersenjata in " Hukum Humaniter Internasional Kontemporer"* by Denny Ramdhany and friends, Jakarta, Rajawali Press. p. 214. See also, Markus Wagner, 2011, "The Dehumanization of International Humanitarian Law: Legal, Ethical, and Political Implications of Autonomous Weapon Systems", Paper of Conference *New Technologies, Old Law: Applying International Humanitarian Law in New Technological Age*, The Minerva Center of Human Rights The Hebrew University of Jerusalem and The ICRC Delegation in Israel and The Occupied Territories: Israel, p. 10

²² *Ibid.*

application in a weapon is in accordance with International Humanitarian Law. This became an obligation in Article 36 of Additional Protocol I of Geneva Convention 1977 regarding the development of new weapon which presumably to violate international law .²³ This convention regulated that²⁴ although Artificial Intelligence is made to strengthen a state defense fleet; however it should be in accordance with Humanitarian law.²⁵

International Humanitarian Law will play a huge role in the future, especially to keep up with the development of science and technology, including the modern weaponry which in its application, could ignoring the humanity.²⁶ International Humanitarian Law works dynamically to control the development of technologies in arm-conflict, since Den Haag convention, which not limited the right of belligerents to harm the enemy.²⁷

Many states reacted with arranging many kinds of the multilateral treaty which prohibited the application of several weapons in armed conflict.²⁸ One of them is Convention on Prohibitions or Restrictions on

²³ Dodik Setiawan, *op.cit*, p. 215

²⁴ *Ibid*.

²⁵ *Ibid*.

²⁶ *Ibid* ; Masyhur Effendi, 1994, *Hukum Humaniter Internasional*, Surabaya: Penerbit Usaha Nasional Surabaya Indonesia, p. 65.

²⁷ Dodik Setiawan, *op.cit*, p.216. See also, Convention Respecting the Laws and Customs of War on Land, October 18, 1907 [Den Haag Convention], Art. 22.

²⁸ Dodik Setiawan, *ibid*. See also, Sean D. Murphy, 2006, *Principle of International Law*, United States of America: Thomson West, p.466

The Use of Certain Conventional Weapons (CCW), which regulated weaponry which restricted or prohibited to use in arm-conflict.²⁹

This study are tries to figure out the position of Artificial Intelligence in Autonomous Weapon System and whether the use of Artificial Intelligence weapon system is accordance with international humanitarian law and principle.

B. Problem Formulation

The problems which formulate from the topics are as follows :

1. Is Artificial Intelligence Weapon Technology in accordance with the law and principle of International Humanitarian Law?
2. What is the importance of Human control over Artificial Intelligence Weapon System under International Humanitarian Law?

C. Research Objective

The objectives of this research are to:

1. To analyze the conformity between the implementation of Artificial Intelligence Weapon System in armed conflict and the fundamental principle of Humanitarian Law.
2. To figure out the importance of Human Control toward the Artificial Intelligence Weapon System operator armed conflict based on International Humanitarian Law.

²⁹ Foreword of Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects, October 10, 1980

D. Definition of Term

The terms which specifically became a notion of this research are:

1. Artificial Intelligence: A computer system which can independently think, a machines with minds,³⁰ an activity that is similar to human thinking, an activity like decision-making, problem solving, and learning.³¹ Artificial intelligence (AI) is the intelligence of a machine. It became the objectives of scientist and engineering to making intelligent machines, especially intelligent computer programs. It is linked to system of a computer to understand human intelligence. While there are many definitions of AI, AI textbooks define AI as "the study and design of intelligent agents", thus it is an intelligent system that senses its environment and takes actions which increase its chances of success.³²
2. Autonomous Weapon System: Autonomous Weapon System (AWS) means a weapon system that can select and engage targets without any control of human operator when it is activated.³³ This includes human-supervised AWS which is to enables human operator to take control of its operation; however, it does not decline its autonomous characteristic. The whole of Fully-automated weapon is not fully

³⁰ Stuart Russel and Peter Norvig, 2010, *Artificial Intelligence : A Modern Approach* (3ed.), New Jersey, Pearson Education, Inc. p. 2. See also, J. Haugeland, 1985. *Artificial Intelligence:The Very Idea*, Massachutes, MIT Press.

³¹ Russel and Norvig, *op.cit.* See also R.E. Bellman, 1978, *An Introduction to Artificial Intelligence: Can Computers Think?* Boyd & Fraser Publishing Company.

³² Prakhar Swarup, 2012, *Artificial Intelligence, International Journal of Computing and Corporate*,2, India, p. 1.

³³ US Department of Defense (US DoD), 2012, *Autonomy in Weapon Systems*, Directive 3000.09, 21 November 2012, Glossary, Part II Definitions

human-free, either designer or operator of the weapon would at least have to program the system of the weapon to specify particular parameter.³⁴

3. International Humanitarian Law: International humanitarian law (IHL) is a set of rules to limit the effects of armed conflict for humanitarian reasons. It protects people who are not or are no longer participating in hostilities and govern the means and methods of warfare.³⁵ International humanitarian law is part of international law, which means law that is governing relations between States. Although the international humanitarian law applies to armed conflicts, it does not regulate whether a State may use force, it has been governed by different part of international law, set out in the United Nations Charter.³⁶ In short, IHL contains rules of international law which establish minimum standards of humanity which must be respected in any armed conflict situation.³⁷

E. Originality

No	Title and Author	Differentiation	
		Author	Researcher
1.	<i>Penerapan Prinsip Proporsionalitas Terhadap Penggunaan Pesawat Tanpa</i>	Focused on the Implementation of Proportionality	This research is focused on compliance of

³⁴ N. Schmitt, Michael, 2013, *Autonomous Weapon system and IHL : A reply to the Critics* , Harvard National Security Journal, p. 3-4

³⁵ International Committee of the Red Cross (ICRC), 2014, *What is International Humanitarian Law ?*, Advisory Services on International Humanitarian Law, p. 1

³⁶ ICRC, *loc.cit.*

³⁷ Nils Melzer coord. By Etienne Kuster, 2016, *International humanitarian law : a comprehensive introduction*, Geneva, ICRC, p. 17

	<i>Awak Dalam Konfil Bersenjata</i> by Dodik Setiawan Nur Heriyanto. (Article in Book)	Principle to the use of Drones in armed conflict	Artificial intelligence technology inside an autonomous weapon system with General Principle of International Humanitarian Law (Distinction, Humanity, Proportionality, and Military Necessity)
2.	<i>Killer Robots : Legality and Ethicality of Autonomous Weapon System</i> by Armin Krishnan. (Book)	The main notion is autonomous weapon system or in the book said as ‘killer robot’ , the author broadly explain about legality and ethical consideration of autonomous weapon system	In this research, author specifically explain about the compliance between general principle of international humanitarian law and the importance of human control inside autonomous weapon system which used artificial intelligence technology.
3.	<i>At the Crossroads of Control: The Intersection of Artificial Intelligence in Autonomous Weapon System in International Humanitarian Law</i> by Alan L. Schuller (Article in Journal)	This journal is specifically focusing on the consideration of artificial intelligence technology which used in autonomous weapon system, it is related to the proper computer system that able to use in weapon system; the notion on how the	The author of this research is only focusing on the compliance of present artificial intelligence technology which used in operation of weapon system with general principle of international humanitarian law and the importance of human control in operation of

		artificial intelligence will affects future autonomous weapon system automation; and legality of increasing automation in autonomous weapon system before international humanitarian law.	autonomous weapon system that used advance artificial intelligence technologies in the future .
4.	<i>Losing Humanity: The Case Against Killer Robot</i> by Human Right Watch (Non-Governmental Organization article)	This Document are explained about the kind of autonomous weapon system based on the interference of human in it, followed by the legality of autonomous weapon system in international humanitarian law and this document also questioning on the liability of autonomous weapon action which cause a violation to international humanitarian law.	In this research, author is focusing on artificial intelligence technologies inside the autonomous weapon system and on the notion on the importance of human control, author also specifically explains the probability of commander liability and programmer liability in a violation of international humanitarian law which caused by artificial intelligence technology.
5.	<i>Artificial Intelligence and the Future of Defense: Strategic Implications for Small and Medium-sized Force Providers</i> by HCSS (Non-Governmental Organization article)	In their document, HCSS is broadly explained about definition, history, and future implementation of artificial intelligence	Author of this research is emphasizing the notion of artificial intelligence technology inside autonomous weapon system

		technology in armed forces	legality in international humanitarian law
6.	<i>A Legal Perspective: Autonomous Weapon System Under International Humanitarian Law</i> by Neil Davison (Document)	In this ICRC document, Neil Davison is explained the legality of autonomous weapon system with proportionality and humanity principle in international humanitarian law. Beside that, this document also has a notion on human control toward autonomous weapon system.	In this research, author is focusing on the legality of artificial intelligence technologies inside autonomous weapon system presently and on the notion on the importance of human control within autonomous weapon system which applied artificial intelligence technology in the future.

F. Theoretical Review

I. Definition and types of Autonomous Weapon System

a. Definition of Autonomous Weapon System

Terms of Autonomous Weapon System (AWS) illustrates an image of Terminator robots: lethal machines with super artificial intelligence, a machine which capable of destroying a target without being restricted by human emotion. This illustration is more science fiction than reality, but recent challenge raised by AWS's development is now at the discussion of international legal discourse and their compliance with International Humanitarian

Law (IHL) are real and must be addressed.³⁸ Robotist Noel Sharkey defines an automatic machine as one that consists of a pre-programmed series of operations or actions in a based environment.”³⁹ Generally, an autonomous machine operates in an unstructured environment, it means, what makes a machine autonomous is the environment it operates in, rather than its internal processes.⁴⁰

US Department of Defense define AWS⁴¹ as a weapon system, when activated, it will be able to select and engage targets without further human intervention. It also includes human-supervised autonomous weapon system which is made to allow the human operator to interfere operation of the weapon system.⁴² Human Rights Watch adopts a similar definition:⁴³

*“Any robot that can select and engage targets without human input, even if there is human failure, will qualify as a “fully autonomous robot.”*⁴⁴

Definitions above conclude the basic characteristic of AWS; human is not necessarily included in targeting decision-making process of the weapon.⁴⁵

³⁸ James G. Foy, 2013, *Autonomous Weapons Systems: Taking The Human Out Of International Humanitarian Law*, 23 Dal J Leg Stud, SSRN Electronic Journal, p. 48

³⁹ *Ibid* ; Noel Sharkey, 2011, *Automating Warfare: Lessons Learned From The Drones*, 21 Journal of Law, Information & Science, p. 141

⁴⁰ James G. Foy, *loc.cit.*

⁴¹ US DoD, *loc.cit*

⁴² *Ibid.*

⁴³ Human Rights Watch, 2012, *Losing Humanity : The Case against Killer Robot*, International Human Right Clinic, p. 2

⁴⁴ *Ibid.*

b. Type of Autonomous Weapon System

Despite the AWS is not being used in the present battlefield, its development level is growing continuously and there are some weapon system approaching fully autonomous capabilities.⁴⁶ Experts believe that the existence of fully autonomous weapon system inevitable and imminent.⁴⁷

By the rapid improvement and proliferation of robotic weapons, machines are starting to take the role of human at the battlefield. A few military and robotics specialist have expected that “killer robot”⁴⁸ may be developed within 20 to 30 years.⁴⁹ At present, officials of military typically say that a person will retain some stage of supervision over decision to use lethal forces, but their statement frequently leave a possibility that robot, at some point, has the potential to take a decision on their own will.⁵⁰

Although its definitions are unclear, robots are generally defined as a machine that have the power to sense and act based on

⁴⁵ James G. Foy, *loc.cit.*

⁴⁶ *Ibid.* p. 50. See also, Human Right Watch, *loc.cit.*; Timothy Coughlin, 2011, *The Future of Robotic Weaponry and the Law of Armed Conflict : Irreconcilable Differences ?*, 17 UCL Jurisprudenc Review, p. 67

⁴⁷ James G, Foy, *op.cit.*, p. 50. See also, Gary E Marchant, 2011, *International Governance of Autonomous Military Robots*, 12 Colum Sci & Tech L Rev, p. 272

⁴⁸ Killer Robots means a fully autonomous weapon that could select and engage targets without human intervention.

