TRADE CONTROL AND DUAL USE RESEARCH: A DIFFICULT COMPROMISE

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INTRODUCTION

Since and maybe even before the discovery of the Greek fire based on a petroleum-based mixture during the reign of Constantine IV Pogonatus (668–685) by Callinicus of Heliopolis to the development of fully autonomous weapons, new means of war have often been based on new scientific findings. Examples of researchers, including research institutions that have contributed directly or indirectly to the development of new armament are well known such as the Kaiser Wilhelm Institute for Physical Chemistry who provided its expertise with gas chemistry to be used for chlorine clouds at Ypres 1915 during WWI.

The necessity to restrain from the dissemination of knowledge and discoveries among scientists to avoid their potential misuses has been discussed in 1939 by Enrico Fermi and Leo Szilard. They were considering that information contained in the article on "Products of Neutrons in Uranium Bombarded by Neutrons" which they intend to publish in ***Physical Review*** could provide useful elements for the German nuclear physic research community and consequently Nazi Government for the elaboration of nuclear fission weapons. Finally, they decided to publish it, after the release in ***Nature*** of an article on "Number of Neutrons Liberated in the Nuclear Fission of Uranium" by another research team containing almost similar information[1].

If certain researchers were concerned by the potential applications of their discoveries, the topic of academic proliferation was not a major concern for authorities and international trade control regimes. One of the reasons might be due to the fact that universities and research centres were not seen as potential suppliers of items targeted by international treaties like the Treaty on the Non-Proliferation of Nuclear Weapons. However, if during the cold war the dissemination of academic research through publications was, in principle, not controlled, scientific collaboration between NATO and Warsaw Pact countries was almost non-existent until Stalin's death in 1953. The situation started to change at the end of the fifties with the signing of a collaboration agreement in certain fields between the United States and Soviet Union but the collaboration remained difficult, in particular due to the asymmetry of research organisations. For Western countries scientific collaboration was organized locally and directly by researchers while for the Soviet Union it was centrally controlled on the basis of stipulated quota[2]. However, if academic interactions between East and West were potentially under scrutiny of their authorities and submitted to the obtention of travel visas, it wasn't prohibited

[1] Von Halban, H., Joliot, F. & Kowarski, L. Number of Neutrons Liberated in the Nuclear Fission of Uranium. Nature 143, 680 (1939). https://doi.org/10.1038/143680a0.

[2] Graham, Loren R. "Big Science in the Last Years of the Big Soviet Union." Osiris, vol. 7, 1992, pp. 49–71. JSTOR, www.jstor.org/stable/301767. Accessed 10 Feb. 2021.

to organize gatherings of the scientific community including delegations of countries from all over the world[3].

Such international exchanges of knowledge were possible as long as it was not directly related to what was considered by States as sensitive technology. For the United States and some of its allies three lists[4] of items have been adopted and any transfer to Communist countries of items listed was prohibited or submitted to prior authorisation adopted by consensus[5]. Even if those lists included the control of technologies related to items listed, it is unclear if academic activities were impacted or not. Discussions between States on the implementation of the lists and even the lists itself were confidential so it is almost impossible to know if research activities organized by Universities during the sixties have been prohibited or submitted for authorisation. However, from the different open sources available it seems that the focus was essentially on industries even for technology transfers[6].

The establishment of the different export control regimes – Zangger Committee, NSG, Australia Group, MTCR – in the eighties didn't change the situation regarding the control of activities in universities and research centres. States common understanding was that research activities conducted in Universities were essentially fundamental science and this research was exempted of trade control by all regimes.

The revelation of academic proliferation cases[7] in the seventies and the development of virtual means of transfer have slowly constrained States authorities to change their policy regarding the control of university research activities. This new paradigm consists of a switch in interpretation of their activities by considering that they may not exclusively conduct fundamental research.

If in principle such switch ended an illogical exception – most universities are not conducting only fundamental research- its implementation raised several difficulties.

