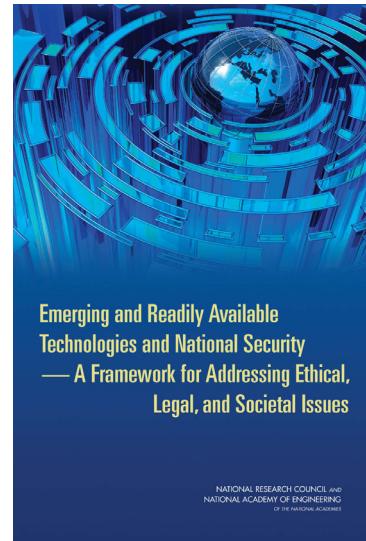


Emerging and Readily Available Technologies and National Security —A Framework for Addressing Ethical, Legal, and Societal Issues

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To maintain technological military superiority over U.S. adversaries, government agencies invest significantly in research and development (R&D) that can lead to new applications of science and technology for national security uses. Some of these developments, however, raise complex ethical, legal, and societal issues (ELSI) that can have a considerable impact on many stakeholders, including the American public. For instance, what limits, if any, should be placed on the development of cyber weapons, given their potential to cause extensive economic damage? What are the ethics of enhancing the physical or cognitive capabilities of soldiers with drugs or implants? A wider variety of ELSI concerns may arise with emerging and readily available technologies whose relatively low cost puts them within the reach of less technologically advanced nations, nonstate actors, and even individuals. To encourage awareness of and attention to ELSI concerns, this report provides a framework developed to help policy makers, researchers, and research sponsors identify and address ELSI implications of R&D on technologies with potential military application. The report also presents findings and recommendations for government agencies and research institutions seeking to implement this framework.



Background

In 2010, the Defense Advanced Research Projects Agency (DARPA) asked the National Academies to develop a framework for policy makers, institutions, and individual researchers that would help them think through ethical, legal, and societal issues related to R&D on emerging and readily available technologies with relevance to national security. Offered as a resource for senior leaders, program managers, and researchers at any agency that supports R&D for military and national security purposes, this report considers three areas with respect to emerging technologies and potential ELSI concerns: the conduct of research, research applications, and unanticipated or inadvertent ELSI consequences.

Sources of ELSI Insight

A number of ideas, intellectual disciplines, and related efforts are sources of insight into the potential ELSI impacts of emerging technologies and their applications. These sources include philosophical and disciplinary ethics; international law (especially the law of armed conflict and various arms control treaties); social and behavioral sciences; scientific and technological framing; the precautionary principle and cost-benefit analysis; and the science and communication of risk. Chapter 4 of the report discusses these sources of ELSI insight and describes how they might be used in anticipating and addressing ELSI concerns associated with R&D on emerging technologies with military significance.

An Analytical Framework

Derived from considering sources of ELSI insight and some ELSI commonalities found in the illustrative technologies described in Chapters 2 and 3 of the report, the analytical framework is an organized list of questions that decision makers can use to identify ELSI concerns potentially associated with particular R&D efforts. Addressing the questions posed by this framework can help in developing useful knowledge and understanding that can then serve as a starting point for decision makers considering the ELSI implications of a new research project or of an unforeseen application of an ongoing project. The framework first considers ELSI concerns of various stakeholders. It then examines ELSI concerns that cut across these stakeholders. The questions below offer a sample of the perspectives the framework can raise.

Stakeholders include:

- Those involved in or connected to the conduct of research – Does a research effort adhere to the ethical principles of beneficence, respect for persons, and justice?
- Users of an application – What are an application’s impacts, especially the cumulative or long-term impacts, on users?
- Adversaries – How will use of an application affect an adversary’s perceptions of and actions toward the United States? If the United States develops a technology, will adversaries then follow suit?
- Law enforcement and civilian users – Will a civilian or domestic adaptation of a given military application raise ELSI concerns that do not arise in a military context?
- Military organizations – Will an application affect traditional military structures of command and accountability?
- Noncombatants – To what extent can an application affect noncombatants on and off the battlefield? Will an application harm the environment or future generations?
- Other nations – Will development or use of an application affect political solidarity with the United States? Could U.S. restraint in pursuing an application induce other nations to exercise similar restraint?

Crosscutting themes include:

- Scale – Do ELSI concerns change in scale when a technology moves from research to deployment? How do short-term benefits compare to long-term costs?
- Humanity – Does an application compromise something essential about being human? Is the application excessively invasive of the human body or mind? Will use of an application cede responsibility to nonhuman systems to an unacceptable degree?
- Technological imperfections – Who determines acceptable safety requirements for an application? Are there tradeoffs between an application’s functionality and its safety?
- Unanticipated military uses – What are the ELSI implications of possible unintended military uses of an application?
- Crossovers to civilian use – What new ELSI implications arise if an application is made widely available to law enforcement personnel or private citizens? How and to what extent, if any, can safeguards or modifications prevent negative outcomes?
- Changing ethical standards – What is the minimum standard of performance required of an application vested with responsibilities formerly held by humans? If a new application raises fewer ELSI concerns than do older applications addressing the same problem, are militaries obligated to use the new application?
- ELSI considerations in a classified environment – How can research in a classified environment be reviewed for ELSI concerns or inappropriate classification?
- Opportunity costs – How should the value of R&D efforts be ascertained and compared?
- Sources of ELSI insight – Are any sources of insight particularly relevant to a given research effort?