⁴⁹ Human Right Watch, *op.cit.*, p. 1

⁵⁰ *Ibid.*

how they are programmed.⁵¹ It consists of autonomy technology, which means the ability of a machine to operate without human supervision.⁵² An unmanned robot is often divided into three categories based on the amount of human involvement in their actions:⁵³

- a. Human-in-the-Loop Weapons: Robots which is able to engage and deliver an attack only with a command of human operator;
- b. Human-on-the-Loop Weapons: Robots which is able to engage an attack under human operator supervision, means the operator could interferes the robot's actions; and
- c. Human-out-of-the-Loop Weapons: An independent Robot system, where the engagement of its attack is independent and cannot be interfered by the operator

Fully autonomous weapon is referring to out-of-the-loop weapon's system and those which enable human operator to

⁵¹Human Right Watch, *op.cit*, p. 2 ; Human Rights Watch telephone interview with Noel Sharkey, professor of artificial intelligence and robotics, University of Sheffield, Sheffield (UK), September 6, 2012. Others have described robots as machines that can sense, think, and act. See, for example, Gianmarco Veruggio and Keith Abney, 2012, *Roboethics: The Applied Ethics for a New Science*, in Patrick Lin, Keith Abney, and George A. Bekey, eds., *Robot Ethics: The Ethical and Social Implications of Robotics*, Cambridge, MIT Press, p.349; P.W. Singer, 2009, *Wired for War: The Robotics Revolution and Conflict in the Twenty-First Century*, New York, The Penguin Press, p. 67. "Think" does not mean to imply processing information in the same sophisticated way as humans. Instead "think" refers to processing "if..., then..." commands. Human Rights Watch telephone interview with Noel Sharkey, September 6, 2012.

⁵² Human Right Watch, *ibid*.

⁵³ *Ibid*.

override its action.⁵⁴ Other terms which are used to describe a fully autonomous weapon are “lethal autonomous robots” and “killer robots.”⁵⁵

Certain kinds of weapon systems already use the capabilities of semi-autonomous weapon. Its automation level in a weapon system is steadily developed. For instance, such South Korean military’s stationary sentry robot in Korean Demilitarized Zone which is able to detect and select a target and also able to respond with lethal or non-lethal force depends on the circumstances.⁵⁶ Developer of such weapon explained that the decision to shoot is decided by human not a robot.⁵⁷ However, present robot is capable of making decision without human input.⁵⁸

The development of AWS is also done by United States (US) Navy, recognized as Phalanx Close in Weapon System for *Aegis* Class Cruiser, this weapon system for *Aegis* Class Cruiser is able to perform its own search, detect, track and kill assessment

⁵⁴ *Ibid.* Major Jeffrey Thurnher, a US Army lawyer, notes the importance of a meaningful override. While a proponent of what he refers to as “lethal autonomous robots,” he writes that such robots “should be required to have some version of a human override” and that “this oversight would not be effective if the human operator were merely a rubber stamp to approve an engagement.” See Jeffrey S. Thurnher, 2012, *No One at the Controls: Legal Implications of Fully Autonomous Targeting*, Joint Forces Quarterly, issue 67, p. 83.

⁵⁵ Human Right Watch, *ibid*, p.3.

⁵⁶ James G. Foy, *op.cit*, p. 50

⁵⁷ *Ibid*, p. 51. See also, Jean Kumagai, 2007, *A Robotic Sentry for Korea’s Demilitarized Zone*, IEEE Spectrum <<http://www.spectrum.ieee.org>> accessed at 7 November 2017

⁵⁸ Although the robot is capable of selecting and engaging targets without human input, its location in the Demilitarized Zone (DMZ) makes it unnecessary for the robot to distinguish between civilian and enemy combatant. Any person that crosses a pre-determined line is considered an enemy combatant by the robot.

function autonomously.⁵⁹ There are four modes of Phalanx Close in Weapon System: Semi-Automatic, where humans decide and control the firing decision; Automatic Special, where humans arrange the targets but the software determines how to carry them out; Automatic, where operator supervise the system but it acts without their input; and Casualty, where the system does whatever is necessary to save the ship.⁶⁰

The United Kingdom is recently testing a new kind of semi-autonomous aircraft, namely as *Taranis*. The designer, BAE Systems⁶¹, describe the aircraft as an autonomous and stealthy unmanned aircraft.⁶² Although *Taranis* is included as Human-in-the-loop system, it may be capable of flying autonomously.⁶³

II. Relation between Autonomous Weapon System and Artificial Intelligence

The present development to make computers think, machines with minds, within the complete and literal sense.⁶⁴ The means of automation are related to human thinking, activities such

⁵⁹ United States Navy, 2012, *Fact File: MK 15-Phalanx Close-in Weapon System (CIWS)* <<http://www.navy.mil>> accessed at 7 November 2017

⁶⁰ Marchant, *op.cit*, p. 287

⁶¹ BAE Systems, Inc. is the U.S. subsidiary of BAE Systems plc, an international defense, aerospace and security company which delivers a full range of products and services for air, land and naval forces, as well as advanced electronics, security, information technology solutions and customer support services.<<http://www.baesystems.com>> accessed at 7 November 2017

⁶² BAE Systems, *Taranis*, <<http://www.baesystem.com>> accessed at 7 November 2017

⁶³ Human Right Watch, *op.cit*, p. 17-18

⁶⁴ Stuart Russel and Peter Norvig, *loc.cit*

as decision-making, problem solving, learning.⁶⁵ It recognized as Artificial intelligence (AI), a new intelligence of machines which able to conduct the automation as has been previously explained. It is the science and engineering to make intelligent machines, especially intelligent computer programs.

By the abilities to make a decision without human input, A.I system is quite related to AWS. A future of AWS might be designed with AI that is so advanced that designers could not predict its performance.⁶⁶

A.I. Technologies which enable the design of systems to acts rationally are based on the objective on the programming of an intelligent “agent.”⁶⁷ The “agent function” defines the act of agent to give responses to the given inputs.⁶⁸ The function could extend from simple “if/then” logic to non-deterministic functions which made by complex algorithmic processes.⁶⁹ “Agent programs” performs the agent function.⁷⁰ This is the programmed software

⁶⁵ Russel and Norvig, *ibid*.

⁶⁶ Alan L. Schuller, 2017, *At the Crossroads of Control: The Intersection of Artificial Intelligence in Autonomous Weapon Systems with International Humanitarian Law*, 8 Harvard National Security Journal, p. 399

⁶⁷ *Ibid*, p. 402

⁶⁸ *Ibid*. See also *Compare Robot History*, Int’l Fed’n Of Robotics, <http://www.ifr.org/robot-history/> accessed at 10 November 2017 (Mathematically speaking, we say that an agent’s behavior is described by the agent function that maps any given percept sequence to an action.)

⁶⁹ Schuller, *ibid*, p. 402

⁷⁰ *Ibid*. See also, William C. Marra & Sonia K. McNeil, 2013, *Understanding “The Loop”: Regulating the Next Generation of War Machines*, 36 Harv. J. L. & Pub. Pol’y, p. 1139, 1145 (“The agent program implements the agent function.”)

which is included into the system that is designed to complete the urge (rational and objective) outcome.⁷¹

Consider a simple technology of the Roomba.⁷² Roomba is a small vacuum that is designed to clean floors without direct command of a human. Roomba as agent uses a certain sensors which assist its function to determine the way to navigate and locate objects, then “remembers” obstacle’s location and avoids them in the future. The agent “knows” when Roomba’s battery is low and the agent program leads the Roomba back to a charging station, it also can distinguish between cleaning carpets or hardwood and adjust power output accordingly. With these capabilities, Roomba are considered as fully autonomous and artificially intelligent learning robot.⁷³

Other elements which might be implemented on the Roomba’s “to clean or not to clean” decision is when the agents were able to sense and make a consideration to these elements, it would be considered either a “factored” or “structured” representation of its environment.⁷⁴ An ability of machine to learn using factored and structured illustration of its environment may be

⁷¹ Schuller, *op.cit*, p. 402

⁷² *Roomba Robot Vacuum*, Irobot, <https://www.irobot.com/For-the-Home/Vacuums/Roomba.aspx> (describing the functions of the device). Accessed at 10 November 2017

⁷³ Schuller, *loc.cit*

⁷⁴ *Ibid*, p. 405

essential to the implementation of A.I. to AWS.⁷⁵ AWS that uses program like explained above will often need to determine multiple factors related to their operating environment. These considerations will continue to affect variant of action by AWS, such as navigation, object recognition, and fire-control solutions.⁷⁶

III. Fundamental Principle in Armed conflict under International Humanitarian Law

There are four core principles of IHL that apply to every combat operation: Distinction, Proportionality, Military Necessity and unnecessary suffering.⁷⁷

a. Principle of Distinction between Civilians and Combatants

At the core of the international humanitarian law stands the principle of distinction, which determines the differentiation among armed forces who conduct the hostilities on behalf of the parties to an armed conflict and civilians who are not participate in hostilities.⁷⁸

⁷⁵ *Ibid.*

⁷⁶ *Ibid.*

⁷⁷ J.Foy, *op.cit.*, p. 54. See also ICRC, *Handout 2 : The Main Source of International Humanitarian Law* <file:///C:/Users/hp%20detach/Downloads/handout_2_the_main_sources_of_international_humanitarian_law.pdf> accessed at 14 November 2017

⁷⁸ Abdulrashid Lawan Haruna , Dr. Laminu Bukar, and Babagana Karumi, 2014, *Principle of Distinction in Armed Conflict: An Analysis of the Legitimacy of 'Combatants and Military Objectives' As a Military Target*, 3 International Journal of Humanities and Social Science Invention, p. 15. See also, Nils Melzer, 2009, *Interpretive Guidance on the Notion of Direct Participation in Hostilities Under International Humanitarian Law*, Geneva, ICRC, p. 11

It is also in accordance with article 48 Additional Protocol of Geneva Convention 1949(AP I) which contains this principle, explaining the parties of hostilities should distinguish civilian and combatant,⁷⁹ except they take a direct part in hostilities⁸⁰ or aim historic monuments, works of art, or places of worship.⁸¹ Moreover, prohibition on AP I is not only referring to the attack on civilians or objects of a civilian nature, but also the attacks on objects that are “indispensable to the survival of the civilian population,”⁸² the natural environment,⁸³ and “installations containing dangerous forces.”⁸⁴

In addition, AP I provision contains provisions which prohibit certain methods of attack, by their nature indiscriminate.⁸⁵ These rules are related to the idea that contains in IHL (i.e. that an attacker must not only distinguish between civilian and military targets but do so with weaponry that is not indiscriminate).⁸⁶ Therefore, a weapon system which is made to destroy a large-scale

48 ⁷⁹ Additional Protocol of Geneva Convention 1949 (AP I Geneva Protocol 1949), Article

⁸⁰ *Ibid*, Article 51(3)

⁸¹ *Ibid*, Article 53

⁸² *Ibid*, Article 54

⁸³ *Ibid*, Article 55

⁸⁴ *Ibid*, Article 56

⁸⁵ *Ibid*, Article 51 (4)

⁸⁶ Markus Wagner, 2014 , *The Dehumanization of International Humanitarian Law: Legal, Ethical, and Political Implications of Autonomous Weapon Systems*, 47 Vanderbilt journal of transnational law, p. 1388.

target, the attack can only be engaged by adhering to these principles.⁸⁷

AWS should be able to determine whether a specific target is civilian or military, AWS would be based on objective which inserted by human. When there is uncertainty over whether a person or object is a lawful target, it is presumed to be a civilian.⁸⁸ A problematic situation occurs when determining whether an individual consider as a military target, not only would AWS have to be able to differentiate civilians from military forces, but it also determine if a civilian is taking a direct part in hostilities.⁸⁹

b. Principle of Humanity

Principle of humanity is related to the prohibition on means and method of warfare which causes a superfluous injury or unnecessary suffering refers to the effect of a weapon on combatants. Although there is general agreement on the existence of the rule, there are many different opinions on how it can actually be determined that a weapon causes superfluous injury or

⁸⁷ *Ibid.*

⁸⁸ *Ibid*, p. 1392

⁸⁹ *Ibid.*

unnecessary suffering. States generally agree that an attack which has no military purpose violates this rule.⁹⁰

The prohibition on methods of warfare which causes a superfluous injury or unnecessary suffering was first acknowledged in AP I.⁹¹ when adopting the Convention on Certain Conventional Weapons, States were referring to the prohibition of “weapons, projectiles and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering”.⁹² International Criminal Court Statute’s also establish “methods of warfare which are of nature to cause superfluous injury or unnecessary suffering” as a war crime.⁹³

c. Principle of Proportionality

This principle regulates the prohibition to armed conflict parties in launching an attack which might cause incidental loss of civilian life, injured the civilians; destroy civilian objects; or a combination thereof.⁹⁴ The principle of proportionality in attack is

⁹⁰ ICRC, *Rule 70. Weapons of a Nature to Cause Superfluous Injury or Unnecessary Suffering* < https://ihl-databases.icrc.org/customary-ihl/eng/docs/v1_rul_rule70> accessed at 13 November 2017

⁹¹ AP I Geneva Convention, *op.cit.*, Article 35(2)

⁹² Preamble of Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects, October 10, 1980

