

# Dual-use Research and Trade Controls: Opportunities and Controversies

CHRISTOS CHARATSIS<sup>1</sup>

## Abstract

*This article intends to clarify the role of trade controls in relation to dual-use research, stimulate the debate on the possible contribution of trade controls to the broader governance of sensitive research, and inspire ways to achieve this in practice. First, the article discusses the different interpretations of the term dual-use research by highlighting its relevance in the context of nonproliferation, research ethics and the dual-use industry. The article offers a working definition for export controlled research activities. Second, the article explores why there is a nexus between trade controls and research. In this regard, the added value and known shortcomings connected to trade control implementation is presented. The article discusses the European and American experience in implementing trade controls to research activities. In addition, the paper attempts a first assessment of the new elements affecting research as set forward by the recent European Commission (EC) proposal for the review of the dual-use regulation. Finally, the article presents a typology of measures presently governing dual-use research while highlighting their synergetic value when applied in combination with trade controls.*

## Keywords

Dual-use research, export controlled research, biosecurity, research ethics, technology transfers, EU export control policy review, tacit knowledge, fundamental research, disruptive technologies

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1 Christos Charatsis is a multidisciplinary practitioner with academic and public sector experience in strategic trade controls and international security. He holds a doctoral diploma in Political Science from the University of Liege with a focus on the implications of export controls law for research organizations. He presently works as a project officer at the European Commission Joint Research Centre providing support to the EU Partner-to-Partner Export Control Program and conducting research on a variety of strategic trade control issues such as the implementation of the Regulation 428/2009, dual-use research and internal compliance.

## Introduction: The Duality of Knowledge and WMD Proliferation

While almost every technology can be misapplied if one has the intention to do so, there are some types of technology that are considered particularly sensitive due to their “dual” usefulness. Concurrently, the proliferation of Weapons of Mass Destruction (WMD) still represents a problem threatening humanity with complete obliteration. As Smith neatly mentions, the nature of the [...] proliferation problem confronting mankind is, in its fundamental sense, a “problem” of knowledge.<sup>2</sup> For instance, in the past, nuclear proliferation took place through effective espionage, deliberate transfer of technology to allied countries and scientists changing ideological camps. Indeed, Reed and Stillman argue that the acquisition of Western nuclear technology by China did not rely primarily on espionage but was accomplished one graduate student at a time.<sup>3</sup> Therefore, it may not be an exaggeration to claim that the dual-use problem finds in WMD proliferation its most glaring manifestation.

Technology is defined as the practical application of knowledge to the practical needs of society and strategic trade controls aim at addressing the dual-use problem by providing a system for monitoring transfers of tangible materials and items as well as intangible transfers of technology and software.<sup>4</sup> As a result, research activities and trade controls intersect. However, the dual-use problem has broader security and ethical implications and may concern a broad range of activities and types of research not necessarily interrelated to activities and technologies targeted by trade controls.

After the nuclear trend, life sciences have been in the spotlight for several years partly due to unprecedented innovations (e.g., synthetic genomics) achieved in that area and incidents suggesting the existence of new security threats (e.g., the 2001 anthrax mail attacks). In relation to this, the body of literature dedicated to risks stemming from emerging technologies in biological and chemical field have influenced the author’s ideas in mapping out and understanding the issues involved in the so-called “research of dual-use concern.” Tucker, in particular, argues that different types of technologies warrant specific governance measures and goes far enough to define a methodology for identifying the right mix of measures (hard-law, soft-law, and informal measures) for any given emerging bio-technology.<sup>5</sup> In his significant work he also highlights that the weaponization of nuclear, biological, and chemical materials and equipment is a technically challenging process involving both explicit and tacit knowledge. In particular, knowledge as it is expressed in its tacit form—skills, know-how, and sensory cues that transferred mainly through personal contacts—is a key capability not always diffused or readily available.

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2 Roger K. Smith, “Explaining the Nonproliferation Regime: Anomalies for Contemporary International Relations Theory,” *International Organization* 41 (1987), p. 266.

3 Thomas C. Reed and Danny B. Stillman, *The Nuclear Express: A Political History of the Bomb and its Proliferation*, (Minneapolis: Zenith Press, 2009), p. 87.

4 Definition inspired by the common definitions used in dictionaries. Check for instance, the definition in the Merriam-Webster Dictionary, available in: <[https://www.merriam-webster.com/dictionary/technology?utm\\_campaign=sd&utm\\_medium=serp&utm\\_source=jsonld](https://www.merriam-webster.com/dictionary/technology?utm_campaign=sd&utm_medium=serp&utm_source=jsonld)>.

5 Jonathan B. Tucker, *Innovation, Dual-use, and Security, Managing the Risks of Emerging Biological and Chemical Technologies* (Cambridge: The MIT Press, 2012), see in particular chapters 4 and 21.

In spite of this, nowadays tacit knowledge is becoming increasingly available due to the global distribution of skilled staff and the extensive collaboration between industry and academia in the research and development (R&D) phase. As Meier highlights, globalization leads to technology diffusion and it is inexorably linked to the sharing of technologies, including dual-use technologies.<sup>6</sup> In this context, the role of key stakeholders—industry and academia—are of central importance in achieving security imperatives including trade controls objectives.

At a time when a new generation of disruptive technologies (e.g., artificial intelligence, 3-D printing, cloud computing, synthetic genomics) are already being widely used and the WMD term is stretching to accommodate less destructive weapons such as radiological dispersal devices, explosives, and cyber weapons, the article intends to:

- Clarify what dual-use research is;
- Define export controlled research;
- Explain the role of trade controls in this broader context and,
- Identify the typology of other available mechanisms for overseeing dual-use research.<sup>7</sup>

### Conceptualizing Dual-use Research

The term dual-use research is composed of two elements: research and dual-use. Research can be defined as “investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws.”<sup>8</sup> Dual-use is generally understood as anything having more than one use and most frequently, as any item that can be used for both benevolent and malign purposes. These basic definitions provide the impetus for making two reflective observations on the understanding of dual-use research and the main dimensions of the problem.

First, considering the definition of research as cited above, the term may include all the different activities potentially involved in research, from the observation of main principles, conduct of analytic studies and experiments, and testing of proof-of-concepts, to the building of prototypes and the actual application of such models to the needs of society at the industrial level through additional modifications. In this view, the term covers both industry and academic research and

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6 Oliver Meier, *Technology Transfers and Nonproliferation of Weapons of Mass Destruction: Between Control and Cooperation* (Oxon: Routledge, 2014), p. 9.

7 For instance on the relationship between the WMD term and cyber security see: Clay Wilson, “Cybersecurity and Cyber Weapons: Is Nonproliferation Possible?,” in Maurizio Martellini, *Cyber Security Deterrence and IT Protection for Critical Infrastructures* (Springer Briefs in Computer Science, 2013), p. 17.

8 See the online Merriam-Webster Dictionary, <<http://www.merriam-webster.com/dictionary/research>>.

links closely with another broadly used term – research and development (R&D).<sup>9</sup> Second, the dual-use concept is quite broad and thus can accommodate varying understandings.

The first observation implies that one could intervene in different phases of a research project in order to examine possible security implications. For instance, a scientist could envision the benefits and risks of research already in the phase of inception so as to take any necessary precautions. University institutions or government authorities could evaluate any possible risks relating to a research proposal and design mitigating measures from the very beginning. One should, however, consider that the potential of research to produce an outcome of dual-use concern may become evident only during the lifetime of the research or even at the end. As a result, the right avenue for overseeing dual-use research may vary depending on the phase of a project and the nature of research per se.

