

## **Killer Robots! Public and private sector responsibilities in addressing ethical implications of technological innovation**

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### **ABSTRACT**

Lethal autonomous weapon systems (LAWS), sometimes referred to as killer robots, are an emerging technology receiving increased attention in the media. Even as business leaders, activist groups, and policy makers struggle with the ethical and legal implications of lethal autonomous weapons, research and development of the component technology is advancing rapidly. In many cases, the technology which could be applied in killer robots, also has numerous non-violent commercial applications. This case explores the challenges faced by private and public sector actors regarding killer robots with an emphasis on the need to balance the concerns of various stakeholder groups.

Keywords: Business ethics; stakeholders; public policy; technology; weapons and warfare

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## INTRODUCTION

The relationship between business ethics and technology has always been a complex one. On the one hand, technological innovation plays a critical role in economic development and in addressing grand challenges faced by modern society - including poverty alleviation, public health issues, clean energy, and climate change adaptation. On the other hand, business innovators and inventors are often more concerned with pushing the technological boundaries and seeing what is possible than with anticipating and analyzing the social and ethical implications of their inventions. Additionally, while some of the ethical implications of technological advancements may be reasonably foreseeable, other implications may be difficult to predict. For these reasons, society is often left wrestling with the ethical implications of new technologies after they have emerged in the marketplace and begun to impact our lives.

This case is designed to elicit a timely discussion about an emergent technology, its potential ethical implications, and the roles and responsibilities of public and private sector actors. Specifically, this case explores lethal autonomous weapons systems - colloquially referred to as “killer robots” and the organizations and stakeholder groups seeking to balance the military and commercial potential of such technology with social, legal, and ethical concerns. This case can be used in conjunction with a screening of the “Slaughterbots” video, created by artificial intelligence expert, Dr. Stuart Russell of the University of California at Berkeley.<sup>1</sup> The short video provides a powerful illustration of the type of not-so-distant future toward which opponents of killer robots fear we are headed. Video link: <https://www.youtube.com/watch?v=9CO6M2HsoIA>

### Lethal Autonomous Weapons Systems (LAWS)

Although there is no legally or militarily agreed upon definition for lethal autonomous weapon systems (LAWS), the International Committee of the Red Cross has suggested that “autonomous weapon systems is an umbrella term encompassing any weapon system that has autonomy in the critical functions of selecting and attacking targets” (International Committee of the Red Cross, 2016). Such weapon systems can be classified as lethal when they are capable of exerting deadly force. The proposed definition is purposefully broad enough to include some weapons currently in use and to facilitate conversation and debate about what features might separate acceptable versus unacceptable types and applications of autonomous weapon systems.

There are some examples of autonomous or semi-autonomous weapons currently in military use. These include modern anti-aircraft guns, guided missiles - sometimes called homing missiles, stationary sentry guns such as the SEII, and various unmanned aerial vehicles (UAVs) commonly referred to as drones. Modern anti-aircraft guns can be used on land or mounted on naval ships. These weapons are primarily used defensively by detecting incoming missiles and eliminating them. Examples include BAE Systems’ 155mm Advanced Gun System (AGS) which has a fully automated ammunition handling and storage system and fires warheads equipped with GPS and inertial positioning systems and the Mk46 which is remotely controlled and equipped with thermal day/night sighting systems (Sea Power, 2018). Guided missiles, while not fully autonomous, are capable of finding and tracking targets in an autonomous manner (Buntinx, 2017). Sentry guns are able to lock on to and eliminate a target completely on their own and are

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<sup>1</sup> Sincerest thanks to Dr. Russell for granting permission to include his video in this case.

mostly used to defend a base or other specific geographic area such as the Demilitarized Zone (DMZ) between South and North Korea. The SEII, made by DoDaam Systems, currently in use in the DMZ is an unmanned, autonomous sentry gun capable of detecting, locking onto, and firing on a human target up to 3 kilometers away using color and thermal cameras and a laser range finder (Tarantola, 2012). UAVs include a variety of self-flying systems used for surveillance, reconnaissance, intelligence, or strike purposes (Gertler, 2012). Among the most well-known UAVs are the Predator®-series drones which have clocked over five million flight hours as of April 2018 (General Atomics, 2018). These UAVs are able to locate and identify enemy points of operation but must receive the command to attack from a human operator located at mission command. This is important given that much of the current debate around defining and regulating killer robots focuses on the degree of autonomy the weapon system possesses and whether or not a human ultimately makes the decision to use lethal force.