⁹³ ICC Statute, *op.cit.*, Article 8(2)(b)(xx)

⁹⁴ ICRC, *Rule 14. Proportionality in Attack* < https://ihl-databases.icrc.org/customaryihl/eng/docs/v1_cha_chapter4_rule14> accessed at 13 november 2017

codified in Article 51(5)(b) of AP I, and repeated in Article 57 of the same protocol.⁹⁵

In addition, under the Statute of the International Criminal Court, it is said that, “intentionally launching an attack in the knowledge that such attack will cause incidental loss of life or injury to civilians or damage to civilian object which would be clearly excessive in relation to the concrete and direct overall military advantage anticipated” constitutes a war crime in international armed conflicts.⁹⁶

Similar to the principle of distinction, the principle of proportionality is designed to provide protection to the civilian population during times of armed conflict. Specific circumstances of the attack are more important for the principle of proportionality than for the principle of distinction, proportionality requires to balancing military goals, that is to anticipate direct military advantage and the prevention of excessive civilian casualties or damage.⁹⁷

d. Principle of Military Necessity

IHL is based on a balance between considerations of military necessity and humanity. On the one hand, in order to

⁹⁵ AP I Geneva Convention, *op.cit*, Article 51(5)(b) and 57

⁹⁶ ICC Statute, *op.cit*, Article 8(2)(b)

⁹⁷ Wagner, *op.cit*, p. 1393

overcome an enemy in wartime, it might be militarily necessary to cause death, injury and destruction, and to enforce more grave security measures than would be permissible in peacetime.⁹⁸

Moreover, IHL clearly determines that military necessity does not give the belligerents a *carte blanche*⁹⁹ to perform unrestricted war.¹⁰⁰ Actually, consideration of humanity imposes particular limits on the means and methods of warfare and require that those who have caught by enemy military forces be treated humanely at all times.¹⁰¹

However, military necessity's concept does not give the armed forces the freedom to ignore humanitarian considerations as a whole and do whatever they want. It must be interpreted in the concept of particular prohibitions and in accordance with the other principles of IHL.¹⁰² Article 52 of AP I lists objects which can be subject to lawful attacks.¹⁰³ The principle cannot be applied to replace a specific protection, or create exceptions to rules where the regulation itself does not provide for one.¹⁰⁴

⁹⁸ Melzer, *op.cit.*, p. 17

⁹⁹ Carte Blanche means complete freedom to act as one wishes or thinks best

¹⁰⁰ AP I Geneva Convention, *op.cit.*, Article 35(1). See also, Hague Convention, *op.cit.*, Article 22; Françoise Hampson, "Military necessity," in "Crimes of War," <<http://www.crimesofwar.org/a-z-guide/military-necessity/>> accessed at 13 November 2017

¹⁰¹ Melzer, *op.cit.*, p.18

¹⁰² Diakonia, *Basic Principle of IHL* <<https://www.diakonia.se/en/ihl/the-law/international-humanitarian-law-1/introduction-to-ihl/principles-of-international-law/>> accessed at 13 November 2017

¹⁰³ AP I Geneva Convention, *op.cit.*, Article 52.

¹⁰⁴ Diakonia, *loc.cit.*

IV. The importance of Human control in weapon system under International Humanitarian Law

The issue of Human Control has become fundamental in the debates on autonomous weapon system. There is an agreement that control of human inside weapon systems and use of force must be maintained, even if the legal, ethical, military operational, and/or policy reasons, and clear definition on “meaningful”, appropriate” or “effective” human control are unclear. A few stages of human control on attacks is required to guarantee accordance with, the IHL general principle of distinction and proportionality.¹⁰⁵

The Chair’s summary in CCW informal meeting of experts states that :¹⁰⁶

“ Views on appropriate human involvement with regard to lethal force and the issue of delegation of its use are of critical importance to the further consideration of LAWS [lethal autonomous weapon systems]”.

Based on this statement, ICRC has stated that human control is going to be retained over weapon systems and use of force to comply with legal and ethical Requirements.¹⁰⁷

A certain condition of control and involvement by human is essential in the application of the IHL rules on the conduct of

¹⁰⁵ Expert Meeting on Lethal Autonomous Weapon System, *op.cit.*, p. 5

¹⁰⁶ United Nations, *Recommendations to the 2016 Review Conference submitted by the Chairperson of the Informal Meeting of Experts*, para. 2 (b)

¹⁰⁷ Neil Davison, 2017, *A legal perspective: Autonomous weapon systems under international humanitarian law*, ICRC, Geneva, p. 11

hostilities. Although IHL made obligation for state and parties to armed conflicts, IHL rules are generally implemented by human subject which responsible to fulfilling with these rules in engaging an attack, and have to be held liable for violations. It similar to the notion of human control over an autonomous weapon system, the operator of weapon system will always be necessary to make sure the accordance between its conduct and IHL, and this may limit the lawful level of autonomy.¹⁰⁸

There are few important component of human control, they are predictability of such weapon system in its circumstances of conduct; human intervention inside the functioning of the weapon system in its development, activation and operation; knowledge and information in the functioning and the environment of the weapon will be use; accountability for the final operation of such system.¹⁰⁹

In regard to autonomous weapon system, as explained, the control and involvement exercised by human are divided into certain forms and level at different stage of development, deployment and use,¹¹⁰ including :

¹⁰⁸ *Ibid.*

¹⁰⁹ *Ibid*, p. 12

¹¹⁰ *Ibid.*

- a. The development and the verification of the weapon system (Development Stage)
- b. Commander's decision or operator's decision to activate weapon system (Activation Stage)
- c. Autonomous weapon system's operation during which it independently selects and attacks targets (Operation Stage)

G. Research Methods

1. Types of Research

This is a normative legal research which is defined as a scientific research to find the truth based on normative aspect of logical legal reasoning.¹¹¹ As what is defined, this research will only focus on legal norms. One of the forms of this type of research is seeking to find how and where a legal act is regulated through analyzing legal facts and relevant applicable laws,¹¹² and this research will focus on that.

2. Research Approach

In this research, the author uses a conceptual approach method. Juridical approach method is a method of research that is done through the study of librarianship. The study of librarianship is done by studying the various legal regulations, literature, Journals, news,

¹¹¹Johnny Ibrahim, *Teori & Metodologi Penelitian Hukum Normatif*, Bayumedia Publishing, Malang, 2006, p.57.

¹¹²Depri Liber Sonata, "Metode Penelitian Hukum Normatif dan Empiris: Karakteristik Khas dari Metode Meneliti Hukum," *Fiat Justisia*, Vol. 8 no. 1 January-March 2014, p. 26

and papers related to themes that will be discussed. Legal regulations like Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects, October 10, 1980; Additional Protocol of Geneva Convention 1949; International Criminal Court Statute. A literature such as paper issued by International Commission of Red Cross (ICRC) and Non-Governmental Organization like Human Right watch. A journal related to the notion of the research, which could be obtained from Foreign University Online Journal Storage. News and papers related to the themes that will be discussed, like the news on the development of war machine in this present time.

3. Sources of Data

The source of data is divided into three; primary legal materials, secondary legal materials and tertiary legal materials. The primary legal materials that were used to complete this research are laws and regulations, nationals and internationals as well as other jurisprudences, they are:

1. Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects, October 10, 1980
2. Additional Protocol of Geneva Convention 1949

3. International Criminal Court Statute

The secondary legal materials comprises books, journals, articles, documents, and news that cover various aspects within this topic and written by relatively highly qualified writers. As for the tertiary legal materials are law dictionary and Information and Technology (I.T.) dictionary.

4. Data Collection Method

The process of collecting data was done through both library studies by digging up as many as possible knowledge and information from the books, journal, articles, documents and news, as well as from national and international laws.

5. Method of Data Analysis

In the process of analyzing data during the process of this research, it is applied the qualitative method of analysis. Which done by describing the already gained data, knowledge and information through description or explanation which is assessed by the opinions of the experts, by laws, and also by the researcher's own arguments

CHAPTER II

THE USE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN AUTONOMOUS WEAPON SYSTEM ARE IN COMPLIANCE WITH INTERNATIONAL HUMANITARIAN LAW

A. General Principle of International Humanitarian Law

There are four core principles of IHL which is applied to every combat operation: Distinction, Proportionality, Military Necessity and Humanity.¹¹³

1. Principle of Distinction between Civilians and Combatants

At the heart of international humanitarian law lies the principle of distinction between the armed forces who conduct the hostilities on behalf of the parties to an armed conflict and civilians who are presumed not to directly participate in hostilities and must be spared against the dangers arising from military operations.¹¹⁴

The protective purpose of the principle of distinction can be achieved only if the underlying categories of person (“civilians” and “combatants”) and objects (“civilians objects” and “military objects”)

¹¹³ J.Foy, *op.cit*, p. 54. See also ICRC, *Handout 2 : The Main Source of International Humanitarian Law* <file:///C:/Users/hp%20detach/Downloads/handout_2_the_main_sources_of_international_humanitarian_law.pdf> accessed at 14 November 2017

¹¹⁴ Abdulrashid Lawan Haruna , Dr. Laminu Bukar, and Babagana Karumi, 2014, *Principle of Distinction in Armed Conflict: An Analysis of the Legitimacy of ‘Combatants and Military Objectives’ As a Military Target*, 3 International Journal of Humanities and Social Science Invention, p. 15. See also, Nils Melzer, 2009, *Interpretive Guidance on the Notion of Direct Participation in Hostilities Under International Humanitarian Law*, Geneva, ICRC, p. 11

are defined, and if the scope and condition of the protection afforded to civilians and civilian objects are clear.¹¹⁵

It is also in accordance with article 48 Additional Protocol of Geneva Convention 1949 which contains this principle which mention that parties of hostilities should distinguish civilian and combatant,¹¹⁶ unless they take a direct part in hostilities¹¹⁷ or target historic monuments, works of art, or places of worship.¹¹⁸ Moreover, AP I prohibits not only attacks on civilians or objects of a civilian nature, but also attacks on objects that are “indispensable to the survival of the civilian population,”¹¹⁹ the natural environment,¹²⁰ and “installations containing dangerous forces.”¹²¹

In addition, AP I contain provisions that prohibit certain methods of attack, namely those that are by their nature indiscriminate.¹²² These rules are an expression of the idea that underlies IHL (i.e. that an attacker must not only distinguish between civilian and military targets but do so with weaponry that is not indiscriminate).¹²³ Therefore, if all that is available for an attack is a weapon system that

¹¹⁵ Melzer, *op.cit.* p. 80

¹¹⁶ Additional Protocol of Geneva Convention 1949 (AP I Geneva Protocol 1949), Article 48

¹¹⁷ *Ibid*, Article 51(3)

¹¹⁸ *Ibid*, Article 53

¹¹⁹ *Ibid*, Article 54

¹²⁰ *Ibid*, Article 55

¹²¹ *Ibid*, Article 56

¹²² *Ibid*, Article 51 (4)

¹²³ Markus Wagner, 2014 , *The Dehumanization of International Humanitarian Law: Legal, Ethical, and Political Implications of Autonomous Weapon Systems*, 47 Vanderbilt journal of transnational law, p. 1388.

is designed to destroy a large-scale target, the attack can only be carried out in a fashion that is adhered to these principles.¹²⁴

2. Principle of Humanity

This principle refers to prohibition of means of warfare which is a nature to cause superfluous injury or unnecessary suffering refers to the effect of a weapon on combatants. Although there is general agreement on the existence of the rule, views differ on how it can actually be determined that a weapon causes superfluous injury or unnecessary suffering. States generally agree that suffering that has no military purpose violates this rule.¹²⁵

International humanitarian law is restricted means and methods of warfare that are considered to inflict unnecessary suffering or superfluous injury on combatants.¹²⁶ As early as 1868, the St. Petersburg Declaration recognized:¹²⁷

“ That only legitimate object during war is to weaken the military forces of the enemy; That for this purpose it is sufficient to disable the greatest possible number of men; That this object would be exceeded by the employment of arms which uselessly aggravate the sufferings of disabled men, or render their death inevitable; That the employment of such arms would, therefore, be contrary to the laws of humanity.”

¹²⁴ *Ibid.*

¹²⁵ ICRC, *Rule 70. Weapons of a Nature to Cause Superfluous Injury or Unnecessary Suffering* < https://ihl-databases.icrc.org/customary-ihl/eng/docs/v1_rul_rule70> accessed at 13 November 2017

¹²⁶ Melzer, *op.cit.*, p. 19

¹²⁷ *Ibid.* See also, St. Petersburg Declaration 1968.