Concerning dual-use, some confusion exists due to various understandings of the term by different professional communities or even among practitioners of one single community. More specifically, the term dual-use research is encountered mainly in three different contexts:

- Nonproliferation and strategic trade controls area;
- Research ethics discourse (chiefly in life sciences) and,
- Synergies between the military/defense and civil organizations.

First, in the nonproliferation purview, dual-use research is not often used as such yet it is implied. For example, the US Export Administration Regulations use the term research and so does the EU dual-use regulation when referring to the “basic scientific research exemption” setting fundamental research out of the scope of trade controls.<sup>10</sup> In practice, the EU system follows the example of Multilateral Export Control Regimes (MECRs) by simply incorporating the decontrol notes of basic research and public domain information without further clarifying the intersection of trade controls with research activities. However, this absence of dual-use research from European and international law does not imply a lack of interest on the topic itself.<sup>11</sup>

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9 “Research and experimental Development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications” as defined in *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development* (Paris: OECD, 2002), p. 30, <<http://www.oecd.org/sti/inno/frascaticmanualproposedstandardpracticeforsurveysonresearchandexperimentaldevelopment6thedition.htm>>.

10 Title 15 CFR, Part 734 §8 of the US EAR and the Nuclear Technology Note of Council Regulation (EC) No. 428/2009 of 5 May 2009, Setting up a Community Regime for the Control of Exports, Transfer, Brokering and Transit of Dual-use Items, Official Journal of the European Union (L 134/1) of May 29, 2009.

11 The author has conducted doctoral research on the interferences between export controls and dual-use research for the University of Liège and on behalf of the European Commission Joint Research Centre. Additionally, several seminars and EU meetings have discussed this topic. Indicatively: *55<sup>th</sup> Dual-Use Coordination Group*, September 25, 2015, Brussels; “King’s College Event on Intangible Technology Controls in Industry and Academia, March 29, 2016, London <<http://iipdigital.usembassy.gov/st/english/publication/2008/08/20080815121848xjyrrep0.1191522.html#>>; Joint JRC-NNSA Technical Seminar/ 6<sup>th</sup> ESARDA Export Control Working Group, April 22-23, 2015, Ispra, Italy.

Dual-use research has entered the spotlight for a number of reasons and this is reflected more frequently in formal yet not legally binding texts. For instance, the European Commission (EC) Communication for the review of the EU export control system notes the imperative “to clarify the control of dual-use research while avoiding undue obstacles to the free flow of knowledge and the global competitiveness of EU science and technology.”<sup>12</sup> It also acknowledges the need for “targeted and coordinated outreach for academic research communities throughout the EU.”<sup>13</sup> In the same refrain, the recent EC proposal for the recast of the regulation refers explicitly to the relationship of research with trade controls in three instances: the definition of exporter, the new general license for intra-company transmission of software and technology, and the imperative not to prevent the export of information and communication technology used for legitimate purposes, including law enforcement and internet security research.<sup>14</sup>

In an international context, in 2016, the United Nations Security Council resolution 1540 Civil Society Forum took place with the aim of providing an opportunity for academia and civil society to contribute to the work of 1540 Committee in the context of the resolution’s comprehensive review. The report, presenting the outcomes of discussions, highlights a host of measures for engaging academics in different aspects of the implementation of the resolution including tackling dual-use research especially in the life sciences.<sup>15</sup>

Second, in research ethics discourse, the dual-use concept appears to comprise any type of research that can be misused. At a practical level this became particularly evident in the preparation of a guidance document by EC with the aim to educate researchers submitting proposals in the framework of Horizon 2020 on identifying any dual-use issues relating to their research.<sup>16</sup> The exchanges between security experts and ethics reviewers showcased how broad the dual-use concept may be. The term concerns in principle research having both civil and military applications. Additionally, it can accommodate a variety of research types such as vulnerability studies uncovering details on critical infrastructure, research projects developing software applications that could be misused, or research on new psychotropic substances that can be used for both medical purposes and as alternatives to controlled substances. In that

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12 European Commission, “Communication for the Commission to the Council and the European Parliament: The Review of Export Control Policy: Ensuring Security and Competitiveness in a Changing World,” COM(2014)244 final, <[http://trade.ec.europa.eu/doclib/docs/2014/april/tradoc\\_152446.pdf](http://trade.ec.europa.eu/doclib/docs/2014/april/tradoc_152446.pdf)>, p. 7.

13 Ibid.

14 EU Commission, “Proposal for a Regulation of the European Parliament and of the Council Setting Up a Union Regime for the Control of Exports, Transfer, Brokering, Technical Assistance and Transit of Dual-Use Items (recast),” COM(2016) 616 final, Brussels, 2016, <[http://trade.ec.europa.eu/doclib/docs/2016/september/tradoc\\_154976.pdf](http://trade.ec.europa.eu/doclib/docs/2016/september/tradoc_154976.pdf)>.

15 “UNSCR 1540 Civil Society Forum: A Dialogue with Academia and Civil Society Meeting Report,” United Nations University Centre for Policy Research, June 2016, <<https://i.unu.edu/media/cpr.unu.edu/attachment/2187/Meeting-Report-UNSCR-1540-Civil-Society-Forum.pdf>>.

16 The result of this consultation was a “Guidance Note for Research Involving Dual-Use Items” aimed at facilitating the ethics self-assessment review required from H2020 applicants, available in: <[http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/guide\\_research-dual-use\\_en.pdf](http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/guide_research-dual-use_en.pdf)>.

view, Rath et al. note a lack of a universal understanding of dual-use research in the literature pertaining to ethical discourse.<sup>17</sup>

Nevertheless, there is an area of research ethics where dual-use research is specifically defined. Dual-use research in bio-science is considered an area of particular concern since “almost all biotechnology in service of human health can be subverted for misuse by hostile individual or nations.”<sup>18</sup> Indeed, scholars in this area refer often to dual-use research of concern (DURC), a term specifically coined to describe sensitive dual-use research in life sciences and used primarily by organizations such as the World Health Organization (WHO) and the American National Science Advisory Board for Biosecurity (NSABB).<sup>19</sup> The legal dispute over the Dutch licensing authority asking for an export authorization for the publication in a well-known journal of a research study exploring the transmissibility of H5N1 virus between mammals turned in part the attention to the possible connections between trade controls and bio-related research.<sup>20</sup>

The third occurrence of dual-use research resides in the interactions between military/defense and civil organizations. From this perspective, the term is used to describe technologies and items that originate from either military or civilian organizations and can have applications in whichever area. As Gallart mentions, “historically there is a shift of focus from R&D outputs derived from military industry and applied for civilian purposes (spin-off) to technological developments occurring elsewhere in the economy and exploited for the benefit of military production (spin-in).”<sup>21</sup> As a result, policymakers at the European and EU Member State level who are not directly concerned by proliferation objectives perceive dual-use research as an opportunity for reinforcing innovation and strengthening the combined output of industry through the development of synergies between defense and civil firms. The EC has taken several initiatives for bolstering the European defense sector, such as incentivizing public authorities and the private sector to invest more in the potential of dual-use research.<sup>22</sup>

