BRIEFING NOTES

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DUAL USE TECHNOLOGY

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SUMMARY

- "Dual use technology" refers to application of technology both in civilian and military targets. State actors such as national governments or non-state actors such as criminals and terrorists could cause harm by misuse of dual technology in malicious manners.
- It is important to distinguish between different categories of dual use to be aware of the potential threat and address how they should be regulated.
- Different measures have been taken to reduce dual technologies risks and threats such as preventing dual use technology development in sensitive applications, supervising gain access to artefacts, data and information related to dual use technology and providing safe and secure application of dual use technology.
- Dual use can be categorized into groups of research, technologies and artefacts. It is important to distinguish between different dual use categories in order to manage each group.
- These research results will directly impact the technology development and can have positive or negative consequences and implications.
- Fundamental ethical issues that one may be tackling with lethal autonomous weapons represent as an example of dual use technology presented here.
- The importance of human control over automatic military technologies should be considered as part of the policy framework.

CONTEXT

- Dual use technologies refer to technologies with civilian and military use. There are three concepts which are included in definition of dual use: research, technology and artefacts. These three items need regulation so that scientists, engineers and authorities can be aware of their responsibilities. National Research Council of Canada (NRC) defines dual use technology as "In the language of arms control and disarmament, dual use refers to technologies intended for civilian application that can also be used for military purposes.''
- European Commission (EC) defines dual use as "items, including software and technology, which can be used for both civil and military purposes". The U.S. government's Code of Federal Regulations expressed dual use as "items that can be used both in military and other strategic uses . . . and commercial applications"
- Dual use can be defined as an element (knowledge, technology, artefact) which has high risk that it can be used in weapon design or production and if a great threat exist that the item is utilized in devising weapons that can be intended or unintended. There are several major challenges in dual use technologies when it goes to restricting weapons spread and avoiding civilian goods from being misused.
- End-user agreements for many goods are required to check how they will be utilized but this can be faked and even weakly supervised. The dual use trade has quite significant

profits for states, therefore it is costly for states to restrict such trades. It is possible to hide transfer of dual use goods by intending them to make profits for civilian programs or giving the fake look of this intention.

🞣 "Duality" concept tries to overcome the problem of understanding the relationship between military and civilian R&D. Dual use methodology proposes that some military products can be utilized for civilian purposes and vice versa. It can be assumed that military goods can be produced in commercial industrial units and on the other hand military advanced technologies can be employed to improve and produce commercial goods.

🞣 Dual use strategy should lead to improved productivity and efficiency in armed forces, as well as effectiveness in the commercial industry with the minimum level of R&D spending.

🞣 It should be considered that implementing dual use strategy may lead to problems such as matching the cost and quality standards needed in high tech commercial domains and military products.

🞣 Military finds it difficult to use commercial products without reforming the overall system with regards to military procurement rules and specifications. Since there are technologies that are used both in commercial and military industries the procedure of promote technology transfer becomes challenging.

🞣 The usage of the "dual use technology" term has become promoted since technology transfer mechanisms have been introduced. Primary definition of the dual use technology refers to technologies with applications in normally used civilian purposes that have also applications in military.

🞣 Different moral and ethical questions arise that should be taken into consideration. Research institutions face problems of overseeing activities on dual use technology need to conduct codes and how to enforce codes on members. Publishers need to develop screening mechanisms and decide on publishing sensitive material. Governments need to impose restrictions on dual use research and technology.

🞣 Decision maker at each level face ethical concerns about freedom in technology development for social benefits versus the security issues. The consequences of dual use technology development in chemical, nuclear and cyber sciences must morally and legally be supervised at national and international levels.

🞣 The artefacts represent materials and components that are used in different fields rather than primary usage purposes. For example, Ammonium nitrate is an artefact that has dual use purpose as a fertilizer or as an ingredient in bomb making. Australia and Saudi Arabia have laws for Ammonium nitrate supply due to the bomb-making purposes.

🞣 Dual use technology can then be defined as a knowledge, technology or artefact that has a high risk to contribute in producing or designing a lethal weapon.

🞣 A growing presence of robots in warfare cause many risks and concerns where legal and ethical issues are raised by them. Basic definition of 'robot' is an engineered device with the ability of sensing, thinking and acting.