The prohibition of methods of warfare which is of a nature to cause superfluous injury or unnecessary suffering was first introduced in Additional Protocol I.¹²⁸ When adopting the Convention on Certain Conventional Weapons, States were basing themselves on the prohibition of “weapons, projectiles and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering”.¹²⁹ The Statute of the International Criminal Court also includes the use of “methods of warfare which are of nature to cause superfluous injury or unnecessary suffering” (emphasis added) as a war crime.¹³⁰

3. Principle of Proportionality

This principle regulates the prohibition to armed conflict parties in launching an attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof.¹³¹ The principle of proportionality in attack is codified in Article 51(5)(b) of Additional Protocol I, and repeated in Article 57.¹³²

¹²⁸ AP I Geneva Convention, *op.cit.*, Article 35(2)

¹²⁹ Preamble of Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects, October 10, 1980

¹³⁰ ICC Statute, *op.cit.*, Article 8(2)(b)(xx)

¹³¹ ICRC, *Rule 14. Proportionality in Attack* < https://ihl-databases.icrc.org/customaryihl/eng/docs/v1_cha_chapter4_rule14 > accessed at 13 november 2017

¹³² AP I Geneva Convention, *op.cit.*, Article 51(5)(b) and 57

In addition, under the Statute of the International Criminal Court, “intentionally launching an attack in the knowledge that such attack will cause incidental loss of life or injury to civilians or damage to civilian object which would be clearly excessive in relation to the concrete and direct overall military advantage anticipated” constitutes a war crime in international armed conflicts.¹³³

Similar to the principle of distinction, the principle of proportionality is designed to provide protection to the civilian population during times of armed conflict. Unlike portions of the distinction analysis, proportionality cannot be defined in the abstract. The particular circumstances of the attack matter more for the principle of proportionality than for the principle of distinction, proportionality entails balancing competing goals, that is to anticipate direct military advantage and the prevention of excessive civilian casualties or damage.¹³⁴

The key term to be examined in the proportionality equation is “excessive.”¹³⁵ While the requirement of proportionality is absolute, the standard of “excessiveness” is relative.¹³⁶ International Humanitarian Law does not establish an objective threshold above which the infliction of incidental harm would always be excessive. In

¹³³ ICC Statute, *op.cit.*, Article 8(2)(b)

¹³⁴ Wagner, *op.cit.*, p. 1393

¹³⁵ Melzer, *op.cit.*, p. 101

¹³⁶ *Ibid.*

principle, targets with a comparatively high military value (high-value targets) will justify greater incidental harm than targets with a comparatively low military value (low-value targets).¹³⁷

Although the proportionality assessment necessarily contains subjective elements, a certain degree of objective guidance can be derived from the terminology used in the treaty text. Thus the infliction of incidental harm on protected persons or objects can only be justified by advantages of a “military” nature, and not by political, economic or other non-military benefits.¹³⁸

4. Principle of Military Necessity

IHL is based on a balance between considerations of military necessity and of humanity. On the one hand, it recognizes that, in order to overcome an adversary in wartime, it may be militarily necessary to cause death, injury and destruction, and to impose more severe security measures than would be permissible in peacetime.¹³⁹

On the other hand, IHL also makes clear that military necessity does not give the belligerents carte blanche¹⁴⁰ to wage unrestricted war.¹⁴¹ Rather, considerations of humanity impose certain limits on

¹³⁷ *Ibid.*

¹³⁸ *Ibid.*

¹³⁹ Melzer, *op.cit.*, p. 17

¹⁴⁰ Carte Blanche means complete freedom to act as one wishes or thinks best

¹⁴¹ AP I Geneva Convention, *op.cit.*, Article 35(1). See also Hague Convention, *op.cit.*, Article 22; Françoise Hampson, “Military necessity,” in “Crimes of War,” <<http://www.crimesofwar.org/a-z-guide/military-necessity/>> accessed at 13 November 2017

the means and methods of warfare, and require that those who have fallen into enemy hands be treated humanely at all times.¹⁴²

However, concept of military necessity does not give the armed forces the freedom to ignore humanitarian considerations altogether and do what they want. It must be interpreted in the context of specific prohibitions and in accordance with the other principles of IHL.¹⁴³

It is important to note that the principle itself is to be found within the rules of IHL. For example, Article 52 of Addition Protocol I lists those objects that can be subject to lawful attacks.¹⁴⁴ The principle cannot be applied to override specific protections, or create exceptions to rules where the text itself does not provide for one.¹⁴⁵

B. The use of Artificial Intelligence under General Principle of International Humanitarian law

The ICRC has defined autonomous weapon systems as: “Any weapon system with autonomy in its critical functions.¹⁴⁶ That is, a weapon system that can select (i.e. search for or detect, identify, track,

¹⁴² Melzer, *op.cit.*, p.18

¹⁴³ Diakonia, *Basic Principle of IHL* < <https://www.diakonia.se/en/ihl/the-law/international-humanitarian-law-1/introduction-to-ihl/principles-of-international-law/> > accessed at 13 November 2017

¹⁴⁴ AP I Geneva Convention, *op.cit.*, Article 52.

¹⁴⁵ Diakonia, *loc.cit.*

¹⁴⁶ Convention on Conventional Weapons (CCW), 2016, Expert Meeting on Lethal Autonomous Weapon System: *Views of the International Committee of the Red Cross (ICRC) on autonomous weapon system*, Geneva, ICRC, p. 1

select) and attack (i.e. use force against, neutralize, damage or destroy) targets without human intervention.”¹⁴⁷

The advantage of this broad definition, which encompasses some existing weapon systems, is that it enables real-world consideration of weapons technology to assess what may make certain existing weapon systems acceptable – legally and ethically – and which emerging technology developments may raise concerns under international humanitarian law (IHL) and under the principles of humanity and the dictates of the public conscience.¹⁴⁸

There are weapon systems in use today which can select and attack targets without human intervention. After activated by human operator, through its sensors and computer programming, autonomous weapon system is able to select a target and launch an attack.¹⁴⁹

Human intelligence (human operator) generally follows a sequence known as the perception–cognition–action information processing loop, in that individuals perceive something in the world around them, think about what to do, and then, once they have weighed up the options, make a decision to act.¹⁵⁰ AI is programmed to do something similar, in that a computer senses the world around it, and then processes the incoming information through optimization and verification algorithms, with a

¹⁴⁷ *Ibid.*

¹⁴⁸ *Ibid.*

¹⁴⁹ *Ibid.*, p. 2

¹⁵⁰ M.L. Cummings, 2017, *Artificial Intelligence and The Future Warfare*, London, Chatham House, p. 3

choice of action made in a fashion similar to that of humans, and of course, without human intervention.¹⁵¹

Generally, there are 3 steps of Artificial Intelligence's world model works. First is Sensing, there are five types of sensing in general world model of Artificial Intelligence, they are: Computer Vision; Global Positioning System (GPS); Light Detection and Ranging (LIDAR); Infrared; and Radar. Second is Verification, after the model senses the object, it will conduct verification with or without human intervention. The Last is Action, after the verification has verified by the original input of the system or by human operator, models will execute the order.¹⁵²

Autonomous UAV (Unmanned Aerial Vehicle) navigation, for example, is relatively straightforward, since the world model according to which it operates consists simply of maps that indicate specific routes, height obstacles and no-fly zones. Radars augment this model in real time by indicating which altitudes are clear of obstacles. GPS coordinates convey to the UAV where it needs to go, with a goal of the GPS coordinate plan being not to take the aircraft into a no-fly zone or cause it to collide with an obstacle.¹⁵³

¹⁵¹ *Ibid.*

¹⁵² *Ibid.*

¹⁵³ *Ibid*, p. 4

There is one additional distinction that is of particular use when thinking about the sequence and speed with which progress on AI will unfold. The literature generally agrees that there are three types of AI:¹⁵⁴

- a. Artificial Narrow Intelligence (ANI or “narrow AI”)¹⁵⁵: machine intelligence that equals or exceeds human intelligence for specific tasks. Existing examples of such systems would be IBM’s Deep Blue (Chess) & Watson (‘Jeopardy!’), Google’s AlphaGo (go), High-Frequency Trading Algorithms, or indeed any specialized automatic systems performing beyond human reach (e.g. Google Translate; spam filters; the guidance systems of point-defense anti-missile cannons etc.).
- b. Artificial General Intelligence (AGI or “strong AI”): machine intelligence meeting the full range of human performance across any task; and:
- c. Artificial Super intelligence (ASI): machine intelligence that exceeds human intelligence across any task.¹⁵⁶

¹⁵⁴ Stephen Lucci and Danny Kopec, 2016, *Artificial Intelligence in the 21st Century: A Living Introduction*, Mercury Learning and Information, Virginia, p. 12. See also, Spegeleire, Maas, and Sweijs, *op.cit*, p. 30

¹⁵⁵ Ray Kurzweil, 2015, *Long Live AI*, http://www.forbes.com/home/free_forbes/2005/0815/030.html accessed at 2 January 2018. See also Spegeleire, Maas, and Sweijs, *ibid*.

¹⁵⁶ Note that even such hypothetical superintelligences might come in different forms, such as ‘speed superintelligence’ - ‘a system that can do all that a human intellect can do, but much faster’; ‘collective superintelligence’ - ‘A system composed of a large number of smaller intellects such that the system’s overall performance across many very general domains vastly outstrips that of any current cognitive system’; or ‘quality superintelligence’ - “A system that is at least as fast as a human mind and vastly qualitatively smarter.” Nick Bostrom, 2014, *Superintelligence: Paths, Dangers, Strategies*, OUP Oxford, London, p. 53, 54, 56; Spegeleire, Maas, and Sweijs, *ibid*.

From the explanation above, researcher will analyze the conformity between Artificial Intelligence system in Autonomous Weapon System and General Principle of International Humanitarian Law.

1. Principle of Distinction

AWS must be able to determine whether a particular target is combatant or non-combatant, AWS would have to be determined based on the input which is inserted by human. When there is doubt over whether a person or object is a lawful target, it is presumed to be a civilian.¹⁵⁷ The situation is much more problematic when determining whether an individual constitutes a military target, not only would AWS have to be able to distinguish civilians from military personnel, but it must also decide if a civilian is taking a direct part in hostilities.¹⁵⁸

Present AWS which implemented A.I. technology are not capable to distinguish between combatant and civilian or civilian which participate directly in hostilities. However, A.I. technology which implemented in AWS such as drones are merely to assist military forces detecting the position of its target, referring to M.L. Cumming explanations on how A.I. works,¹⁵⁹ A.I. technology will provide an information about military's target position by using radar or other

¹⁵⁷ Wagner, *op.cit*, p. 1392

¹⁵⁸ *Ibid.*

¹⁵⁹ Cummings, *loc.cit.*

type of sensing, and decision-making to strike the target are decided by operator of the weapon.

Therefore, A.I. technology does not violated the principle of distinction, but decision taken by the operator of A.I.-Implemented Weapon such as drones and other automated weapon has possibility to violate this principle. Although there are few AWS which implement A.I. technology, such as Samsung AGR A-1 and Phalanx Weapon System, they are included as Human in-the loop weapon system¹⁶⁰, which means these weapon are undoubted as weapon which clearly defining the terms “autonomous”, because these weapon are operator-less, but it is only used as defense system and not a weapon to strike a target like drones.

2. Principle of Humanity

From the explanation above on How Artificial intelligence works, it seems this kind of technology could adhere the rules of international humanitarian law. It is because in the implementation, human still takes part in its loop to verify the action. However, in case of drone strike in Yemen and Pakistan,¹⁶¹ in attempt to kill 24 targeted man in Pakistan, U.S Drone has killed 874 people, while in Yemen, it attempts to kill targeted person which are 17 persons in total. It has att

¹⁶⁰ See chapter I

¹⁶¹ Spencer Ackerman, 2014, *41 men targeted but 1,147 people killed: US drone strikes – the facts on the ground* <https://www.theguardian.com/us-news/2014/nov/24/-sp-us-drone-strikes-kill-1147#img-1> accessed at 12 January 2018

killed 273 people,¹⁶² In that case, civilian also included as victim of Yemen and Pakistan drone strike.¹⁶³

The reason why drone attacking the civilian, is because of technology applied within the drone itself. The drone itself is equipped by computer system which means also equipped by Artificial Intelligences technology. Generally drone system is using GPS, Radar, Infrared, and Computer Vision to detect its target¹⁶⁴, in the case of Yemen and Pakistan Drone strike, the drone uses “Signature Strike” to kill the target, Signature Strike means :¹⁶⁵

“A military attack by a drone or drones in which people are targeted because their activities are believed to fit a particular behavioral profile, though their individual identities are unknown.”