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- 17 Johannes Rath, Monique Ischi and Dana Perkins, “Evolution of Different Dual-Use Concepts in International and National Law and its Implications on Research Ethics and Governance,” *Science and Engineering Ethics* 20:3 (September 2014), p. 770.
- 18 “Biotechnology Research in an Age of Terrorism (The Fink Report),” National Research Council, Washington, DC, The National Academy Press, 2004, preface.
- 19 Dual-use research of concern (DURC) is life sciences research that is intended for benefit, but which might easily be misapplied to do harm, retrieved from the WHO website: <<http://www.who.int/csr/durc/en/>>. See also the complete definition from the US National Institute of Health, available in: <<http://osp.od.nih.gov/office-biotechnology-activities/biosecurity/dual-use-research-concern/>>.
- 20 Robert Shaw, “Export Controls and the Life Sciences: Controversy or Opportunity?,” Volume 17, *EMBO Reports* 17:4, (2016), pp. 474–480; Angela Cirigliano et al., “Biological Dual-Use Research and Synthetic Biology of Yeast,” *Science and Engineer Ethics* 23:3 (June 2016), pp. 1-10; Christos Charatsis, “Setting the Publication of ‘Dual-use Research’ under the Export Authorization Process,” *Strategic Trade Review* 1:1 (Autumn 2015), pp. 56-72.
- 21 Jordi Molas-Gallart, “The Political and Economic Context of European Defense R&D,” *University of Sussex Electronic Working Papers Series* 52 (2000), p. 2.
- 22 See for instance: European Union, “Communication Towards a More Competitive and Efficient Defense and Security Sector,” COM (2013) 542 final, Brussels, 2013, <<http://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex:52013DC0542>>; European Commission, “EU Funding for Dual-use: A Practical Guide to Accessing EU Funds for European Regional Authorities and SMEs,” October 2014, <<http://s3platform.jrc.ec.europa.eu/-/eu-funding-for-dual-use-guide-for-regions-and-smes?inheritRedirect=true>>.

To circle back to trade controls and nonproliferation, trade controls may link to certain types of dual-use research as understood in the different contexts pinpointed above. However, dual-use trade controls, as largely list based instruments, cover only certain dual-use technologies falling within the defined thresholds and having specific performance capabilities. The fact that the trade control community lacks a commonly agreed definition of what dual-use goods mean adds complication to an already complex picture.<sup>23</sup> Therefore, it might be useful to offer a working definition of dual-use research, or to be more accurate, of ‘export controlled research:

*Export controlled research is defined as those research and development activities involving items, technologies, and software restricted under relevant trade control law. It concerns primarily civil research activities that are considered as integral to the design, construction, use, and delivery of Weapons of Mass Destruction and in some instances of conventional weapons.*<sup>24</sup>

This definition serves a number of purposes:

1. It refers solely to those research activities falling within the scope of trade control law but not to all research of dual-use nature. It is only the export of certain items and technologies that requires an authorization and may result in legal sanctions for the violators. The term R&D indicates that both basic and applied research may be in the scope of controls, if they involve controlled items.
2. The dual-use goods definitions adopted in the framework of MECRs point to an element of a major contribution for the development of military capabilities.<sup>25</sup> The definition denotes this element with the use of the adjective “integral.”
3. It clarifies that the scope of trade controls concerning tangible items (materials, equipment, components, etc.) as well as technology (technical data and technical assistance) and software.
4. Dual-use research may be associated with technologies and items capable of contributing to the development of both WMD and conventional weapons. In line with the spirit of the law and the contents of dual-use control lists, the definition covers also conventional weapons and related end-uses.

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23 For example, Quentin Michel and Andrea Viski have highlighted this problem in “Dual-Use: An Undefined Term?,” Presentation prepared for the 3<sup>rd</sup> ESARDA Export Control Working Group, November 13, 2013, Ispra, Italy.

24 The definition derives from the doctoral study: C. Charatsis, “Interferences between Nonproliferation and Science: ‘Exporting’ Dual-Use Know-How and Technology in Conformity with Security Imperatives,” University of Liege (forthcoming).

25 The NSG for instance, connects dual-use items to “certain equipment, materials, software and related technology that could make a **major contribution** to ‘a nuclear explosive activity’, an ‘unsafeguarded nuclear fuel cycle’ or ‘acts of nuclear terrorism’ without defining further the term. The WA provides that “dual-use goods and technologies to be controlled are those which are **major or key elements** for the indigenous development, production, use or enhancement of military capabilities.

Overall the definition is inspired by the definition provided in United Nations Security Council resolution 1540. The resolution seems to imply reference to dual-use goods when it expresses concern over the illicit trafficking in nuclear, chemical, or biological weapons and their means of delivery, and related materials. Indeed, in a footnote, it is clarified what “related materials” shall mean:

*“Materials, equipment and technology covered by relevant multilateral treaties and arrangements, or included on national control lists, which could be used for the design, development, production or use of nuclear, chemical, and biological weapons and their means of delivery.”<sup>26</sup>*

## The Nexus between Trade Controls and Dual-use Research

The term dual-use applies to situations where a dual-use dilemma arises. For instance, to what extent can research having a peaceful or even a life-saving application be misused? Further, how could a researcher share blueprints, source codes, and know-how of innovative dual-use technologies without undermining security objectives? Dual-use trade controls offer—maybe unintentionally—some leverage for addressing this dilemma. The analysis below discusses the linkages between trade controls and research by highlighting the merits and drawbacks of the former for the latter.

### Why is there a Nexus?

Trade controls were not designed as a tool for the governance of dual-use research. Indeed, the term until recently was hardly used in formal or legally binding texts. In alignment with this, decontrol notes, crafted in the framework of the MECRs, exclude fundamental research and information falling in the public domain from the scope of controls. That said, researchers still have a responsibility for applying for an export authorization when they export tangible dual-use items and materials in the framework of their research. Such activities are not negligible.<sup>27</sup> Additionally, the scope of controls extends to transfers of technology (technical data and assistance) and software including transfers through electronic means, the so-called ‘intangible’ ones. With this in mind, common activities undertaken in the framework of research such as posting software codes, sharing diagrams and technical information through emails or providing technical services abroad fall within the scope of controls if certain conditions apply.<sup>28</sup> Increasing collaboration between universities and firms and the related changing nature of academic research, moving steadfastly towards applied applications, make export control screening all the more necessary.

Interestingly, the scope of controls has been expanding to cover not only different types of activities (technology transfers, transit, and brokering) but also to accommodate new technologies by adjusting control lists so as to keep pace with new technological advancements.

26 United Nations Security Council 1540, S/RES/1540, New York, April 2004.

27 Discussion with US official in the margins of the 9<sup>th</sup> JRC-NNSA Technical Seminar, Ispra, Italy, June 16-17, 2016.

28 Christos Charatsis, “Setting the Publication of ‘Dual-use Research’ under the Export Authorization Process,” *Strategic Trade Review* 1:1 (Autumn 2015), pp. 57-58.