- For example, US Air Force's Predator which is an Unmanned Aerial Vehicle (UAV) in some cases can make directional decision by itself and has a degree of autonomy, hence it is a kind of robot.
- Autonomous robots bring a number of advantages such as helping disabled people, but they can also cause serious harm as in killer robots. War robots perform different types of duties such as target attacks, inspect hideouts, defuse bombs and many other tasks.
- Autonomous robots can make decisions without human intervention and they can be sufficiently smart. At the first glance robots can be argued to be several times more practical than soldiers because they do not affect from fatigue, lack of sleep, low morale and other difficult conditions. Also, fewer soldier would die in war and fewer parents will be in pain. In fact, instead of human losses, robots are getting involve in battlefield.
- On the other hand, soldiers can overreact under impression of emotions and adrenaline and may perform atrocities which are known as war crimes, but robots would not be influenced by emotions and can report unethical behavior in battleground.
- Since advanced autonomous military robots have dual use nature, there are several concerns about utilizing robots in warfare such as the responsibility of malfunctioning of robots that can result from manufacturer, commander or robot itself complications, the case of robot hacking and its lethal harm and programing to reduce robot power in civilian regions. The robot's ethics is proposed to take the above issues into account.

CONSIDERATIONS

- The Office of Technology Assessment of the US Congress have developed a new concept in military field to overcome the above conceptual challenge. Civil-Military Integration (CMI) recommends that policies for technology and industry should integrate military and commercial actions within a united base of technology and industry.
- Two documents on dual use technology was published in United States that are:
  1. A Defense Strategy for Affordable, Leading-Edge Technology by the Department of Defense (DoD) and
  2. Preserving America's Military Advantage Through Dual Use Technology by the White House Office for Science and Technology Policy.
- DoD wants to overcome the obstacles between commercial and defense industries and to establish similar development and internal procedure acquirement. The starting point was to revise the acquisition policy of the DoD and to modify the management strategy of three parts, namely:
  1- Investment of R&D on dual use technologies,
  2- Incorporation of commercial and military products
  3- Add commercial resources into military procedures

- DoD places high priority in investment on dual use technologies that US military will reinforce through commercial technology which is at leading edge. The military requirement is important for investment in dual use characteristics. Therefore, development of technologies that can be employed both in military and civilian purposes are becoming important such as those in information technology, materials technology, electronics and improved simulation and modelling.

- The second pillar is integration of commercial and military productions that is called "dual procedure" is targeted to develop commercial technologies that can be acquired by the DoD at market value.
- The DoD was looking for commercial industries to manufacture technologies that are required in military aims and develop new industries that can satisfy military and private sector. This trend will lead to reduced cost in mass production and also the technologies will not dedicate to military and it is available for commercial use.
- There are several successful examples of this policy such as GPS systems, the Microwave Monolithic Integrated Circuits (MIMIC), and the Multi Chip Modules (MCM).
- Finally, the third pillar is to insert and add best commercial technologies, products and materials into military structures. The DoD has figured out that conversion of commercial products to military structures may put military into risks and costs. Design military structures from the beginning point to considering compliances with dual use components are one way to decrease the cost of insertion. The third pillar which is concentrated on entering commercial technologies into military structures is more likely to stand in the near future.
- For monitoring dual use technology research three different methods have been proposed as scientific society legislation, government external supervision, and combination of the previous two methods. Generally speaking, three forms of policies are emphasized: dual use technology research funding, gaining access to sensitive information and artefacts in research processes and monitoring data and the results publications.
- Scientists prefer internal collegial councils for regulating the publications as opposed to external administration censorship as that will affect scientific development, freedom of expression, restricting publications of new findings that have public benefits and raise extra administrative expenses on the research domain. National Science Advisory Board for Biosecurity (NSABB), a committee which tackles biosecurity issues and dual use research at the request of the United States Government, has issued self-regulation with supervisory of government organizations as a template for publications.
- The process for the government supervisions consists of:
  - Regulation for dangerous materials access such as biological, chemical and radiological materials.
  - Legislation on international technology transfer.
  - Control, restrict and censor research generated by government grants that may put national security in danger.
  - Monitoring scientists' immigrations with background in dual use technology
- Scientist self-regulation work consists of:
  - Monitoring institutions and researchers in the way artefacts and technologies are utilized.
  - Form committees to control research and review publications, educate scientists on their duties regarding dual use technology research, and
  - Legislate ethical codes and rules for dual use technology research
- Strategic goods that have dual use in military and civilian are important in the export process. As an example, fire retardants that are used in construction industry may have application in creating poisonous gas. Due to risks of dual use goods governments strictly control their export.
- The United States Department of Commerce (DOC) monitors exports and re-export of dual use technologies. Some dual use goods require license to be exported such as telecommunication equipment, but this license is not essential for the ally countries.
- There are certain complications in exporting dual use goods. Dual use goods are not easily accessible and some restricted state exporters, that are mainly members of four international export groups, namely the Australia Group, the Missile Technology Control Regime, the Nuclear Suppliers Group and the Wassenaar