Signature Strike is supported by A.I to locate its target, but the decision to launch a signature strike is in the hand of Military operator. From this explanation, present artificial intelligence technology could be violated principle of humanity. Taking an example from Signature strike, drones which supported by A.I technology which conduct the strike may cause an unnecessary suffering.¹⁶⁶ The launch of strike in Signature strike based on pattern of behavior considered suspicious, thus it cannot distinguish

¹⁶² *Ibid.*

¹⁶³ *Ibid.*

¹⁶⁴ Cummings, *loc.cit.*

¹⁶⁵ Oxford dictionaries definition on Signature Strike, https://en.oxforddictionaries.com/definition/signature_strike accessed at 12 January 2018

¹⁶⁶ Ackerman, *loc.cit*

specifically, whether the strike will harm the target or non-target who detected in drone strike-range.¹⁶⁷

3. Principle of Proportionality

Related to drone-strike which discuss in Principle of Humanity, U.S. Drone Strike has killed 1.147 not-combatant people, this data shown that AWS like drones are often to injured civilians. Nevertheless, Proportionality principle which codified in Additional Protocol of Geneva Convention in 1977,¹⁶⁸ has govern about the prohibition on a strike which cause an unnecessary suffering to civilian and civilian object. Principle of proportionality are made to protects the civilian population during times of armed conflict. Unlike the analysis on principle of distinction, proportionality cannot be defined in the abstract. Specific circumstances of the attack are more important for the principle of proportionality than for the principle of distinction, proportionality needs competing goals, that is to reach direct military advantage and the prevention of excessive civilian casualties or damage. Military necessity establish that a strike in armed conflict are limited to military objectives itself, means the military objective only to weakening the enemy forces, military strike are not deploy to give a damage to civilian or non-combatant person and its property.

¹⁶⁷ *Ibid.* See also, Oxford Dictionarie, *loc.cit.*

¹⁶⁸ Additional Protocol I of Geneva Convention 1977, article 5(b)

Principle of Proportionality are related to the terms “Collateral Damage” , it means a damage which cause death, injuries, or other damages inflicted on an unintended target, in time of armed conflict. It is referring to the unintentional death and injuries of civilian and not-combatants, and also damage their home, school, hospital and etc.¹⁶⁹

To prevent the collateral damage which can arise a violation of these principle, Collateral Damage Estimation (CDE) Methodology (CDM) are needed to prevent the violation occurs. Introduced by U.S. in 2009, CDM has a role to cover all standards, methods, techniques, and processes for a commander to conduct CDE and decline an unintended damage or injury to civilian or non-combatant persons, property and the environment. CDM is a methodology that produces the best judgment of potential damage to collateral concern.¹⁷⁰ Using physic-based computer model which applied A.I. technologies, CDM will provide information about the effects of the weapon, incidental consequences, and mitigation techniques that will assisted in decision-making process. CDM also lists the object which is lawful or unlawful to strike during an armed conflict to make a certainty in reaching the military objectives.¹⁷¹

¹⁶⁹ Definition of Collateral Damage, <https://dictionary.cambridge.org/dictionary/english/collateral-damage> accessed at 6th March 2018

¹⁷⁰ Chairman of The Joint Chiefs of Staff Instruction (CJCSI), 2009, *No-Strike and The Collateral Damage Estimation Methodology*, U.S. Departement of Defense, p. D1-D2

¹⁷¹ *Ibid*, p. B.1 – B.6

However, although this method already had an input of list on lawful and unlawful objects to strike and implement A.I. technologies to stipulate the effect of a strike, CDM does not predict the actual outcome of weapon-strike, it is only estimation, not a certain outcome. Therefore, despite A.I. technologies are applies in CDM to analyze the estimation of weapon-strike's outcome and it is in accordance with the principle of proportionality which is to decrease an excessive effects of a strike, however it is only an estimation, the actual outcome will determine whether there is a violation to this principle or not.

4. Principle of Military Necessity

Military necessity establish that a strike in armed conflict are limited to military objectives itself, means the military objective only to weakening the enemy forces, military strike are not deploy to give a damage to civilian or non-combatant person and its property.

Similary to Principle of Proportionality, Principle of Military Necessity is also refers to the term "Collateral Damage". It is mean a damage which cause death, injuries, or other damages inflicted on an unintended target, in time of armed conflict.¹⁷² To avoid this damage to occur, an autonomous weapon system was equipped by an artificial intelligence, called as Collateral Damage Estimation (CDE) technology, it has a function to cover all standards, methods,

¹⁷² Definition of Collateral Damage, <https://dictionary.cambridge.org/dictionary/english/collateral-damage> accessed at 6th March 2018

techniques, and processes for a commander to conduct CDE and decline an unintended damage or injury to civilian or noncombatant persons, property and the environment. CDM is a methodology that produces the best judgment of potential damage to collateral concern.¹⁷³

However, this technology does not predict the actual outcome of weapon-strike. It is only estimation, not a certain outcome. Therefore, despite A.I. technologies are applies in CDE technology to analyze the estimation of weapon-strike's outcome and it is in accordance with the principle of proportionality which is to decrease an excessive effects of a strike, however it is only an estimation, the actual outcome will determine whether the action of a autonomous weapon system will violated this principle or not.

Although present artificial intelligence technologies which applied in autonomous weapon system are not violated current international humanitarian law, development of such technologies that will be used in armed must be reviewed¹⁷⁴ to ensure its compliance to general principle of international humanitarian law and was not violated current international humanitarian law. Moreover, a *lex specialis* are need to be establish to govern about the use of autonomous weapon system which applied artificial intelligence.

¹⁷³ Chairman of The Joint Chiefs of Staff Instruction (CJCSI), 2009, *No-Strike and The Collateral Damage Estimation Methodology*, U.S. Departement of Defense, p. D1-D2

¹⁷⁴ Additionla Protocol I, *op.cit*, art. 36

C. The use of Artificial Intelligence Technologies in Islamic Perspectives

One of the important principle of islamic law which refers to the relationship between government and the people is “*Tasharruf al-imâm ‘alâ ar-ra’iyyah manûthun bi al-maslahah*” which mean an act of government to its people must refers to the benefit (*Maslahah*) of its people.¹⁷⁵ Government’s obligation to take notice on the benefit of its people is quite related to islamic teaching in regard to the government position before its people. Ibnu Taimiyyah presume that government is group people which have an obligation from Allah SWT to take care of its people.¹⁷⁶

Syeh Ammer Ali asserts that protection of nation for all of its citizen becomes an obligation of government with a primary reason to refrain the nation from enemy that want to disturb its peaceful condition. This reason confirmed that Islam dislike a dispute resolution through “sword”, because it is contradicted with the learning of Prophet Muhammad SAW. War in Islam is started with a restricted requirement, its objectives is to erase the injustice. Declaration of war is declared as a means for self-protection and

¹⁷⁵ Malik Madaniy, 2010, *Politik Berpayung Fiqh*, Perpustakaan Pesantren, Yogyakarta, p.73.

¹⁷⁶ *Ibid*, p.74

the permission to conduct an armed conflict arises after war-threat is actual.¹⁷⁷

Ethics of war in Islam emphasizes to the prohibition of public facilities destruction and protection of civilian during time of armed conflict.¹⁷⁸ As stipulated in Al-Baqarah verse 190 :

وَقَاتِلُوا فِي سَبِيلِ اللَّهِ الَّذِينَ يُقَاتِلُونَكُمْ وَلَا تَعَدُّوا إِلَيْهِ اللَّهُ لَا يُحِبُّ الْمُعْتَدِينَ

Means :

“ Fight in the way of Allah those who fight you, but do not overstep, for Allah does not loves those who transgress”

History of hadith from Abdullah bin Umar, Rasulullah prohibit its army to kill woman and children in ared conflict.¹⁷⁹ Another history of hadith from Ibnu Umar explain that Rasulullah will gave protection to the people (specillay woman and children) who seeks for protection in armed conflict (even they are not moslem people) until they have faith in Islam.¹⁸⁰

As explained above and followed by verse of Al-Baqarah, it is clear that Islam restricts the means and method of war. If it is refering to the ethics of war in Islam, it is almost similar to the principle which is

¹⁷⁷ M. Fajar Shodiq, 2014, *Perlindungan Penduduk Sipil dan Etika Perang Dalam Islam*, GEMA, Th. XXVI/48/, IAIN Surakarta, p. 1439. See also Syed Ameer Ali, 1967, *Api Islam*, PT Pembangunan, Jakarta, p.78

¹⁷⁸ Shodiq, *ibid*, p.1444.

¹⁷⁹ Book of Sahih Muslim No. 3279

¹⁸⁰ Book of Sahih Muslim No. 3312

implemented in IHL. From the discussion in the previous notion, the use of A.I. is to simplify and ease the military objectives in armed conflict, implementation of A.I. technologies to present AWS or another weapon are lawful and application of A.I. technologies are applied at the stage of pre-military strike.

It means that present A.I. technologies which are applied are merely to assist the military forces in making a decision through certain kind of action like detecting the target, automation, making an assessment and judgment like CDM. The violation occurs from decision of operators or commander which has an authority to engage a target in armed conflict. Thus, by referring to the notion of *Maslahah*, government has an obligation to considering the effect of its decision which could affect its own people or not, whether its a negative impact or postivie impact

CHAPTER III

THE IMPORTANCE OF HUMAN CONTROL IN WEAPON SYSTEM UNDER INTERNATIONAL HUMANITARIAN LAW

A. Human Control over weapon system under International

Humanitarian Law

The issue of Human Control has become fundamental in the debates on the autonomous weapon system. There is an agreement in which that control of human inside weapon systems and use of force must be maintained, even if the legal, ethical, military operational, and/or policy reasons, and clear definition on “meaningful”, appropriate” or “effective” human control are unclear. A few stages of human control on attacks are required to guarantee accordance with, the IHL general principle of distinction and proportionality.¹⁸¹ The Chair’s summary in CCW informal meeting of experts states that :¹⁸²

“ Views on appropriate human involvement with regard to lethal force and the issue of delegation of its use are of critical importance to the further consideration of LAWS [lethal autonomous weapon systems]”.

Based on this statement, ICRC has stated that human control to be retained over weapon systems and use of force to comply with legal and ethical Requirements.¹⁸³

¹⁸¹ Expert Meeting on Lethal Autonomous Weapon System, *op.cit.*, p. 5

¹⁸² Recommendations of the Informal Meeting of Experts, *op.cit.*

¹⁸³ Neil Davison, *op.cit.*

A certain condition of control and involvement by human is essential in the application of the IHL rules on the conduct of hostilities. Although IHL made obligation for state and parties to armed conflicts, IHL rules are generally implemented by human subject who responsible to fulfilling with these rules in engaging an attack, and have to be held liable for violations. It similar to the notion of human control over an autonomous weapon system, the operator of weapon system will always be necessary to make sure the accordance between its conduct and IHL, and this may limit the lawful level of autonomy.¹⁸⁴

Recognizing that human are the addressees of IHL rules, whether collectively or individually, then there are several restrictions of weapon operation which implies by the law in relation to humans. IHL terms for ‘attacks’ provides a set of military and individual ‘attacks’ that specific legal judgment must be implemented.¹⁸⁵ Therefore an attack is part of the law’s structure; they represent legal application toward military action and human.¹⁸⁶

For instance, Additional Protocol I provide regulation on precautions to be applied in attack.¹⁸⁷ Where it stated “those who plan or decide upon an attack”, it is referring to humans. Based on this rules, human shall applied these legal rules, it includes determining the objective, means and

¹⁸⁴ *Ibid.*

¹⁸⁵ Article 36, 2016, *Key Elements of Meaningful Human Control*, United Kingdom, p. 2 <<http://www.article36.org/wp-content/uploads/2016/04/MHC-2016-FINAL.pdf>> accessed 20 March 2018

¹⁸⁶ *Ibid.*

¹⁸⁷ Additional Protocol, *op.cit.*, art. 57.

methods of attack that shall be chosen, and certain circumstances to refraining from and cancelling an attack.¹⁸⁸

As explained in Additional Protocol I, attack must engage at particular military objectives otherwise it is considered as indiscriminate.¹⁸⁹ Military objectives also obligate to make a classification (nature, location etc.) to reach military advantages¹⁹⁰ and the implementation of the legal rules and direct military advantage must be verified by the human and decided over an attack.¹⁹¹ Therefore legal determination must be made by human upon an attack based on circumstances at the time, over a specific military objective.¹⁹² The capacity to cancel or to cease an attack should also exist during the operation of a weapon/machine.¹⁹³ According to these rules, it implies that machine cannot determine and attack a military objective without application of legal judgment and control by a human.

Maintaining human control over a machine are clearly become a military interest, it is to ensure the compliance with IHL rules and to ensure that a military operation are directly controlled by the commander.¹⁹⁴ Rules of engagement related to a specific weapon system

¹⁸⁸ Article 36, *ibid*, p. 3

¹⁸⁹ Additional Protocol I, *op.cit*, art. 51(4a)

¹⁹⁰ Article 36, *op.cit*.