With the exception of UAVs (particularly those used to strike targets), current military applications of these autonomous weapon systems have not resulted in widespread controversy. Nonetheless, rapid advances in technology and public awareness efforts headed by concerned business leaders such as Elon Musk and activist groups such as the Campaign to Stop Killer Robots are generating considerable interest and controversy regarding the types of LAWS on the horizon. Currently, the Perdix drones undergoing testing by the United States Department of Defense (DoD) represent one of the most significant known advances in autonomous operation but are not designed to conduct lethal strikes. Perdix drones are comparatively tiny and inexpensive drones capable of fully autonomous operation and equipped with swarm intelligence which allows them to maintain autonomous and adaptive operation even in a complex battlefield situation (Walker, 2017). With individual units automatically positioning themselves in response to dynamic conditions, a swarm of Perdix drones could provide full coverage surveillance of a battle area and could jam enemy communications (Walker, 2017).

Developing a shared understanding of what defines lethal autonomous weapons systems and consensus regarding acceptable versus unacceptable applications of such technology will be an important step in discussing and potentially regulating killer robots. The lack of a formal definition can make it difficult to make regulations regarding the research, development, and production of a technology that is broad and hard to categorize. In the meantime, the technology for killer robots continues to advance through efforts of military agencies, academic researchers, large corporations, entrepreneurs, and even clandestine organizations. Additionally, public awareness of the potential threat of killer robots is growing. In November 2017 the activist group Campaign to Stop Killer Robots screened the “Slaughterbots” video for delegates of the U.N.’s Convention on Conventional Weapons (Campaign to Stop Killer Robots, 2017a). The release of the video led to a flurry of global media reporting about the issue of killer robots, and just six months from being posted the video had been viewed over 3 million times on YouTube.

## **ROLES AND RESPONSIBILITIES OF PUBLIC AND PRIVATE SECTOR ACTORS**

Various types of organizations will need to act in order to address the killer robot challenge. Each of these types of organizations has the potential to make a unique contribution to addressing the issue, but they also each face unique challenges and constraints which may hamper their abilities to act. We will discuss the roles which supra-governmental agencies such as the United Nations, national governments, non-state actors, and businesses might play in shaping policies and practices regarding killer robots.

## The United Nations

When the United Nations was founded in 1945 the founding 51 Member States declared its first purpose, “To maintain international peace and security, and to that end: to take effective collective measures for the prevention and removal of threats to the peace” (United Nations, n.d.). Since its initial founding, the U.N. has grown to a total of 193 Member States who have committed to stand for this purpose, along with the others stated in the organization's charter. Although it is inspiring for this many nations to come together to work toward such a noble goal, forming and implementing international policies, as well as creating effective enforcement mechanisms has proven to be difficult. Even though Member State representatives are meant to function as a unit in the United Nations, each State still has its own nation's beliefs and well-being to consider.

The U.N. began hosting talks about killer robots in 2014 with Meetings of Experts convened in 2014, 2015, and 2016 to discuss questions related to the emergence of LAWS (United Nations, n.d.). In November 2017 the U.N. held a formal meeting of the Convention on Conventional Weapons (CCW) to discuss potential regulation of LAWS. The CCW operates by consensus, and thus far, opposition of a formal ban by member nations such as Israel and Russia, as well as reluctance from the United States has impacted progress (Miles, 2018). Historically, the group has moved forward with some regulations and treaties even in the absence of full international support. For example, a treaty banning the production, use, stockpiling, and transfer of landmines was adopted in 1997 and currently has over 150 signatory nations, but the United States and Russia are not among them (UNODA, n.d.). While this approach has been adequate in the past, it is possible that the international community may be reluctant to pursue a ban on killer robots without the support of major military powers. In sum, disagreements amongst the Member States and the inherent sluggishness of international bureaucracy have thus far prevented the U.N. from taking decisive action in the killer robot arena.