One could glean some striking examples showing the sometimes proactive role of trade controls. The Wassenaar Arrangement (WA) dual-use list maintains controls concerning information security technologies and software. In 2013, the WA agreed upon the introduction of additional controls on technologies relating to intrusion software. In the cyber security arena, the recent EC proposal sets forward the unilateral implementation of controls on certain types of cyber surveillance technologies. Concurrently, different international regimes and the EC examine the usefulness of including in the scope of controls on equipment and technology relating to the manufacture of 3-D printers.<sup>29</sup>

### **The Importance of Including Trade Controls in the Mix of Dual-use Research Governance**

There are several further factors to consider when contemplating the fitness and readiness of trade controls to address dual-use research concerns. These are listed here:

- The nature of controls has been shifting from a system of denial of technology to a system of monitoring. Only a limited number of transactions are prohibited as well as the number of denied export authorizations.
- Trade controls represent rather agile frameworks. Their flexibility consists in the fact that their main principles and control lists are negotiated and regularly updated in the framework of MECRs. They also provide a possibility for the application of ad hoc controls and prohibitions in the event of a transaction involving sensitive end-uses or end-destinations (e.g., embargoed and sanctioned countries or diversion hubs) and items with technical parameters close to the controlled ones.
- Trade controls envisage a number of trade facilitations such as general licenses in the EU and license exemptions in the US for compliant exporters operating from and exporting to less risky destinations.
- Trade controls offer exemptions for technology and software generally available to the public as well as for basic scientific research.
- Trade controls contribute to the development of standards for internal compliance for industry and academic organizations. Such standards when coupled with other safety and security rules (e.g., laboratory protocols and physical protection measures) can better guarantee the overall security of such organizations and instill a culture of compliance.

In relation to this last element, holding industry and universities accountable is important for one other reason. The center of innovation seems to be moving from defense to civil industry as “armed forces and defense industry’s dependence on technologies with a civilian origin is increasing.”<sup>30</sup> By extension, governments’ control over commercial innovations—that are

29 For instance, the former NSG chair Ambassador Rafael Grossi confirmed in the EU Nonproliferation Conference (November 2016) that ongoing NSG discussions consider the implications of 3-D printing. At the EU level, the first discussion on this topic took place already in 2013.

30 European Commission, “EU Funding for Dual-use: A Practical Guide to Accessing EU Funds for European Regional Authorities and SMEs,” October 2014, <<http://s3platform.jrc.ec.europa.eu/-/eu-funding-for-dual-use-guide-for-regions-and-smes?inheritRedirect=true>>, p.7.

potentially game changers for modern warfare—is limited compared to the oversight they exercise over defense related innovations. Trade controls as legally binding instruments function also as a pressure lever to firms and research institutes for researching and trading responsibly.

### **Drawbacks of Implementing Technology Trade Control Provisions**

Trade controls are not a panacea for every type of technology considered to be dual-use. Trade controls seek to prevent the proliferation of most sensitive technologies relating to the construction of WMD, their means of delivery and certain military end-uses. In drafting their lists, trade controls regimes take into account certain criteria such as:<sup>31</sup>

- a) Foreign availability outside the participating states;
- b) Ability to effectively control the export of goods;
- c) Ability to make a clear and objective specification of the item;
- d) Whether the item is controlled by another regime.

Not all types of sensitive technologies are eligible to be covered by the dual-use lists. However, as explained above, the scope of controls can be adjusted based on new developments and perceptions of the most persistent risks and what the term WMD may include. The issue of foreign availability is also particularly important since it indicates technological areas where the implementation of controls is or has become meaningless due to the diffusion of a technology. At the same time, foreign availability hints at a need for universalizing trade controls by holding all suppliers of controlled technologies accountable.

More than a restrictive or discriminatory measure, trade controls function to deter, detect, delay, and prevent the diffusion of sensitive technologies. However, the present enforcement of technology controls is imperfect. In particular, the effectiveness of technology controls is fundamentally challenged by variance in national implementation.<sup>32</sup> The effectiveness of technology controls can be indirectly benefited by fostering transparency and accountability. In that regard, publishing licensing data concerning both tangible and intangible transfers and reporting on the systematic outreach activities and inspections conducted to industry and academia are steps to consider. States' asymmetrical implementation of controls by can harm their overall effectiveness since lax implementation in one country could lead to license shopping by unlawful state and non-state actors. Setting common standards where possible at the international level and increasing cooperation through exchange of information and best practices could improve the current situation. The 2006 “WA Best Practices for Implementing ITT Controls,” underlining the role of industry, academia, and individuals in furthering compliance with technology controls represent only a first step in the right direction.<sup>33</sup>

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31 See footnote in the WA document specifying the “Criteria for the Selection of Dual-use Items” available in: <[http://www.wassenaar.org/controllists/2005/Criteria\\_as\\_updated\\_at\\_the\\_December\\_2005\\_PLM.pdf](http://www.wassenaar.org/controllists/2005/Criteria_as_updated_at_the_December_2005_PLM.pdf)>.

32 Ian J. Stewart, “The Contribution of Intangible Technology Controls in Controlling the Spread of Strategic Technologies,” *Strategic Trade Review* 1:1 (Autumn 2015), p. 54.

33 Wassenaar Arrangement, *Best Practices for Implementing Intangible Transfer of Technology Controls*, WA Plenary 2006, <[http://www.wassenaar.org/wp-content/uploads/2015/06/ITT\\_Best\\_Practices\\_for\\_public\\_statement\\_2006.pdf](http://www.wassenaar.org/wp-content/uploads/2015/06/ITT_Best_Practices_for_public_statement_2006.pdf)>.

Trade controls, in addition, may be perceived as being at odds with the academic freedom and the imperative to protect the free circulation of information and the peaceful advancement of science. It is an inalienable right of researchers to perform their activities in an autonomous way and without unnecessary interference by any authority. This is a civil right enshrined in many countries also constitutionally.<sup>34</sup> Nonetheless, academic freedom is not unlimited either. “Academic freedom automatically includes academic responsibility, both for the university as a whole and for the individual professor or researcher.”<sup>35</sup> In that view, section 8 §1 of the UK Export Act (2002) clarifies succinctly the role of trade control authority *vis-à-vis* cases raising questions on the protection of civil rights: “any interference of protected freedoms must be no more than is strictly necessary.”<sup>36</sup> Another element to ensure is the existence of checks and balances keeping the authority accountable on its amplitude to require an export authorization for a research activity.

### Addressing Dual-use Research Through Trade Controls: Current Approaches

Implementing trade controls in an academic context is particularly challenging. On the one hand, researchers, already faced with a number of ethics and integrity rules, safety and security regulations, and ensuing licenses and approvals, are required to take additional mitigating measures and produce extra paperwork for conducting research. On the other hand, authorities, often subject to spare resources and within the limits of available expertise, need to process license applications quickly, assess the risks stemming from complex research, conduct outreach activities, and inspect whether research organizations conform to existing obligations set in the law. The distinct mind-set encountered in academic environments hints at the intrinsic difficulties in communicating export control risks and imperatives to the academic and scientific community. For instance, an official from the US Department of Commerce (DOC) noted that the initial efforts of US authorities—about 15 years ago—to reach out to a university audience were unsuccessful.<sup>37</sup> Only when they contacted those higher in rank (deans, faculty presidents), were they effective in building bridges of understanding and communicating trade control objectives to scientific staff and students. Likewise, in Europe, Hungarian authorities were confronted with a similar attitude and a negative predisposition towards governmental controls of sensitive research during awareness raising seminars conducted in the past years in selected universities.<sup>38</sup>

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34 For example, Article 5 §3 of the German basic law foresees that “arts and sciences, research and teaching shall be free.” It is also noted though that “the freedom of teaching shall not release any person from allegiance to the constitution.”

35 Andre Oosterlinck, “The Modern University and its Main Activities,” in Luc E. Weber and James J. Duderstadt, *Reinventing the Research University* (France: Economica, 2004), p. 121.