¹⁹¹ Additional Protocol I, *op.cit*, art. 51(5) and art. 57(2a. i&ii).

¹⁹² Article 36, *op.cit*.

¹⁹³ Additional Protocol I, *op.cit*, art. 57(2b)

¹⁹⁴ Expert Meeting on Lethal Autonomous Weapon System, *op.cit*, p. 6

are the main method to exert an operational control to a weapon system and use of force.¹⁹⁵

In regard to autonomous weapon system, as explained, the control and involvement exercised by human are divided into certain forms and level at different stages of development, deployment and use,¹⁹⁶ including :

- a. The development and the verification of the weapon system (Development Stage)
- b. Commander's decision or operator's decision to activate weapon system (Activation Stage)
- c. Autonomous weapon system's operation during which it independently selects and attacks targets (Operation Stage)

From the explanation above, it is clearly stated that human control is used in the development and deployment stages of weapon system. In the third stage, when the weapon was operated – when it autonomously selects and engages the target – the issue arose as whether the first two stages are adequate to overcome minimal or no human control at the last stage, from legal, ethical and operation of military aspect.¹⁹⁷

¹⁹⁵ *Ibid.*

¹⁹⁶ *Ibid.*

¹⁹⁷ Expert Meeting on Lethal Autonomous Weapon System, *op.cit*, p. 3

1. Development Stage

Human control can be implemented at the stage of development, such as technical design and programming of the weapon system phase. Implementation of human control in development stage is to ensure that the weapon system can be operated in accordance with rules of IHL and other applicable international law.¹⁹⁸ Within this stage, the weapon system's predictability and reliability are ought to be determined by testing in actual environments. Operational parameter over the operation of weapon system must be existed in military guidance for its use, for example are the limitation of its use in particular condition, to restrict its movement in time and space, or to give an opportunity for human supervision.¹⁹⁹

A concrete example is in an existing vehicle "active protection" weapon (which attacks incoming rockets). This system is necessary to be tested against the objectives of its use, and the limit of its operation have to be arranged in order to predict the effects of weapon system when it is activated.²⁰⁰ The other requirements are also needed, like supervision over the operational requirement and technical mechanism of weapon system, followed by an ability to deactivate the system, are needed to be arranged.²⁰¹

¹⁹⁸ Neil Davison, *op.cit*, p.12

¹⁹⁹ *Ibid.*

²⁰⁰ *Ibid.*

²⁰¹ *Ibid.* p. 13

2. Activation stage

Another stage which human control can be used is in the activation stage, which includes commander and operator decision to use a specific weapon system for specific objectives for a specific attack or to overcome to the threat in a specific condition (e.g. defending from incoming rockets or mortar).²⁰² Commander and operator decision must be based on adequate knowledge and concept on how the weapons operating in specific condition to ensure its operation is in accordance with IHL.²⁰³ This knowledge must follow by an adequate situational awareness over the operational environment, especially related to the possible risks to civilian and civilian objects.²⁰⁴

Whether the operation of weapon system is in the constraint of IHL will depend on the technical performance in specific circumstances where the specific weapon system activated, especially its predictability and reliability (as explained and tested at the stage of development). However, it is still needed to be verified through various parameter of its operation, some of them are include in development stage, and others were included in activation stage. They are:²⁰⁵

- a. The task of weapon system;
- b. The type of target which weapon system engages;
- c. The environment where the system operates

²⁰² *Ibid.*

²⁰³ *Ibid.*

²⁰⁴ *Ibid.*

²⁰⁵ *Ibid.* See also, Recommendations of the Informal Meeting of Experts, *op.cit.* p. 3.

- d. The movement of weapon system when it operates
- e. The time-frame of operation
- f. Possibility for human supervision and intervention to override or deactivate the system.

There are lessons to be taken from the present autonomous weapon system, for instance defense system from rocket and missile, where human control is applied both within the technical performance and operational limitation, such as limits of targets, limits in the environment where the system operates, limits on space and time frame geography, and capability of human to supervise and to deactivate the system.²⁰⁶

3. Operation Stage

Decreasing the risk of IHL rule's violation can be done by manipulating the operational parameters up to the aspect of activation. Nevertheless, to ensure the certainty of IHL compliance, it may need an additional human control in the situation of operation stage, when the system of weapon autonomously selects and engages targets.²⁰⁷

Derived from the last operational parameter listed in activation stage, the Possibility for human supervision and intervention to override or deactivate the system, it means that further control is needed to be applied over an attack. When operational parameter and weapon's

²⁰⁶ ICRC, 2016, *Autonomous Weapon System: Implication of Increasing Autonomy in the Critical Functions of Weapons*, ICRC, Geneva, pp. 10-14

²⁰⁷ Neil Davison, *op.cit*, p. 14

technical performance are implemented within development and activation stage is inadequate to comply with IHL in enforce an attack, capability for human control and decision making during operation stage will be needed.²⁰⁸

Supervision of the weapon system, target area, and two-way communication links that allow adjustment of the engagement parameter and the capability to cancel an attack are become an example of the ability of human control and decision-making in operation stage.²⁰⁹ For instance, the present counter-rocket, artillery and mortar weapons maintain the ability, even with incoming attacks, human operator need to visually determine the attack (e.g. projectile) on screen and make a decision to cancel the attack if necessary.²¹⁰

The information received by operator is necessary to assess the validity of specific military action at the time of an attack and to make an evaluation in context of the legal rules over a suggested attack by the military forces.²¹¹

Briefly, human control's type and degree within autonomous weapon system which are required to guarantee compliance with IHL can be demonstrated in:²¹²

- a. Determined weapon system's technical performance for the purpose of its operation, as explained at the development stage;

²⁰⁸ *Ibid.*

²⁰⁹ *Ibid.*

²¹⁰ *Ibid.*

²¹¹ Article 36, *op.cit*, p. 4

²¹² Neil Davison, *op.cit*, p. 15

- b. Operational parameter's adjustment at the development and activation stages; and
- c. Capability for human supervision, intervention, and deactivation in times of weapon system's operation.

B. Predictability for International Humanitarian Law Compliance

Predictability in operating a weapon in specific circumstances of use is essential to compliance with IHL. High level of confidence is needed by the commander or operator in activation of autonomous weapon system, such system will operate predictably, will require a high level of predictability in its technical performance; the environment; and interaction between two of them.²¹³

The estimation of whether an autonomous weapon system could comply with IHL rules may depend on the certain technical characteristic and performance of the system (AWS) and objectives and circumstances of its operation.²¹⁴ Several technical characteristics with a distinct operational parameter could become an important impact to the estimation, including:²¹⁵

- a. The task of weapon system;
- b. The type of target which weapon system engages;
- c. The environment where the system operates

²¹³ *Ibid.*

²¹⁴ Recommendations of the Informal Meeting of Experts, *op.cit.* p. 3

²¹⁵ *Ibid.*

- d. The movement of weapon system when it operates
- e. The time-frame of operation
- f. The adaptability of the weapon system (its capability to adapt with the different environment, to define its function and to set its own objectives);
- g. Possibility for human supervision and intervention to override or deactivate the system.

Combination of those technical characteristic and performance of the weapon system produce several important component of human control to determine whether its operation is in compliance with IHL rules, they are , “predictability” and “reliability” of such weapon system in its circumstances of conduct; human intervention inside the functioning of the weapon system in its development, activation and operation; knowledge and information in the functioning and the environment of the weapon will be use; accountability for the final operation of such system.²¹⁶

Indeed, engaging a weapon system which has an unpredictable effect will create a risk for IHL violations. The risk would be high to permit the use of weapon, or else mitigation is required to limit the weapon’s autonomy. Looking at the last parameters above – human intervention – could be determined as a risk mitigation factor.²¹⁷ The risk resulting from a

²¹⁶ *Ibid*, p. 12

²¹⁷ Recommendations of the Informal Meeting of Experts, *op.cit.* p. 4

predictability reduction of a weapon system may be affected by a few factors, like the weapon operational environment.²¹⁸

The outcome prediction in using autonomous weapon system will be difficult if the operation of its system is very complex (e.g., hardware, software algorithms, and sensors) and/or the system receives significant freedom to operate its function over time and space.²¹⁹ For example, assessment of the autonomous weapon's legality which enforced a task against a particular target in simple environment, in stable and limited in times of its operation, which included human operator's supervision with the possibility to intervene/override at all times (e.g. present missile and rocket defense system). It may be consider as an acceptable level of predictability, give a capability for human to ensure the compliance with IHL.²²⁰ Nevertheless, the outcome will be different if the autonomous weapon system carried out different tasks against multiple types of targets in a difficult environment, and it is operated for a long duration in a wide area.²²¹

Flexibility which increased in task over time and space would increase the possibility of uncertainty in regards to when and where attacks would be carried out, and the environment that encountered will be unpredictable.²²² The increase of complexity such as artificial intelligence-

²¹⁸ *Ibid.*

²¹⁹ *Ibid* ; Recommendations of the Informal Meeting of Experts, *op.cit*

²²⁰ *Ibid.*

²²¹ Recommendations of the Informal Meeting of Experts, *op.cit*

²²² Neil Davison, *op.cit*, p. 16

based technology which controls the system, the known system has the capability to set its own goals or to “learn” and adapt its functioning, would surely unpredictable, especially when it combined with an unpredictable and hostile environment.²²³

C. Accountability for Violation of International Humanitarian Law

Related to the previous discussion regarding autonomous weapon system, a question was raised about whether the use of such system may lead to legal accountability in situation of IHL violation. As long as the human involvement still exists in the decision to activate the weapon, accountability could be attributed. The responsibility may not always be clear if a weapon system has the nature of autonomy.²²⁴

Base on the rules of State Responsibility, state could be responsible for violation of IHL occurred by the use of autonomous weapons system, such as when the armed forces are committed a violation of IHL through the use of autonomous weapon system.²²⁵ A state would also be responsible for IHL violation if the test and review prior to deployment of autonomous weapon system are considered inadequate.²²⁶

Previous paragraph explained that a conduct of armed forces are become the responsible of the state, conduct of state’s organ and person are consider as an act of state if they empowered to enforce the elements

²²³ *Ibid.*

²²⁴ *Ibid.*

²²⁵ *Ibid.*

²²⁶ *Ibid.*

of governmental authority and act as in that capacity.²²⁷ Under Article 3 of the Hague Convention no IV²²⁸ and article 91 of Additional Protocol I of Geneva convention, a party to the hostilities must be responsible for whole action by person forming part of its military/armed forces.²²⁹ Explained in its commentary, International Law Commission (ILC) considers that international humanitarian law rules are the example of Draft article on Responsibility of States for Internationally Wrongful Acts, However ILC determines that international humanitarian law regulation as an exception for general rules of state responsibility, as a *lex specialis*.²³⁰

Under IHL and international criminal law, the limits of control and unpredictability of autonomous weapon system make a difficulty in finding the person who involved in the programming and deployment of

²²⁷ International Law Commission (ILC) article on Responsibility of state for Internationally Wrongful Acts [Article on Responsibility of State], art. 7. See also, Marco Sassòli, 2002, State Responsibility for Violations of International Humanitarian Law, IRRC June Vol.84 No.846, p. 405

²²⁸ Convention (IV) respecting the Laws and Customs of War on Land [Hague Convention No. IV] and its Annex: Regulations concerning the Laws and Customs of War on Land [Hague Regulations]

²²⁹ For the broad meaning of armed forces, art. 43 of Additional Protocol I explained that “(1) The armed forces of a Party to a conflict consist of all organized armed forces, groups and units which are under a command responsible to that Party for the conduct of its subordinates, even if that Party is represented by a government or an authority not recognized by an adverse Party. Such armed forces shall be subject to an internal disciplinary system which, inter alia, shall enforce compliance with the rules of international law applicable in armed conflict; (2) Members of the armed forces of a Party to a conflict (other than medical personnel and chaplains covered by Article 33 of the Third Convention) are combatants, that is to say, they have the right to participate directly in hostilities; (3) Whenever a Party to a conflict incorporates a paramilitary or armed law enforcement agency into its armed forces it shall so notify the other Parties to the conflict.”