Judgments about how to treat a particular R&D project or program should be undertaken after decision makers have examined the issues raised by the questions posed in the framework. The full set of considerations reflected in the framework can be found in Chapter 5 of the report.

Going Beyond an Initial Analysis

The analytical framework offered by the report can help to identify some—but not all—potential ELSI implications of an emerging military technology. Inaccurate technology forecasts, unforeseen applications of a technology, and unexpected stakeholder concerns limit but do not obviate the predictive value of the framework. To ensure consideration of as broad a range of ELSI impacts as possible and to identify and prepare for unanticipated ELSI concerns, decision makers can employ two additional techniques: deliberative processes and adaptive planning.

Deliberative processes involve a broad range of perspectives and possible stakeholders in discussions of a given issue. These processes may yield new questions and knowledge and identify new risks. Adaptive planning establishes systems for gathering new information and schedules periodic opportunities for evaluation and response. This approach allows policy makers to respond quickly if and when new concerns arise as a technology path unfolds.

Mechanisms for Addressing ELSI Concerns

A number of mechanisms to address different types of ethical, legal, and societal issues associated with a given R&D project are available for agencies, policy makers, and researchers to use. Perhaps the most important mechanism is good judgment. Individuals are expected to exercise good judgment in not proposing, approving, or supporting unethical projects. Other mechanisms, such as codes of ethics, oversight bodies, and laws-of-war compliance reviews, support and enhance the good judgment of individuals. Chapter 7 of the report discusses a variety of mechanisms for addressing ELSI concerns. Adapting these mechanisms for use in the military R&D context must take into account the special characteristics of the military environment.

Findings

Some developments in emerging and readily available technologies in a military context are likely to raise complex ethical, legal, and societal issues, some of which are different from those associated with similar technologies in a civilian context.

The ELSI concerns that may be associated with a given technology development are very hard to anticipate accurately at the start of that development. Using diverse sources of input and a broad set of perspectives on a given technology increases the likelihood of identifying ELSI concerns. Classified efforts necessarily rely on a smaller set of sources of ELSI insight and perspectives.

Sustainable policy—policy whose goals and conduct can be supported over the long run—regarding science and technology requires decision makers to attend to the ELSI aspects of the S&T involved. Inattention to ELSI aspects of an R&D endeavor can undermine even scientifically sound R&D efforts and call into question policy decisions that led to those efforts.

Public reaction to a given science or technology effort or application is sometimes an important influence on the degree of support it receives. A negative perception of the ethics of a research effort may reduce public support for that science or technology, regardless of its technical merits.

Any approach to promote consideration of ethical, legal, and societal issues in R&D of military significance will have to address how such plans are implemented at both the program and the project levels. The exercise of good judgment coupled with an understanding of the fundamental intent of ELSI policies—not simply formal compliance—is an important foundation for developing an ELSI-sensitive culture. ELSI policies should have a “light footprint” when implemented.

Recommendations

Recommendation 1:

The senior leaders of interested agencies that support R&D on emerging and readily available technologies of military significance should be engaged with ethical, legal, and societal issues in an ongoing manner and declare publicly that they are concerned with such issues. Such a public declaration should include a designation of functional accountability for ethical, legal, and societal issues within their agencies. Such support must be visible and sustained over time. Project teams have primary responsibility for addressing ELSI concerns, but designating a management point of functional accountability will increase the likelihood that ELSI concerns will be addressed.

Recommendation 2:

Interested agencies that support R&D on emerging and readily available technologies of military significance should develop and deploy five specific processes to enable these agencies to consider ethical, legal, and societal issues associated with their research portfolios.

2.a – Initial screening of proposed R&D projects

– The goal is to determine if the research, as understood at this stage, can raise significant ELSI concerns that require further consideration.

2.b – Reviewing proposals that raise ELSI concerns

– Review of such proposals requires closer examination of those ELSI concerns, including asking how likely they are to arise, how serious they are likely to be, and whether there are ways to mitigate them. Program managers can consider a range of possible responses, including halting the effort, proceeding with the effort, or proceeding in a modified form.

2.c – Monitoring R&D projects for the emergence of ethical, legal, and societal issues and making midcourse corrections when necessary – The intent is not to reopen a debate over a project as initially characterized but rather to see if new issues have arisen since the last examination. Monitoring should touch all projects in an agency's R&D portfolio.

2.d – Engaging with various segments of the public as needed – Interested agencies must be prepared to communicate with the public when unforeseen outcomes arise. Ongoing public engagement

helps to build public understanding of an agency's actions and to defuse complaints that the agency ignored certain perspectives.

2.e – Periodically reviewing ELSI-related processes in an agency – Periodic review will help to ensure that ELSI processes do not place undue burdens on programs.

Recommendation 3:

Interested agencies supporting R&D on emerging and readily available technologies of military significance should undertake an effort to educate and sensitize program managers to ethical, legal, and societal issues.

Recommendation 4:

Interested agencies supporting R&D on emerging and readily available technologies of military significance should build external expertise in ethical, legal, and societal issues to help address such issues.

Recommendation 5:

Research-performing institutions should provide assistance for researchers attending to ethical, legal, and societal issues in their work on emerging and readily available technologies of military significance. Intended for universities and other research institutions, this recommendation could be fulfilled by adapting existing civilian ELSI review processes.

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