## National Governments

In relation killer robots, some of the disagreements between U.N. Member States center on rhetorical and technical details in drafts of potential regulations. For example, some countries are arguing in favor of explicit distinctions between “use” and “misuse” of such technologies or for exemptions for “peaceful uses” while other countries argue that such distinctions are implicit an unnecessary (Acheso 2017). Other disagreements reflect more substantial military, economic, and ideological differences between countries which believe killer robots should be banned and those who do not currently support such a ban.

There is a general consensus amongst the countries advocating for a ban on killer robots that a human should maintain ultimate control of any lethal weapon system. As of April 2018 twenty two countries, including Uganda, Mexico, Ghana, Cuba, and Zimbabwe support a ban on killer robots (Campaign to Stop Killer Robots, 2017a). Pakistan was the first country to formally support a ban on killer robots and is still the only nuclear power to do so (Campaign to Stop Killer Robots, 2017b). The countries currently in favor of a ban on killer robots are generally not major military powers or technological leaders, but in standing together they hope to gather more like-minded countries to their cause and facilitate international regulations regarding LAWS.

Among the countries that do not formally support an international ban on killer robots, there are a variety of positions. For example, the United Kingdom has a national ban on such

technology but has not yet staked a position in favor of an international ban (Caughill, 2017). The United States has claimed that such a ban would be premature until consensus is reached regarding the defining features of LAWS and acceptable versus unacceptable uses. Additionally, the United States military currently claims that its Perdix drones are at the forefront of autonomous weapon system development (Walker, 2017). Israel also has highly advanced technology and defense sectors and is believed to be the world's largest exporter of UAVs (Walker, 2017). Israel is also a leader in anti-drone countermeasures and has stated that they do not currently support a ban on killer robots. Russia not only opposes a ban on killer robots but has explicitly stated that it will continue to develop and build LAWS regardless of any policy the U.N. adopts (Hutchison, 2017). Russia has claimed that such laws would restrict the growth of humankind and that "the lack of working samples of such weapons systems remains the main problem in the discussion on LAWS" (Hutchison, 2017).

Regardless of various governments' official stances on restrictions or bans on killer robots, both military and private experts agree that the potential for such technology to be developed and deployed by enemy states or non-state actors, such as terror organizations or rebel groups, poses a serious risk to national security (Horton, 2018). In fact, many countries are already working on increasingly sophisticated countermeasures in anticipation of increasingly sophisticated autonomous weapon systems. The threat of being outcompeted by another country or militant group is currently driving capable countries to develop the technology lest they fall behind in this new arms race and face the risk of being put at a disadvantage.

### **Non-State Actors**

Another important group to consider outside of national and international governments is non-state actors, such as rebel and terrorist groups. On the one hand, LAWS could be used to target and strike members of these groups with negligible collateral damage or loss of innocent lives. This is something with which even some of the most highly trained soldiers in our world can struggle. In May 2011 US Navy Seals raid of Osama bin Laden's compound in Abbottabad, Pakistan the Seals successfully carried out their mission to kill Osama bin Laden, but they also killed 3 other men and one woman in the process (CNN, 2018). On the other hand, producing and using LAWS could make it easier for insurgent groups to use them for their own agendas.

Rebels, terrorists and even criminal groups are already taking advantage of the rapid and widespread development and accessibility of such technology. Law enforcement agents recently reported that a criminal organization used drones to disrupt FBI operations during a hostage situation in December of 2017. The criminals used drones to provide surveillance of FBI operations outside to those holding hostages inside and also used the drones to disorient FBI agents by flying high-speed low passes where agents were positioned (Tucker, 2018). Criminal organizations have also used drone surveillance of police departments, port facilities, and courthouses to monitor law enforcement operations and identify and intimidate witnesses and informants. Drones have also provided a relatively cheap and low-risk means of smuggling contraband into prisons and across borders (Rigg, 2018).