²³⁰ United Nations, International Law Commission, *Report on the Work of its Fifty-third Session (23 April–1 June and 2 July–10 August 2001)*, General Assembly, Official Records, Fifty-fifth Session (A/56/10), <<http://www.un.org/law/ilc/reports/2001/2001report.htm>> p. 101 (para. 4 on Draft Art. 10). See also, International Law Commission, 1975, *Yearbook of the ILC 1975*, Vol. II, p. 69 (para. 26 on Draft Art. 10); Marco Sassòli, *op.cit.*

the weapon to hold liable for serious violation of IHL.²³¹ Programmers might not have a knowledge about the use of such weapon could create a violation of IHL, on other hand, programmers who intended to make an autonomous weapon which is likely to commit a war crime would be criminally liable.²³² Similarly, a commander would be liable for his/her decision to use autonomous weapon system in unlawful manner, for instance deploying an autonomous weapon system which is incapable to differentiate civilian from combatants in populated area. In addition, a commander with his/her consciousness activate and deploy the weapon system without knowing the prediction of weapon's performance and effects, might be held criminally liable for any serious IHL violations and deemed reckless under the circumstances for his/her decision.²³³

D. The Role of Human Control in Artificial Intelligence Weapon Technology

As explained above, the literature generally agrees that there are three types of artificial intelligence AI:²³⁴

- a. Artificial Narrow Intelligence (ANI or “narrow AI”)²³⁵: machine intelligence that equals or exceeds human intelligence for specific tasks. Existing examples of such systems would be IBM's Deep Blue

²³¹ Recommendations of the Informal Meeting of Experts, *op.cit.*, p. 5

²³² *Ibid.*

²³³ *Ibid.* See also, Neil Davison, *op.cit.*, p. 17; Rome Statute of The International Criminal Court, art. 8(2b)

²³⁴ Stephen Lucci and Danny Kopec, *Artificial Intelligence in the 21st Century: A Living Introduction*, *op.cit.*, p. 12. See also, Spegeleire, Maas, and Sweijs, *Op.cit.*, p. 30

²³⁵ Spegeleire, Maas, and Sweijs, *ibid.* See also. Ray Kurzweil, 2015, *Long Live AI*, http://www.forbes.com/home/free_forbes/2005/0815/030.html accessed at 2 January 2018

(Chess) & Watson ('Jeopardy!'), Google's AlphaGo (go), High-Frequency Trading Algorithms, or indeed any specialized automatic systems performing beyond human reach (e.g. Google Translate; spam filters; the guidance systems of point-defense anti-missile cannons etc.).

- b. Artificial General Intelligence (AGI or "strong AI"): machine intelligence meeting the full range of human performance across any task;
- c. Artificial Super intelligence (ASI): machine intelligence that exceeds human intelligence across any task.

In the second chapter, it has analyzed the compliance of IHL rules with present AI technology which is applied to assist in the armed forces. Present AI technology which applied in the armed forces are included within the level of artificial narrow Intelligence,²³⁶ by means that the performance of present AI is only limited to several functions such as to make an assessment to effect of a weapon (e.g. CDM); to analyze the target; and to create information about target-range (sensing).²³⁷ Those functions can be categorizes as a task which exceed human intelligence, however by functioning only in a particular task,²³⁸ it only determined as an artificial narrow intelligence.

²³⁶ *Ibid.*

²³⁷ For further explanation, see chapter 2 on the The use of Artificial Intelligence under General Principle of International Humanitarian law section

²³⁸ *Ibid.*

This section will analyze various weapon systems which could be categorized as Artificial General Intelligence (AGI) and/or Artificial Super Intelligence (ASI),²³⁹ both of these degrees are usually applied as a fully-autonomous weapon system²⁴⁰ because of the nature of these type of AI are the only technology which could satisfied the definition of fully-autonomous weapon system. By determining the various kind of artificial intelligence weapon or fully-autonomous weapon system, this section will make an assessment on human control, predictability, and accountability over the weapon system under IHL rules.

1. Artificial Intelligence Weapon Technologies

Artificial Intelligence is technology which is equipped by weapons or robot which is not new to the field of hostilities, but its developing function interferes to traditional responsibilities of human more than before.²⁴¹ Presently, performance of US predator, Reaper, and other drones in Afghanistan or another country has showed the early displacement of human soldiers.²⁴²

United States military policy documents, describe a plan to increase weapon system's autonomy, namely as "Unmanned Systems Integrated Roadmap FY 2011-20136", US Department of Defense stated that:

"Envisions unmanned systems seamlessly operating with manned system while gradually reducing the degree of human control and

²³⁹ *Ibid.*

²⁴⁰ For further explanation, see chapter 1 on background section

²⁴¹ Human right watch, *op.cit*, p. 6

²⁴² *Ibid.*

decision making required for the unmanned portion of the force structure.”²⁴³

2004 US Navy Document’s on unmanned undersea vehicles (UUVs) explained their plans to make a UUVs which is able to autonomously sense, track, identify, target, and destroy an enemy.²⁴⁴ Current unmanned weapon systems which still retains human in or on the loop²⁴⁵ potentially become the pioneer to fully autonomous weapons.

For example, South Korea and Israel have created and applied sentry robots which operate on the ground. South Korea SGR-1s can sense people with heat and motion sensors and inform it to command center, from the received information, human soldier can communicate with the detected person and make a decision to engage with various kind of weapon.²⁴⁶ Israel’s *Guardium*, which consider as semi-autonomous weapon system, patrolling Israel’s border, it is designed to perform a routine missions, such as patrols the border and autonomously react to unexpected event in compliance with it guidelines and it also has capability to execute the mission autonomously.²⁴⁷ Another example is US military’s SWARMS²⁴⁸ technology which involving autonomous aircraft, it controlled by operator as a group of “swarm” rather than individually, it was operated to gather

²⁴³ US Department of Defense, *Unmanned Systems Integrated Roadmap FY 2011-2036*, p.3

²⁴⁴ US Department of the Navy, 2004, *The Navy Unmanned Undersea Vehicle (UUV) Master Plan*, p. Xvii; *ibid*, p. 7

²⁴⁵ See p. 14

²⁴⁶ Jon Rabirot, 2010, *Machine Gun-Toting Robots Deployed on DMZ*, Stars and Stripes. < <http://www.stripes.com/news/pacific/korea/machine-gun-toting-robots-deployed-on-dmz-1.110809>> accessed 26 March 2018

²⁴⁷ G-NIUS Unmanned Ground System, 2012, *Guardium UGV*, p.2

²⁴⁸ SWARMS stand for Scalable sWarms of Autonomous Robots and Mobile Sensors. University of Pennsylvania, SWARMS. < <http://www.swarms.org/>> accessed 26 March 2018

intelligence,²⁴⁹ but in specific circumstances, it capable to undertake offensive operation.²⁵⁰

Above information arose a question, what are the relation between AI technology and autonomous weapon which explain above? An autonomous weapon system is artificial intelligence weapon which independently or autonomously²⁵¹ capable to make a decision to kill or attacks based on their programming.²⁵² However, the weapons which explained above are inadequate to describe as fully autonomous weapon system,²⁵³ the system which still has human control; capability to be overrides; and decision-making are made by human become the reason why it cannot satisfied the definition of “Fully Autonomous Weapon” and excluded from AGI and ASI.²⁵⁴ Nevertheless, weapon system above is possibly become a precursor of AGI and ASI weapon or the fully autonomous weapon system.

2. Human Control

As mentioned in the previous section, present autonomous weapon is operated under the supervision of human operator, it mean there still a

²⁴⁹ Boeing news release, 2012, *Boeing Team Demonstrate Expanded Control of Unmanned Aircraft Swarm*. <<http://boeing.mediaroom.com/index.php?s=43&item=2379>> accessed 26 March 2018

²⁵⁰ Defense Industry Daily, 2009, *SWARM Project: Swarming Drones to Sting the Enemy ?*, <<http://www.defenseindustrydaily.com/Swarming-Drones-Will-Be-Able-to-Sting-Enemy-05540/>> accessed 26 March 2018

²⁵¹ More explanation on chapter 1 in definition of terms section

²⁵² Guy-Warwick Evans, 2013, *Artificial Intelligence: Where We Came From, Where We Are Now, and Where We Are Going*, University of Victoria, Canada, p.

²⁵³ More explanation on chapter 1 in background section

²⁵⁴ Human Right Watch, *op.cit*, p. 1. See also, Stephen Lucci and Danny Kopec, *op.cit* ; Spegeleire, Maas, and Sweijs, *Op.cit*,

human control inside the operation of the weapon system. A question was raised about the roles of human control if the AGI, ASI, and/or the fully autonomous weapon system existed, whether human control is still needed to ensure the compliance of IHL rules. Assessment on the important roles of Human control will be divided into three levels, the first is development stage; the second is activation stage; and the third is the operation stage.²⁵⁵

In the development stage or during the development of autonomous weapon system, a developer has to ensure that the weapon has a program which capable of discriminate civilian from group of armed forces.²⁵⁶ It is one of important abilities that must be programmed to comply with IHL rules. Recent weapon system such as remote weapon system; missile; guns; and other weapons which already exist in present armed conflict is directly controlled by human.

Issue occurs in the development of the fully autonomous weapon or AGI and ASI weapon, the nature of their system is enable to exceeding human capability to think, learn, adapt, make a decision, and attack the target autonomously or independently.²⁵⁷ It means that human control or supervision are no longer needed. The development itself has advantages and disadvantages, by replacing a human soldier with a robot. It will ease the military forces to reach their military advantages and decrease the casualties in hostilities, however without a human control within the

²⁵⁵ Expert Meeting on Lethal Autonomous Weapon System, *op.cit*, p. 6

²⁵⁶ Additional Protocol I, *op.cit*, art. 51(4a)

²⁵⁷ Human Right Watch, *op.cit*, p. 1. See also Stephen Lucci and Danny Kopec, *op.cit* ; Spegeleire, Maas, and Sweijs, *Op.cit*,

system, possibility of civilian casualties will be more increasing than before and compliance of IHL rules will become uncertain.

In activation stages and operation stages, operator or commander has to make a legal determination over an activation based on circumstances at the time and space upon specific military objectives, verification on implementation of legal rules and direct military advantages also have to decide upon activation²⁵⁸ and ensuring the existence of capability to cancel or cease the operation.²⁵⁹ Specifically in activation stage, there are parameters which have to be applied, such as the time-frame operation and the possibility for human intervention and supervision to override or deactivate the system.²⁶⁰ Accordingly, human control is important in order to fulfill the obligations above.

In case of AGI and ASI weapon or fully autonomous weapon system, based on their nature²⁶¹ which excluded the role of human control in it system will make a problematic condition to ensuring the compliance of obligation above. In the present autonomous weapon system²⁶² within the activation and decision making stage, the weapon still needed a human assessment and supervision in order to comply with IHL rules. Violation of IHL rules will occur if in the operation and activation of AGI and ASI

²⁵⁸ Additional Protocol I, *op.cit.*, art. 51(5) and art. 57(2a. i&ii). See also, Article 36, *op.cit.*

²⁵⁹ Additional Protocol I, *ibid*, art 57(2b)

²⁶⁰ Neil Davison, *op.cit.*, p. 13. See also, Recommendations of the Informal Meeting of Experts, *op.cit.* p. 3

²⁶¹ Human Right Watch, *op.cit.*, p. 1. See also Stephen Lucci and Danny Kopec, *op.cit.* ; Spegeleire, Maas, and Sweijs, *Op.cit.*

²⁶² See Artificial Intelligence Weapon Technologies in chap. 3

weapon not based on operator authorization but based on their nature,²⁶³ it will try to reach military objectives without a legal determination, parameter of technical performance, and cannot be overridden, or it can be said as “justify any means and method to reach military objectives”.

3. Predictability

In order to comply with IHL rules, a commander or operator is obliged to predict the technical performance and environment of the weapon system.²⁶⁴ The estimation of whether an autonomous weapon system could comply with IHL rules depends on certain technical characteristics and performances.²⁶⁵

The prediction in using an autonomous weapon system which has a complex system will be difficult (e.g., hardware, software algorithms, and sensors) and/or the system has a freedom to operate its function over time and space.²⁶⁶ For example, verification of the autonomous weapon's legality which conducts a task against a specific target in a simple environment, in a stable and limited time of its operation, which included human operator's supervision with the possibility to intervene/override. It may determine an adequate level of predictability, give a capability for humans to ensure compliance with IHL.²⁶⁷ However, the result will be different if the autonomous weapon system performs different tasks

²⁶³ Human Rights Watch, *op.cit*, p. 1. See also, Stephen Lucci and Danny Kopec, *op.cit* ; Spegeleire, Maas, and Sweijs, *Op.cit*.