Arrangement, can trade high-tech equipment. The exporters are promised to ensure the dual use goods and prevent their use for military purposes.

- One of the important subjects in Unmanned Systems (UMS) in military applications is building safe systems. The safe term here implies that when compared to manned systems, UMS can reach similar performance and operation of procedure should not put safety of the operator at risks.
- UMS should be adept to work with manned systems together in the time of war or test conditions. For UAVs there exist the same design rules for sharing the airspace with military and civilian aircraft.
- Distinction between friend or foe is another concern in autonomous systems. War ethics are proposed to avoid adverse consequences such as killing and injuring civilians, and it aims at making distinctions that are appropriate or inappropriate for countries and people.
- Just War Theory is a doctrine that expresses conditions for only go to war and conditions of how that war should be organized. There are three main issues: killing innocent people is immoral, countries are forced to protect their citizens, and utilizing violence and force for saving human lives is required.
- Four main concepts are considered for using war robots: decision of firing, discrimination, responsibility and proportionality.
- Firing decision is back to the human firing or autonomous firing in the battleground. Some researchers in robotics have suggested that intelligent robots that have the authority to fire, behave more ethical in some cases in the battlefield. On the other hand, some autonomous robots such as combat aircraft must have full authority to fire for efficient performance in critical situations due to the higher speed in processing information and data. In situations where these autonomous war robots are not legal because of the autonomy firing decision without supervision, the just war law requires discrimination and proportionality norms to be conducted.
- Discrimination is an important issue and core ethical issue in concept of war robots which define distinction between combat and non-combats objects. Specifically, the war robot must have the ability to recognize friend and foe and legal and illegal targets in terms of violent military actions.
- For example, there are different categories such as enemies, civilian, attackers, viewers, dangerous, safe and injured persons. Affirm morally right or morally wrong cannot be defined properly for a person or a group technically but there are engineering methods and computerized pattern classification schemes that can teach a machine how to classify by optical character recognition or to map patterns of voice and sound or face recognition on digital photographs.
- Proper classification is essential for moral evaluation, however misclassification leads to not moral error. It is still a question that a machine has the right to kill the enemy soldiers in a conflict and does the robots morally permitted to kill humans in different situations. However, there are still debates on the fact that humans under stress and pressure conditions are less reliable to react morally.
- The responsibility concept in different application of robots is still unclear and ethical and legislation issues should be considered. If a failure and an error occur by a war robot a person's live is threaten and it is hard to determine the responsible person for blaming and punishment, as either the designer, manufacturer, commander, supervisor, or the robot itself can be guilty.
- Proportionality rules evaluate benefits of war robots against expected civilian harms and it is part of the just war principle which should be considered by the designer and programmer.

NEXT STEPS (If applicable)

The three items (research, technology and artefacts) need regulation where scientists, engineers and authorities can be aware of their responsibilities. The dual use technologies are considered as a double edge sword that can be as dangerous as they are useful. Improper use of dual technology may lead to various types of harm ranging from endangering people's lives to damaging the security, commercial and economies of a nation.

The dual use concept of technologies in Artificial Intelligence (AI) and autonomous robots will be investigated in future BNs.

In this report an example of a dual use technology, namely autonomous robots, is presented. Different ethical issues about war robots are also stated. In the next report regulation and laws in different countries regarding the war robots will explained.