In Syria a group of rebels recently used a basic compilation of technologies to launch a sophisticated drone attack on the Russian army based at Khmeimim and the Russian naval base at Tartus. The group in Syria used small gas engines, laminated Styrofoam, packed bombs and shrapnel to the wings of drones, included barometric sensors, a leveling system and GPS to take these armed drones to a preselected target that could have been damaged if the Russian military

had not intercepted them (Horton, 2018). This example illustrates the ease that current technology and basic resources allow in building weapons that do not need human control.

The ability to carry out targeted attacks without a human present could change the method of operation for insurgents and terrorist groups. Currently, these groups often depend on individuals carrying out attacks where the high likelihood of death is anticipated from the beginning. Relatively few people have the dedication required to carry out these suicide attacks. However, if an individual could send a killer robot to carry out an attack and keep his or her life, this could impact the incidence of terrorist attacks. Some warn that technological advancement with drones has, “the potential to usher in a golden age for terrorists and militants” (Horton, 2018). It is important to include this kind of analysis when considering developing and regulating killer robots because the spread of technology and ease of replication, mean that no one entity will be able to keep LAWS exclusive.

## **Businesses**

While national and international regulators have been resistant to or slow to enact regulations related to killer robots, the technology on which such devices could be based continues to develop at a phenomenal pace with both private businesses and publicly funded research programs playing key roles. While some of this research and development is being conducted explicitly for military or defense purposes, many businesses have other, less nefarious, applications in mind. Many of the foundational technologies which could be used in killer robots, such as artificial intelligence, machine learning, facial recognition, individual tracking, and autonomous navigation, have a wide variety of potential applications. For example, the 2019 Subaru Forester, unveiled at the New York International Auto Show features optional facial recognition technology which can recognize up to five different drivers and automatically adjust the seat and mirrors for each driver. The technology can also detect drivers who are distracted or sleepy (Lyon, 2018). Skydio, a startup company founded in 2014, has developed a self-flying drone which can navigate around obstacles at up to 25 miles per hour while following a human target and recording video. The Skydio drone is now commercially available for \$2499 and is marketed toward sports and outdoor enthusiasts (Matney, 2018).

The far-ranging commercial applications of such technologies ensure that numerous businesses will continue working to advance research and development in these areas. However, many business leaders have become increasingly concerned over the potential for such technology to be weaponized in killer robots. Elon Musk, the well-known founder of Tesla Motors, SpaceX, and the Boring Company, has been particularly outspoken about the myriad of threats artificial intelligence and robots could pose to society. In the documentary “Do You Trust this Computer” Musk raises the possibility that AI developed by an authoritarian regime could outlive its creators becoming an immortal dictator from which citizens could not escape (Wagstaff, 2018). While Musk has been one of the most vocal critics of AI in the business world, he is certainly not alone. In 2017 CEOs and leaders from 100 organizations from 29 countries signed an open letter to the U.N. CCW supporting a ban on killer robots (Walsh, 2018). Not surprisingly, many of the business leaders who signed the letter lead organizations which are at the forefront of research and development into technologies which could be used in killer robots. For example Swarm Technology has developed and patented a swarm intelligence system called Solidarity Cell Architecture which enables scalable distributed computing, purpose-based automation, dynamic adaptability, and collective intelligence (Swarm Technology, n.d.).

Infinium, based in Singapore, has developed a fully autonomous aerial drone designed for taking stock of inventory inside warehouses (Infinium Robotics, n.d.), and the company even experimented with a drone designed to serve food and drinks in restaurants (Balea, 2017). These companies are focused on commercial applications of their technologies, but concerns about the ease with which such technology could be weaponized is at the heart of the killer robot debate.

It is likely that the leaders of businesses engaged in developing these technologies have practical as well as moral reasons to take a stance against killer robots. From a practical standpoint, these business leaders likely recognize that heightened public concern about lethal applications of the technologies they are developing could damage their firms' reputations and relationships with customers and other stakeholders. Activist groups, such as the Campaign to Stop Killer Robots have gained increased media attention and raised public awareness about killer robots, enhancing the likelihood that companies working in artificial intelligence, robotics, and related areas will face pressure from various stakeholders. In fact, some companies are already facing pressure from employees, investors, business partners, and activists.