36 United Kingdom Export Control Act, 2002, pp. 5-6, available in: <[http://www.legislation.gov.uk/ukpga/2002/28/pdfs/ukpga\\_20020028\\_en.pdf](http://www.legislation.gov.uk/ukpga/2002/28/pdfs/ukpga_20020028_en.pdf)>.

37 Discussion with the Director of Office of Nonproliferation and Treaty Compliance, A. Lopes, December 3, 2015.

38 Discussion with Director of the Hungarian licensing authority, September 24, 2015.

## The State of Play in the European Union

Researchers and research organizations in the European Union experience varying approaches adopted by different Member States. An issue of central importance in implementing trade controls in the research context is the clarification of decontrol notes: What could be a working definition for “basic scientific research” in view of trade control law? How can software and information “falling in the public domain” be defined? The EU dual-use regulation does not clarify further the application of decontrol notes save the definitions provided in the framework of MECRs.<sup>39</sup> In the same line, most Member States have not adopted any national legislation or guidance on the nexus between trade controls with research.

Despite this, certain EU Member States have attempted to clarify how these exemptions shall work in practice.<sup>40</sup> For instance, as regards the publication of research deemed dual-use, the British and Dutch authorities consider that the process of making research available for publication abroad can be subject to authorization.<sup>41</sup> In practical terms, submitting a publication containing sensitive data or methodologies in a journal or a publishing house outside the EU could require an export authorization in the view of certain Member States. With this in mind, it is worth wondering whether any scientific papers—apart from the Fouchier work—have been requested to take an export authorization in any EU Member State. Concerning the public domain exemption some Member States such as the UK and Germany consider that when controlled items and technologies are to be bought from a supplier who controls the supply, or require registration or are restricted for access by certain people, then they do not pertain to the public domain.<sup>42</sup> When it comes to technology and software transfers, such general principles may need further clarifications and guidance. Concerning the enforcement of such controls, some Member States are known to have implemented both outreach activities and controls toward research organizations particularly those being active in nuclear and defense related research. For instance, in Germany, some of the most renowned research establishments conducting research of both basic and applied nature have taken specific internal measures as a result of such government communications and awareness raising seminars.<sup>43</sup>

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39 Definitions used invariably by all MECRs: ‘Basic scientific research’ or ‘fundamental’ is experimental or theoretical work undertaken principally to acquire new knowledge of the fundamental principles of phenomena or observable facts, not primarily directed towards a specific practical aim or objective. ‘In the public domain’ means “technology” or “software” which has been made available without restrictions upon its further dissemination.

40 See for instance: UK Department of Business, Innovation and Skill (BIS), Export Control Organization, *Guidance on Export Control Legislation for Academics and Researchers in the UK*, 2010, available in: <[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/68680/Guidance\\_on\\_Export\\_Control\\_Legislation\\_for\\_academics\\_and\\_researchers\\_in\\_the\\_UK.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/68680/Guidance_on_Export_Control_Legislation_for_academics_and_researchers_in_the_UK.pdf)>.

41 Discussion with UK official in the King’s College Event on Intangible Technology Controls in Industry and Academia, March 29, 2016.

42 UK BIS, *Guidance for Academics*, p. 8; Discussion with German official in the margins of the 42<sup>nd</sup> Dual-Use Coordination Group, pp. 23-24 October, 2013, Brussels.

43 The Helmholtz and the Fraunhofer Associations conduct research of mainly basic and applied character respectively and both have in place export compliance structures in the different establishments of their associations. Discussions and interviews with the export control officers from Helmholtz Association Berlin (HZB) and Fraunhofer, December 2015.

Thus far, the EU experience points to a non-compact and homogeneous approach. The insight of practitioners working in different parts of the R&D chain is enlightening. Compliance officers in certain research centers feel perplexed in deciding whether a publication is sensitive or whether sharing a source code requires an export authorization.<sup>44</sup> In addition, industry compliance officers confirm that export controls affect their collaboration with academia.<sup>45</sup> For example, technology transferred in the course of collaborative projects may be subject to an export authorization when research partners are located outside the country of establishment. To quote one of the officers, “We apply export controls *vis-à-vis* academic institutions in the same way as for other research partners.”<sup>46</sup> Moreover, technology developed may be controlled and thus, subject to authorization. Information classified due to proprietary or security reasons warrants certain assurances and may require export authorizations as well. It might be also necessary for companies to ensure that their partners can only access those parts of their information systems that relate directly to the project in execution and/or for which an export authorization has been granted. Another practitioner noted that sometimes research institutes are not aware of trade control issues and researchers challenge the applicability of trade control provisions as pursued through non-disclosure agreements.

### **The Recast of the Regulation: An Opportunity?**

The reform of the EU trade control system may represent an opportunity not to be missed. A long process of public consultation, initiated with the Commission’s Green Paper from 2011, led to a proposal set forth by the EC for streamlining and modernizing the dual-use regulation. The proposal suggests, *inter alia*, the introduction of further EU general authorizations (e.g., intra-EU transfers, low-shipments, and large projects), the revision of terminology and previous ambiguous language (e.g., definitions of export, exporters, and transit) and the reform of the catch-all clause. The new text refers to research in recital five when discussing the imperative not to hinder internet security research. Also, recital eight emphasizes the need for a new definition of exporter captures all different categories of natural persons involved in the export of dual-use items including researchers and even a person downloading controlled technology.

Most interestingly, the revised language introduced for controls on intangible transfers of technology has de facto some bearing for research activities. Under the new definition of export and exporter the mere transmission of technology to a destination abroad is not any more controlled. However, in the case where the technology is released to a legal or natural person abroad, an export authorization will be still necessary. This amendment aims to render the use of cloud services less problematic.<sup>47</sup> Further interesting provisions include the applicability of controls in items contained in a person’s luggage which are to be exported outside the EU, the control of technical assistance in connection with WMD or controlled military end-uses,

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44 Ibid.

45 This is the result of an online survey gathering responses from forty industry practitioners. The survey ran from December 9, 2015 to January 8, 2016 and the outcomes will be made available in the doctoral study on the interferences between trade controls and research to be published in 2017.

46 Ibid.

47 However, the American approach provides for additional safeguards such as encryption of transmitted data and assurances that the cloud provider’s servers are not located in restricted countries.

and the provision for an EU General Export Authorization for intra-company transfers aiming to facilitate technology and software transfers among the affiliates of a parent company.<sup>48,49</sup> Presumably such facilitations could also apply for transfers between research centers of the same institution if the necessary conditions are fulfilled.