²⁶⁴ Neil Davison, *op.cit*, p. 15

²⁶⁵ Neil Davison, *ibid*, p. 16

²⁶⁶ *Ibid*, p. 15. See also, Recommendations of the Informal Meeting of Experts, *op.cit*

²⁶⁷ *Ibid*.

against multiple types of targets in a difficult environment, and it operate for a long duration in a wide area.²⁶⁸

Flexibility which increased in task over time and space will increase the possibility of uncertainty in regards to when and where attacks would be carried out, and the environment that encountered will be unpredictable.²⁶⁹ The increase of complexity such as AGI and ASI technology which control the system based on their nature²⁷⁰, the system which known has the capability to set its own goals or to “learn” and adapt its functioning, would surely unpredictable, especially when it combined with an unpredictable and hostile environment.²⁷¹

4. Accountability

As long as there is a human involvement in making decision in development, activation, and operation of a weapon system, an accountability of IHL violation will be certain. The responsibility may not always be clear if a weapon system operates with full autonomy capability.²⁷²

In IHL and international criminal law, restriction of control and unpredictability of autonomous weapon system make it difficult to determine the person who is involved in development and deployment of

²⁶⁸ Recommendations of the Informal Meeting of Experts, *op.cit*

²⁶⁹ Neil Davison, *op.cit*, p. 16

²⁷⁰ Human Right Watch, *op.cit*, p. 1. See also, Stephen Lucci and Danny Kopec, *op.cit* ; Spegeleire, Maas, and Sweijs, *Op.cit*,

²⁷¹ *Ibid.*

²⁷² Neil Davison, *op.cit*, p. 16

such system to be liable for serious violation of IHL.²⁷³ In case of AGI and ASI weapon, weapons which have become “sentient”, operate without any human involvement will raise a possibility for IHL violation. The violation can arise from the unforeseeable conduct of AGI and ASI weapon. It occurs because of their nature which autonomously and independently could “act” by their own. Therefore, it is hard to find a person to accountable for the violation.²⁷⁴

A developer or programmer which applies AGI and ASI to autonomous weapon can not take responsibility for individual criminal responsibility for the action of such weapon system. Generally, an activity of programmer only exists in the development stage of weapon system, which means it is only a preparation for the activation and operation of weapon system, an act of activation and operation are made by another person or organization.²⁷⁵ Therefore by not taking any part on the commission of weapon system which violated the law, a programmer cannot take any responsibility for the violation of weapon system which developed by them.²⁷⁶ However, if a programmer intentionally makes a weapon system for illegal purpose or taking a direct part in controlling a weapon system which commit an illegal activity, it might be appropriate

²⁷³ Recommendations of the Informal Meeting of Experts, *op.cit*, p. 5

²⁷⁴ Human Right Watch, 2015, *Mind the Gap : The Lack of Accountability For Killer Robots* <<https://www.hrw.org/report/2015/04/09/mind-gap/lack-accountability-killer-robots>> accessed 29 March 2018

²⁷⁵ Tim McFarland & Tim McCormack, 2014, *Mind the Gap : Can Developers of Autonomous Weapon be Liable for War Crimes ?*, 90 Int'l L.Stud. 361, U.S. Naval War College, p. 375-376

²⁷⁶ ICC, *op.cit*, art. 25 (3a)

for a developer to hold individual criminal liability for its commission to contribute in such crime which is done by a group of persons acting with common purpose²⁷⁷ and for facilitating and providing the means of illegal commission in operation of a weapon system.²⁷⁸

However, a commander who decides to launch AGI and ASI weapon, as any other weapon system, is accountable for that decision under international criminal law or developer who intends to build such machine that does not comply with IHL.²⁷⁹ An AI operation has several similarities with Cyber Operation – both of them use computer-based system – within cyber operation. A commander does not expect to have a deep knowledge regarding cyber operation, but they rely on their subordinate capability and knowledge. This situation does not make commander and other superior lose responsibility to exercise their control to subordinates.²⁸⁰ As a matter of law, commanders or other superiors are presumed to have same understanding as a reasonable commander in the operational context. In all condition, sufficiency of knowledge has to exist in order to fulfill their legal duty to act reasonably to identify, prevent, or to stop the creation of

²⁷⁷ *Ibid*, art. 25(3d)

²⁷⁸ *Ibid*, art. 25(3c)

²⁷⁹ Charles J. Dunlap, Jr., 2016, *Accountability and Autonomous Weapons: Much Ado About Nothing ?*, TEMPLE INT'L & COMP. L.J. 30.1.2016, USA, p. 68-69 ; Michael Schmitt, 2015, *Regulating Autonomous Weapon Might be Smarter Than Banning Them* < <https://www.justsecurity.org/25333/regulatingautonomous-weapons-smarter-banning/>> accessed 29 March 2018 ; Armin Krishnan, 2009, *KILLER ROBOTS : Legality and Ethicality of Autonomous Weapons*, ASHGATE, USA, p. 105

²⁸⁰ Charles J. Dunlap, Jr, *ibid*, p.70. See also, Michael N. Schmitt, 2013, *Tallin Manual on International Law Applicable to Cyber Warfare*, United Kingdom, Cambridge University Press, p. 193

cyber war crime.²⁸¹ Base on the previous explanation, similar procedures are also applied in autonomous weapon.

Liability for violation of IHL can be avoided by developers, commanders, operators and others who are involved in the creation of autonomous weapon. Like any other weapons, autonomous weapon system must be designed and tested to anticipate the violation of IHL in the future operation.²⁸² The review of weapon system before their deployment and operation has been already regulated in Additional Protocol I,²⁸³ ICRC interpreted the regulation which indicates that testing is included in review process for every weapon.²⁸⁴

Taking an example from United States, their Department of Defense (DoD) are demanding a standard in order to ensure that weapons are created and operated in proper manner :

“DoD policy establishes rigorous standards for system design, testing of hardware and software, and training of personnel on the proper use of autonomous and semi-autonomous systems. Among other things, the policy requires that military commanders use autonomous and semiautonomous weapon systems in a manner consistent with their design, testing, certification, operator training, and doctrine”.²⁸⁵

From this explanation, a nation is obligated to adhering the law by conduct a testing and examination of autonomous weapon system in order to receive information on how those weapon system works, and

²⁸¹ Charles J.Dunlap Jr., *ibid*. See also, Michael N Schmitt, *ibid*.

²⁸² Charles J.Dunlap Jr., *ibid*

²⁸³ Additional Protocol I, *op.cit*, art. 36

²⁸⁴ Charles J. Dunlap Jr, *op.cit*. See also, International Commission of the Red Cross(ICRC), 2006, *A guide to the Legal Review of New Weapons, Means and Method of Warfare: Measures to implement Article 36 of Additional Protocols of 1977*, 88 Int'l Rev. Red Cross, p. 52

²⁸⁵ United States Department of Defense, 2015, *Law of War Manual*, chap. 6.5.9.4. See also, US DoD Directive, Autonomoy in Weapon System, *op.cit*.

foreseeable consequences of their operation. The inexistence of due diligence, surely will create an inconsistent of their operation with IHL.²⁸⁶

In case of AGI and ASI weapon, a certain kind of test and examination have to be applied. It is in order to prevent the chaotic event raised by the unforeseeable conduct of those weapon in the future operation. AGI and ASI weapon surely has to be tested and examined before their deployment, a test and examination are compulsory considering the rules which obligates a state to review a weapon system before its deployment²⁸⁷ and the nature of AGI and ASI which autonomously capable to think, learn, adapt, and making decision to attack,²⁸⁸ those nature are increasing the possibility of unforeseeable conducts happen in future operation of AGI and ASI weapon.

The accountability of IHL violation arises from an unforeseeable event which is conducted by AGI and ASI will be accountable to the commanders or other superiors. Commander is expected to have an understanding of to the operation of weapon system and an unforeseeable event generally will never exist if the weapon system already tested and examined, which mean an unforeseeable event will become foreseeable during the review²⁸⁹ of the weapon system itself. Failing to adhered a weapon system with IHL and other international law will cause an

²⁸⁶ Charles J. Dunlap Jr, *op.cit.*

²⁸⁷ Additional Protocol I, *op.cit.*

²⁸⁸ Human Right Watch, *op.cit*, p. 1. See also, Stephen Lucci and Danny Kopec, *op.cit* ; Spegeleire, Maas, and Sweijs, *Op.cit*,

²⁸⁹ Additional Protocol I, *op.cit.*

inconsistency to law of war and a commander or other superior, subordinates, and developer which are included in development, deployment, operation of autonomous weapon will responsible if their intention is to deploy and operate a weapon system which cannot comply with IHL or a weapon system which is not yet to being reviewed.²⁹⁰

Therefore, a future autonomous weapon system which applies more sophisticated artificial intelligence are needed to be reviewed by human, including in its development, activation, operation stages.²⁹¹ Aside from the obligation to review a weapon before its deployment, a clear liability or responsibility toward a violation of IHL which is done by an autonomous weapon system are needed to be establish in a specific regulation. It is objectively to make a certainty on legal responsibility on a violation of such system.

²⁹⁰ *Ibid.*

²⁹¹ Additional Protocol I, *Op.cit*, art. 36

CHAPTER IV

CLOSING REMARKS

A. Conclusion

Finally, after the analysis from the research, it can be concluded that:

1. Based on its characteristic, artificial intelligence has three categories; artificial narrow intelligence (ANI); artificial general intelligence (AGI); and artificial super intelligence (ASI).²⁹² Although artificial intelligence sounds like a new kind of technologies in weapons system, while in reality, it has been used by the military forces in their remote weapon system and semi-autonomous weapon system. Present semi-autonomous weapon which applies artificial intelligence in their operation only utilize the technology to ease their operation, not implemented as the “brain” of weapon system. For instance, artificial intelligences are used to assist the drone with their technology to detect enemy through various kind of sensing; the capability of drone to ‘autonomously’ return to base; and to make an estimation of collateral damage which unleash by the weapon system (CDM). Above examples are artificial intelligences which are considered as ANI, which means they only have a capability to do a specific task; and their operation in autonomous weapon system does not violate general principle of

²⁹² Stephen Lucci and Danny Kopec, *op.cit*, p. 12 ; Spegeleire, Maas, and Sweijs, *Op.cit*, p. 30; see chap. 2.

international humanitarian law. As explained before, present operation of weapon system which involves artificial intelligence is not intended to violate international humanitarian law, like CDM involvement in drone operation, it used to make an estimation of collateral damage raising from a weapon system. The attacks, therefore, do not violate any general principle of international humanitarian law.

2. The importance of human control in the operation of autonomous weapon system, specifically in AGI and ASI weapon or called as fully autonomous weapon system which does not involve human in their operation. Human control applied in the development stage, activation stage, and operation stage of the weapon system, the existence of human control are to ensure predictability within weapon system operation and to ensure the accountability in case of international humanitarian law violation inside the weapon system operation. AGI and ASI weapon which are known by their 'human-free' system predicted to cause a problem in the future. These weapons are obliged to be reviewed. This is in compliance with article 36 of additional protocol I. The review occurs in 3 stage which mention above; development stage, activation stage, and operation stage. Accountability are needed to know the person who should liable in violation of international law within weapon system operation; in case of AGI and ASI weapon system, their operation are possibly can be

accountable to commander, developer, or/and states which deployed the weapon system.

According to these information, present artificial intelligence which is used in autonomous weapon system are not violating the general principle international humanitarian law. It was used to ease and help the armed forces to ease and reach the legality of autonomous weapon system operation, however a problematic matter are occur in the formulation of fully autonomous weapon system which applied more sophisticated artificial intelligence in their system, developers ought to determine the technical operation and impact of these weapon will comply with international humanitarian law, to realize that obligation, human control are become compulsory inside this weapon to make an unforeseeable event that would occur from this weapon become foreseeable, therefore a violation to international humanitarian law could be anticipated.

B. Recommendation

- a. In establishing ASI or AGI weapon system or fully autonomous weapon system, International Humanitarian Law provision has to be involved, since this weapon will mostly operate in armed conflict. Therefore, the means and method of this weapon have to fullfil the provision of general principle of international humanitarian law
- b. Although this weapon will operate autonomously or without any kind of human intervention, human control should be exist in all stage of weapon

system establishment (development, activation, and operation) to ensure the predictability and accountability over weapon system operation.

- c. The existence of human control is important to fulfilled the obligation which exist in international humanitarian law. Human control exists to review the weapon system before it operates. The review is to ensure that weapon system has a capability to adhering international humanitarian law provisions.
- d. Predictability is important to help the commander makes decision on the deployment of weapon system, if the effects and technical performance of weapon system is predicted, a commander will have a knowledge regarding the legality of weapon system activation and deployment.
- e. Accountability is needed to know the person who should be liable in violation of international law within weapon system operation. In case of AGI and ASI weapon system, their operation can be possibly accountable to commander, developer, or/and states which deployed the weapon system, since their development and deployment under the authorization of commander.
- f. An effort can also be done from the international organization which related to this matter. A proactive action is to avoid the violation needs to be taken. Semi or fully autonomous weapon are need to be regulated in specific provision – since the regulation relating to these weapon systems are not yet to be regulated – including the procedure to develop, activate, and operate the weapon system which can be complied to international

humanitarian law. Thus, the existence and the operation can be limited in a particular action and their operation will be considered as legal before international humanitarian law.

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