Recently, over 3,100 Google employees - including dozens of senior engineers - signed a letter urging the company's leaders to cease work on a Department of Defense project titled Project Maven (Shane & Wakabayashi, 2018). The project is designed to help the military integrate cutting-edge artificial intelligence and imagery recognition technology into defense applications. Google's leaders stated that they welcome this type of internal dialogue with their employees but gave no indication that they plan to cease work with the Department of Defense (Spektor, 2018). Meanwhile, other major tech companies such as Amazon and Microsoft have managed to avoid widespread employee dissent despite having ongoing projects with the Department of Defense (Shane & Wakabayashi, 2018).

Bank of America has partnered with Harvard University's Belfer Center for Science and International Affairs to form the Council on the Responsible Use of Artificial Intelligence (Crosman, 2018). Bank of America is providing foundational funding for the program which will also involve researchers from Massachusetts Institute of Technology (MIT) and which will seek to understand and articulate the social, economic, and ethical implications of AI (Crosman, 2018). Bank of America has also announced that they will stop lending to companies which make military-style guns for sale to civilians (Keller & Mosendz, 2018). While assault rifles and killer robots are not the same, the fact that Bank of America's leaders have indicated concerns over the implications of AI and an aversion to funding companies that make military-style weapons for civilians raises the possibility that banks and investors may exert pressure on, or withdraw support from, companies engaged in developing killer robot technology.

Businesses and other organizations may also face pressure from business partners. For example, over fifty leading academic researchers from around the world signed a letter calling for a boycott of a South Korean University, Korea Advanced Institute of Science and Technology (KAIST), and defense manufacturer Hanwha Systems. The researchers claim that the collaboration between KAIST and Hanwha will speed up the global arms race to develop LAWS and have pledged not to collaborate with or host researchers from KAIST unless the program is discontinued (Haas, 2018). In 2017, Alphabet sold two robotics companies they had previously acquired including Boston Dynamics - a company famous for videos of its robots like Big Dog and Atlas - to SoftBank, a diversified Japanese firm with a strong presence in robotics (Statt, 2017). At the time, some analysts suggested that Alphabet's desire to sell Boston Dynamics was at least partly motivated by concerns that the robotic company was overly focused on military applications and that this was not a good fit for Alphabet (Dillet, 2018). Chip

manufacturer, Nvidia, distanced itself from Uber following a fatal accident involving one of their self-driving cars (Korosec, 2018). Although self-driving cars are not being designed as weapons, this incident further illustrates the reluctance companies may have about working with businesses that are developing potentially lethal technologies.

## **CONCLUSION**

Killer robots are a relatively new issue, and society has not yet fully come to terms with the potential applications and concerns associated with this technology. Activist groups like the Campaign to Stop Killer Robots hope to shape public opinion about LAWS and increase the likelihood that companies developing and producing LAWS will face public criticism and consumer activism. These issues may impact not only companies explicitly developing military applications of technology but even companies who are developing related technology for a variety of non-military commercial applications. In sum, businesses developing technology and applications potentially related to killer robots will need to balance commercial interests with moral values and a variety of stakeholder interests.

## **DISCUSSION QUESTIONS & IN-CLASS ACTIVITY**

### **Discussion Questions**

- 1) Are killer robots fundamentally different from other types of weapons including long-range rifles and assault rifles? Why or why not? What are the ethical and legal implications of your answer?
- 2) From a military perspective, what are the advantages and disadvantages of killer robots? From a civilian perspective, what are the advantages and disadvantages of killer robots?
- 3) Internationally, compliance with restrictions on the development of nuclear weapon systems has been relatively easy to monitor due to the scarce resources, large amount of capital, specialized facilities, and expertise needed to develop such weapons. The component technology involved in developing killer robots is relatively basic and readily available and many open-source AI and robotics platforms exist. What are the implications of this for those who might seek to ban or regulate killer robots?