The proposal does not take any steps to clarify the decontrol notes and it does not refer explicitly to the need for compliance measures by and outreach activities towards academic institutions. One could argue that the exporter definition includes also researchers and thus by extension, any consequent responsibilities concern researchers as well. From one point of view, important questions such as those raised in the H5N1 case remain unaddressed. According to an Italian officer, “as long as the EU regulation does not include an explicit reference to the role of the academic world in relation to trade controls, we lack the means to convince our hierarchy to dedicate resources so as to better tackle the problem of dual-use research.”<sup>50</sup> However, other scholars and practitioners would rather prefer the adoption of guidelines focusing on intangible transfers and the role of academia. Interestingly, 76% of the respondents that participated in an online public consultation launched by the European Commission last summer supported the idea for some sort of guidance on this topic.<sup>51</sup>

The way forward towards the adoption of the new regulation is long and it requires the approval of the EU Member States and the European Parliament prior to becoming the new rule. The deliberations to come in the relevant formations of the Commission and Council are expected to be intense. As one experienced expert estimates, the final text of the regulation will maybe have little relation with the proposed one.<sup>52</sup> The new regulation aspiring to “generate the modern capabilities the EU needs for the coming decade” should consider ways to address satisfyingly the challenges stemming from the application of controls to research activities.<sup>53</sup>

### The American View

US authorities have a clear and pragmatic approach to clarify the role of trade controls with regards to research. In the first place, they distinguish between inputs to research that can be controlled if covered by the Export Administration Regulation and outputs that are not

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48 EU Commission, “Proposal for a Regulation of the European Parliament and of the Council Setting Up a Union Regime for the Control of Exports, Transfer, Brokering, Technical Assistance and Transit of Dual-Use Items (recast),” COM(2016) 616 final, Brussels, 2016, <[http://trade.ec.europa.eu/doclib/docs/2016/september/tradoc\\_154976.pdf](http://trade.ec.europa.eu/doclib/docs/2016/september/tradoc_154976.pdf)>, see article III.

49 The formerly separate legal basis for technology—covered by the regulation—and technical assistance provided through the cross-border movement of persons—covered by the Council Joint Action 2000/401/CFSP—has been merged into the recast regulation.

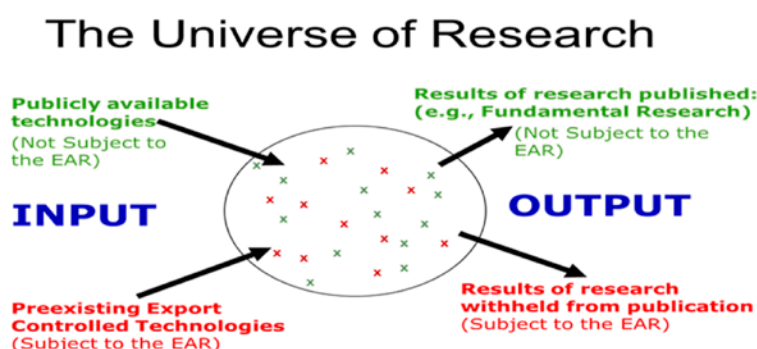
50 Presentation in the 7th Export Control Working Group meeting “Complying with Trade Controls in a Research Setting,” November, 2015.

51 EU Commission, “Impact Assessment: Report on the EU Export Control Policy Review Brussels,” SWD (2016) 315 final, Brussels, 2016, pp. 52-53.

52 This was the experience with the former proposal amending the old dual-use regulation 1334/2001. Discussion with Pr. Dr. Quentin Michel.

53 EU Commission, “Impact Assessment: Report on the EU Export Control Policy Review Brussels,” SWD (2016) 315 final, Brussels, 2016, p. 5.

controlled if no information is withheld in application of proprietary or security restrictions.<sup>54</sup> The distinction implies two possibilities for trade controls to come into play. The first concerns the case where existing controlled items, technical information, or software is used as input in research. This means that researchers dealing with such controlled commodities will need to comply with export and deemed export obligations applying each time. Deemed export rules in particular may require export authorizations to be in place for foreign nationals working in an American laboratory and accessing controlled information. The second possibility concerns the case where outcomes generated by research are subject to proprietary or security restrictions. Again in this case, an export authorization shall apply for releasing abroad controlled information. On the contrary, research that is to be shared broadly within the research community and for which researchers have not accepted restrictions for proprietary or national security reasons is considered as ‘fundamental research’ and is free from constraint.<sup>55</sup> The applicability of the US trade controls is described vividly in the figure I below.



*Figure I: Dealing with the dual-use research in the US context.<sup>56</sup>*

Second, the law, as amended recently, provides that information or software arising during or resulting from fundamental research—this is the term used for basic research in the US—is excluded from the scope controls.<sup>57</sup> In addition, research that is consistent with prepublication reviews and obligations set under national security controls is also considered as “fundamental research” and therefore, it can be exported freely.<sup>58</sup> Such an approach presupposes the existence of a reliable and strong security control system by government agencies for federally funded research.

54 15 CFR 730-774. The Export Administration Regulations (EAR) setting the rules for the transfer and export of commercial dual-use equipment, materials and technologies, administered by the Bureau of Industry and Security (BIS) at the Department of Commerce, can be consulted in: <<https://www.bis.doc.gov/index.php/regulations/export-administration-regulations-ear>>.

55 15 CFR §734.8 (c) as amended in December 31, 2016.

56 Figure from the presentation “The Nexus between Strategic Trade Controls and Academic Research,” offered by Alexander Lopes, US DOC, in the 7<sup>th</sup> ESARDA Export Control Working Group, December 3-4, 2015.

57 15 CFR §734.8 (a).

58 See notes 1-3 in §734.8.

Third, in the same fashion that the “publishability” of research is the main criterion for applying the fundamental research exemption, the EAR defines when information and software are considered as “published” or, the “public domain exemption”<sup>59</sup>:

- Library collections open to the public;
- Printed books and pamphlets;
- Public posts on internet websites;
- Information distributed unlimitedly in a conference or released by instruction in a catalogue course; and
- Published patents and open patent applications.

The practical implementation of such rules does not always come at ease for universities and firms. For example, the most renowned US universities invest considerable resources and efforts in ensuring compliance with EAR and ITAR rules.<sup>60</sup>

On the flip side, the US approach does not consider a different contingency: what about the case where one publishes controlled or sensitive information solely with the intent to circumvent controls? Logically, most of the time a company does not have an interest in publishing commercially valuable information but the current practice may allow loopholes. In addition, whereas the fundamental research exemption intends to protect the free dissemination of information, one could ask what shall apply for fundamental research that is deemed as particularly sensitive. A plausible answer could be that trade controls cannot address all threats and indeed are not the sole instrument in place for tackling dual-use research.

## The Governance of Dual-use Research

At this point it is useful to consider what mechanisms are in place or could be used for the oversight of sensitive research activities. All instruments discussed below can be considered as mutually reinforcing to trade controls yet some of them are of more direct relevance to export control objectives. The examples set forth do not represent an exhaustive compilation of existing measures or possible mechanisms for future consideration.

### Measures Complementary to Trade Controls

Visa screening procedures and student vetting schemes are useful instruments aimed at ensuring that criminals or individuals of certain nationalities are not able to access particularly sensitive information. Preventing specialized teaching or training of certain nationals in disciplines relating to nuclear activities has been pursued internationally at the highest level through the

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59 15 CFR §734.7.

60 This was one of the main finding in C. Charatsis, *Interferences between Nonproliferation and Science*, (forthcoming).



adoption of the United Nations Security Council resolutions 1874 (2009) and 1737 (2006) in relation to sanctions against North Korea and Iran.<sup>61</sup>

Although highly discriminatory, visa screening may represent a plausible approach for certain cases. As Rebolledo observes, “the structure of technical-scientific knowledge in a given state could be described as a system with inflows (imports of ITT and immigration of foreign students, technical experts, and researchers seeking scientific knowledge) and outflows (exports of ITT and emigration of national technical experts and scientific researchers seeking scientific knowledge abroad) where changes in one function would probably affect the other one.”<sup>62</sup> In other words, what would be the added value of implementing trade controls preventing EU nationals from sharing knowledge with foreign nationals abroad when they are allowed to come to the EU and acquire sensitive knowledge?

In the US, visa screening procedures have also been considered as an alternative to the problematic application of the deemed export control rule. The deemed export notion considers that any release of controlled ‘technology’—as understood in the regulations—to a foreigner within the US amounts to an export to this foreigner’s country for destinations requiring an export license. The deemed export rule has been challenged as burdensome while at the same time its current interpretation allows for loopholes.<sup>63</sup> On the other hand, leaving the monitoring of the flow of students solely up to the visa processing system has been also considered insufficient or cumbersome.<sup>64</sup>

In the EU, the “New Lines for Action in Combating the Proliferation of WMD and their Delivery Systems” acknowledges the risks relating to the exploitation of knowledge and technology for malicious purposes and recommends increasing cooperation in terms of consular vigilance in order to tackle this problem.<sup>65</sup> In fact, EU Member States address such concerns mainly through visa screening procedures and other student vetting systems. However, one should not forget that visa policies and procedures falling primarily within the national discretion and common standards at the EU level have not been achieved so far. For short stays—up to three months—common visa procedures for the Schengen Area apply.<sup>66</sup> However, for longer stays, applicants are required to follow the procedures set at the national level (normally a resident

61 See §28 of the UN Security Council resolution 1874, S/RES/1874, New York, 2009 and §17 of the UN Security Council resolution 1737, S/RES/1737, 2006.

62 Vicente Garrido Rebolledo, “Intangible Transfers of Technology and Visa Screening in the European Union,” *EU Nonproliferation Papers No. 13, EU Nonproliferation Consortium* (2012), p. 6, <[http://www.sipri.org/research/disarmament/eu-consortium/publications/EUNPC\\_no%2013.pdf](http://www.sipri.org/research/disarmament/eu-consortium/publications/EUNPC_no%2013.pdf)>.

63 For the current interpretation and effectiveness of the deemed export rule see: US Deemed Export Advisory Committee (DEAC), “The Deemed Export Rule in the Era of Globalization,” Report for the Secretary of Commerce, 2007, p. 83, <<https://www.fas.org/sgp/library/deemedexports.pdf>>.

64 See the considerations in adopting of these alternatives: *Ibid*, 30-31.

65 “Council Conclusions and New Lines for Action by the European Union in Combating the Proliferation of Weapons of Mass Destruction and their Delivery Systems,” Council of the European Union, December 17, 2008, <[http://trade.ec.europa.eu/doclib/docs/2008/december/tradoc\\_141740.pdf](http://trade.ec.europa.eu/doclib/docs/2008/december/tradoc_141740.pdf)>.

66 For more information on the Schengen Area visa policies see the website of European Commission Directorate General Home at <[http://ec.europa.eu/dgs/home-affairs/what-we-do/policies/borders-and-visas/schengen/index\\_en.htm](http://ec.europa.eu/dgs/home-affairs/what-we-do/policies/borders-and-visas/schengen/index_en.htm)>.

permit will also be required in addition to a valid visa). In practical terms, the extent to which nonproliferation screening takes place may vary from country to country.<sup>67</sup>

In the UK context, the Academic Technology Approval Scheme (ATAS) operated by the Foreign and Commonwealth Office exemplifies how nonproliferation can be addressed by such a means. The ATAS is a student vetting scheme for nationals who originate from countries other than the UK, EEA, or Switzerland and wish to study in a British university.<sup>68</sup> In practice, the ATAS certificate seeks to ensure that individuals who apply to study certain sensitive subjects do not have links to WMD programs. ATAS certificates are required in addition to the normal visa procedures only for certain post-graduate courses.

### Systems in Mutual Reinforcement with Trade Controls

Whilst trade controls have traditionally focused on tackling threats originating outside the borders of a given country, there are a host of security measures for addressing in principle risks within the borders of a state. Physical protection measures for research facilities, classification policies for research having security implications or entangling proprietary rights, and best practices for IT security (encrypted emails and reliable file sharing platforms) are broader security measures having some usefulness also from an export control angle. Such measures are implemented pursuant to national statutory regulations as well as international agreements and standards set sometimes by the nonproliferation treaties' implementing organizations.<sup>69</sup> The IAEA is particularly active in setting such standards with universal acceptance. Concerning the proliferation of bio-chemical technologies and especially biosafety and biosecurity measures, the picture is more fragmented. In fact, there are several organizations having published guidance at both the national and international level.<sup>70</sup> The role of the World Health Organization is also of particular importance for life science research of dual-use concern.

### Early Warning Mechanisms

Admittedly, governments can exercise control over R&D activities through schemes for funding academic research, public-private partnerships, and other industry originated projects. This is an advisable approach mainly because precautions taken at an early stage of a research

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67 Information drawn from discussions with European Union Member State representatives in the margins of the 55<sup>th</sup> Dual-Use Coordination Group meeting, September 24, 2015.

68 For more information on ATAS see the webpage of the United Kingdom government: <<https://www.gov.uk/guidance/academic-technology-approval-scheme>>.

69 For instance, the "Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act" of 2001 United States Patriot Act and guidance such as the "NIH Guidelines on Research Involving Recombinant or Synthetic Nucleic Acid Molecules," National Institutes for Health, 2016, <[http://osp.od.nih.gov/sites/default/files/resources/NIH\\_Guidelines.pdf](http://osp.od.nih.gov/sites/default/files/resources/NIH_Guidelines.pdf)> are notable examples of security and safety rules applying to federally funded bio-technology research in the US. For an overview of the US biosafety and security governance measures for sensitive life science research see Jonathan B. Tucker, *Innovation, Dual-use, and Security, Managing the Risks of Emerging Biological and Chemical Technologies* (Cambridge: The MIT Press, 2012), pp. 49-55.

70 Indicatively see: Peter Clevestig, *Handbook of Applied Bio-Security for Life Science Laboratories* (Stockholm SIPRI, 2009); The Dutch Royal Netherlands Academy of Arts and Sciences (KNAW), *The Code of Conduct for Biosecurity* (Amsterdam: KNAW, 2008).

project can benefit its smooth and secure execution all along its life cycle. Most governments apply specific national controls and classification schemes for defense or military-oriented research, for example. It should be noted that classification policies are presented quite often as an alternative to trade control measures. Researchers, coming especially from countries known to apply strict classification systems, have noticed that such an approach could eventually lead to over classification and more rigid restrictions compared to trade control requirements.<sup>71</sup> Therefore, it is advisable to use such measures only when necessary and in a moderate way.

In the EU context, the evaluation system for proposals submitted for funding in the framework of Horizon 2020 comprises an “ethics appraisal screening” including assessments for dual-use research in the meaning of the regulation.<sup>72</sup> It is notable that the H2020 national experts in charge of assessing such proposals use the Technology Readiness Level (TRL) metric in order to estimate the imminence of a research project to deliver a practical application of dual-use concern.<sup>73</sup>

Furthermore, in the life sciences, the oversight of dual-use research may rely on government committees and advisory bodies composed by both academic and security experts who are called upon to assess risks and benefits of sensitive research at any stage of a project. One could mention the American NSABB and the Dutch Biosecurity Office set up in 2009 and 2013 respectively.<sup>74</sup> It is notable that the competencies and status of such boards may differ. For example, while the Dutch Biosecurity Office is responsible mainly for awareness raising activities and policy support, the Danish Centre for Biosecurity and Bio-Preparedness (CBB) is also in charge of licensing for bio-related research.<sup>75</sup>

Contrary to early warning mechanisms, the editorial boards of journals or the reviewers involved in the peer review process could report to responsible authorities or university committees their concerns in the event of an alarming publication requiring possibly a cost-benefit analysis.