### **Role Play Discussion Activity**

1. You are a prominent tech business leader. You believe that LAWS technology can be beneficial to the military and to society and should be pursued by businesses for profit. What different challenges could you face from investors and other stakeholders? Justify your position in favor of LAWS technology and develop responses to the anticipated concerns and challenges from stakeholders.
2. You are a prominent tech business leader and while you believe LAWS technology could be profitable, you believe that the ethical and legal concerns posed by such technology outweigh the benefits and do not believe your company should engage in the development or production of LAWS. State the main concerns you have regarding the ethical and legal issues related to LAWS. Are there stakeholders who may try to convince

you to change your position and begin working on LAWS projects? What arguments might these stakeholders make, and how would you respond?

3. You represent the civilian consumer. What characteristics or market segments make up the potential consumers for LAWS, or technology that could be converted into a lethal autonomous weapon (drones etc.)? What applications would you be interested in using the technology for? What are your responsibilities when using such a product? What product features or company characteristics will influence your purchasing decisions?
4. You represent a current employee at a tech business that is considering or in the process of developing LAWS technology. What impact might this have on your feelings about your company or your company's culture overall? Should a company consider its employees beliefs and feelings before getting involved in this kind of technology?
5. You represent an investor in tech businesses. Does a company's willingness to pursue LAWS attract or detract you to invest in it? Why or why not? Do you, or should you consider ethical implications when making your investment decision?



## TEACHING NOTES

This case relates to issues and events which continue to unfold. Frequent releases of additional news and information about relevant technological advances, various stakeholder concerns and activities, and regulatory discussions are likely to continue as businesses and societies wrestle with issues related to LAWS. This case highlights many of the key stakeholder positions related to LAWS and provides a foundation for discussion which can be supplemented with current events and developments occurring when the case is presented. Professors using this case may gather relevant current news items themselves or have students research recent developments related to this topic.

This case, minus the teaching notes, is designed to be read by students and can be used in both face-to-face and online course settings. In a face-to-face course, the case should be read before or during class in order to facilitate an engaging discussion during class. The discussion questions can be used for in-class discussion or given as a written assignment. Professors may wish to development additional discussion questions based on current events or on the topics most relevant to their courses. The role play activity is ideal for an in-class group activity but could also be completed individually or used as a written assignment. For an in-class group activity, students should be divided into small groups with each group assigned one of the roles presented. The groups should be given approximately 10 minutes to discuss their position and prepare to present their perspective to the class. Multiple groups can be assigned each of the roles. The role play activity could also be used as the basis for in-class debates. In an online course, students can provide written responses to the discussion questions or role-play activity. Discussion boards or other interactive forums can be used to facilitate discussion and debate.

Responses to the discussion questions and activities should be evaluated based on how comprehensively students understand the issues and the concerns of various stakeholders. Ideally, both positive and negative perspectives should be discussed. The professor or person leading the case discussion should be prepared to play devil's advocate in order to facilitate a balanced discussion. There are a few topics which were purposefully left out of the case with the hope that they would arise during discussion of the case. The first of these is the possibility that LAWS could be hacked. This raises the possibility that hostile actors could commandeer weapons and use them for their own purposes - perhaps even causing them to target their original owners. Another issue which is not raised in the written case, but which is presented in the "Slaughterbots" video, is the possibility for LAWS to be used to commit genocide or otherwise target entire groups of people. For example, instead of being programmed to target specific enemies, LAWS could be programmed to target anyone wearing a hijab or anyone with certain characteristics like a particular skin color or facial features. Finally, while much of the discussion about killer robots focuses on explosive and projectile weapons, it is worth noting that LAWS could also be used to engage in chemical or biological attacks. Additional ethical, social, and legal implications raised by this possibility may be worth discussing.

This case can be used on its own or as a hybrid video/text case by screening or assigning the "Slaughterbots" video discussed in the introduction. The video is just under 8 minutes and can be watched in class or online. The video focuses on the dark side of LAWS and provides a powerful illustration of some of the issues raised by such technology. Used in conjunction with this case and the discussion questions and activities it can be part of an engaging and balanced discussion about an important topic facing businesses, governments, and societies.

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