### Self-governance Measures

Governmental oversight works in synergy with internal measures adopted by research institutions and industry. These efforts are either voluntary or at times represent statutory obligations. In this category belong codes of conduct, ethics committees, and internal regulations adopted by universities. In Belgium for example, the University of Leuven (KUL) has set up separate committees in charge of different aspects of research such as medical ethics, social and societal ethics, laboratory experimentation, data privacy, scientific integrity, and most interestingly,

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71 Discussions with bio-experts in the context of 3<sup>rd</sup> Annual Conference on the “Impact of Export Controls on Higher Education & Scientific Institutions” organized by AUECO and the University of Virginia.

72 The Ethics Appraisal procedure differentiates presently between dual-use research as understood in the regulation, research with exclusive focus on civil applications and research results that can be misapplied. Security concerns were addressed also in the FP7 in the context of ethics review; however at the time there was no such differentiation.

73 The TRLs metric was first developed by NASA scientists in 1970s and the updated version is available in: <[https://www.nasa.gov/directorates/heo/scan/engineering/technology/txt\\_accordion1.html](https://www.nasa.gov/directorates/heo/scan/engineering/technology/txt_accordion1.html)>.

74 For more information visit the websites of NSABB and Dutch Biosecurity Office in: <<http://osp.od.nih.gov/office-biotechnology-activities/biosecurity/nsabb>>; <<http://www.bureaubiosecurity.nl/en>>.

75 Information retrieved from the website of CBB in: <<https://www.biosikring.dk/home/>>.

dual-use research.<sup>76</sup> Especially for life science research involving clinical trials and animals testing, guidance documents and codes of conduct are provided by international organizations and university networks while many universities have approval committees in place.<sup>77</sup> In relation to this, funding organizations such as the Economic and Social Research Council (ESRC) in the UK may require universities to have some kind of internal mechanism for ethical review of all research funded under their frameworks. Other internal measures take the form of so-called “Technology Control Plans” (TCPs) monitoring who has access to what information and ensuring that sensitive information is not exported to unauthorized users either on-site or abroad. Although generally such measures are taken voluntarily by research organizations and firms, the application of strict related legislation can indirectly trigger the implementation of internal compliance mechanisms.

Moreover, the role of National Academies and Research Councils is highly relevant to the governance of dual-use research. Presently, their contribution includes ad hoc policy support advice and guidelines for implementing self-regulatory measures. For instance, the Dutch Royal Academy of Arts and Sciences published a report as early as 2013 for improving biosecurity and the European Academies Science Advisory Council (EASAC) prepared a special report dedicated to concerns about “gain of function research.”<sup>78</sup> Logically, the adoption of guidance and standards by academic associations must be well received by the academic community.

### **Conclusion: Contemplating the Role of Trade Controls for the Governance of Dual-use Research**

The present paper considers a number of issues pertaining to the governance of dual-use research. More than an account of all issues addressed, this concluding section attempts to respond to whether trade controls are a “fit for purpose” instrument as regards the oversight of dual-use research and what initiatives could be taken for increasing the clout and leverage of trade controls towards dual-use research.

Building a WMD requires at least three elements: (1) special material (2) technological equipment and related knowledge (3) explicit information and technical expertise.<sup>79</sup> It can be argued that among the three, the element posing the greatest difficulty to acquisition is tacit knowledge but this varies depending on a weapon’s type and performance capabilities of a

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76 The relevant information can be found in the KUL website <<https://www.kuleuven.be/english/research/integrity/committees>>.

77 Indicatively see “Responsible Life Sciences Research for Global Health Security: A Guidance Document,” World Health Organization, Geneva, 2010, <[http://apps.who.int/iris/bitstream/10665/70507/1/WHO\\_HSE\\_GAR\\_BDP\\_2010.2\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/70507/1/WHO_HSE_GAR_BDP_2010.2_eng.pdf)>.

78 “Improving Biosecurity, Assessment of Dual-use Research,” Royal Netherlands Academy of Arts and Sciences, 2013, <<https://www.knaw.nl/shared/resources/actueel/publicaties/pdf/advies-biosecurity-engels-web>>; “Gain of Function: Experimental Applications Relating to Potentially Pandemic Pathogens,” German National Academy of Sciences Leopoldina for EASAC, 2015, <<http://www.easac.eu/home/reports-and-statements/detail-view/article/easac-report-1.html>>.

79 The impact of an attack involving a WMD will also depend, apart from the destructive power of the weapon itself, on the capacity of the means of delivery.

weapon.<sup>80</sup> Consequently, it is legitimate to include technology (technical data and assistance) and software in the scope of trade controls.

As explained above, trade controls were not designed to oversee the conduct of all different types of dual-use research. They just represent a means to control certain research activities falling within the scope of controls and thus the term “export controlled research” may be more pertinent in this context. Without overstating the relevance of trade controls for dual-use governance, the benefits for the latter are multiple. Trade controls function as a safeguard for certain types of activities that can be misused and offer many opportunities for reinforcing the accountability of research organizations originating in either the academic or industrial context. Importantly, the practical implementation of trade controls could act synergistically with physical protection, safety, and other security measures founding thereby a net for the prevention of different types of threats.

Bearing this in mind, activities undertaken in the framework of the United Nations Security Council resolution 1540 Committee could increase the research community’s awareness and generate added value for other security objectives, too. In addition, enhanced cooperation coordinated at the level of MECRs could improve the present implementation of technology controls among participating states. For example, a possible agreement of participating states upon common guidelines or standards for technology transfers in a research context could have high resonance among the key stakeholders concerned. In relation to this, reaching out to non-participating countries and communicating best practices could benefit the international harmonization of controls.

Trade controls do not intend to hinder unduly the free dissemination and diffusion of peaceful research. This needs to be made clear to the greatest extent possible by clarifying the decontrol notes and their application, preferably at international level. The EU Member States do not have unlimited possibilities to consider in this regard. They could opt for one of the following:

- Follow the US paradigm by exempting from the scope of controls all publishable research that respects security and proprietary classifications;
- Continue applying trade controls as an ad hoc manner for the assessment of research of dual-use concern as Dutch have done in the H5N1 case; or
- Establish a *sui generis* methodology for evaluating sensitive research based on criteria such as the overall utility, sensitivity and the readiness of research to be misapplied.

It must be acknowledged that the proliferation of WMD has occurred in the past and its continuing practice could harm the overall credibility of trade controls as a nonproliferation tool. Trade controls, as any other security measure, cannot respond to every threat. The realistic contemplation of the world suggests that different asymmetric factors need to be considered. For example, an irrational or determinant actor can always find a way to circumvent a security measure. However, these acknowledgments should not be used as an excuse for underestimating the contribution of trade controls in meeting security objectives.

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80 Jonathan B. Tucker, *Innovation, Dual-use, and Security, Managing the Risks of Emerging Biological and Chemical Technologies* (Cambridge: The MIT Press, 2012), p. 23.

Above all, the dual-use problem of technology relates to an underestimated aspect: the education and training of the next generation of scientists on the security implications potentially connected to the development of emerging technologies. Such training could include export control concepts and principles and should also aim at developing the ethos and character of researchers in confronting dual-use dilemmas.