[3] The international Congresses on Biochemistry and Molecular Biology are a good example on how international scientific community interactions were possible during the cold war (Reminiscence Articles 54 Years of International Congresses of Biochemistry and Molecular Biology, IUBMB Life, 55(4–5): 183–191, April–May 2003, https://iubmb.onlinelibrary.wiley.com/doi/pdfdirect/10.1080/1521654031000124186, accessed 11 Feb. 2021).

[4] The three lists were: the munition list that includes all military items, the atomic energy list that includes sources of fissionable materials, nuclear reactors and their components, and an industrial/commercial list.

[5] This informal group established 1950 known as COCOM for Coordinating Committee for Multilateral Export Controls gather initially representatives from United States, United Kingdom, France, Italy, Netherland, Belgium and Luxembourg, later joined by West Germany, Norway, Denmark, Canada, Japan, Greece and Turkey.

[6] Some transfers of technology in violations of the measures have been committed by Toshiba and Konsberg early eighties. See the analysis of Joseph Edward Gregory in "Controlling the Transfer of Militarily Significant Technology: COCOM After Toshiba", Fordham International Law Journal, Volume 11, Issue 4 1987 Article 6.

[7] In particular, the case of A.Q. Khan who largely contributed to the elaboration of the Pakistanis nuclear weapons. He graduated in metallurgy from the University of Karachi. He studied further in what was then West Germany, and in the Netherlands. At the Catholic University of Leuven in Belgium he was awarded a PhD in 1972.

1.

THE DEFINITION OF ACADEMIC PROLIFERATION

The difficulty to define academic proliferation is directly linked to the difficulty to define academic activities. As already stated, the principle that universities are only conducting fundamental research is not accurate any more even if it was the case previously. Universities have a full panel of activities usually subdivided into two mains groups: teaching and researching. The subdivision is essentially conceptual and both groups are interacting constantly. Courses, especially Master ones and PhD seminars, are built on the basis of the latest development of academic research on the topics. Audience of publications or working papers are students, colleagues as well as economic operators or political authorities. Universities are providing consultancy to stake holders (public authorities, economic operators) and are developing applied research programs in cooperation with industries. Moreover, they are encouraged to host and develop commercial applications related to their research findings[8].

Therefore, universities and research centres could also be engaged in activities that might appear similar to the ones conducted by industrial operators.

Considering that Universities couldn't be limited anymore to fundamental science, it will be irrelevant to elaborate an ad hoc definition of academic proliferation as long as it is not fundamentally different to one of other operators. Therefore, it might be more appropriate to attempt to identify academic proliferation specificity via the following two parameters: firstly items including technology necessary for the research activities and secondly research objectives.

[8] As example, Ghent University in Belgium has developed more than 30 spin-off companies in the last 5 years (https://www.ugent.be/techtransfer/en/spin-offcompanies).

2. ACADEMIC PROLIFERATION BY ITEMS CATEGORIES

Academic proliferation by items could be subdivided in five categories of risk. The first includes the potential transfer of conventional weapons. The second includes the potential transfer of items listed by international and/or EU trade control regimes dedicated to the fight against the proliferation of weapons of mass destruction (WMD) like the NSG or the Australia Group. The third includes potential transfer of items not identified by a trade control regime but that could contribute to the elaboration of a conventional weapon or a WMD. The fourth concerns the import of items originating from a sensitive supplier as defined, for instance, by the Kimberley process for the import of diamonds. Finally, the fifth category is focusing on the risk associated to potential end-users like a country or an entity targeted by the UN Security Council or other trade restrictions adopted by a State or a group of States like the EU[9].

Lists and categories of controlled items have largely increased over the last two decades. Initiated in the fifties with COCOM, today it includes a large number of item rules by specific trade control instruments.

2.1. Conventional Weapons

The list of conventional weapons submitted to trade control has been adopted by the Wassenaar Arrangement[10] and implemented in the EU by Council Decision of February 19 2019[11]. It is difficult to assess if research conducted in universities might involve an item identified in this weapons list. The range of the 21 entries is broad as it includes weaponry like rifles, torpedoes, war vessels including submarines but also satellite navigation systems or chemicals and related software.

[9] See EU Sanctions Map, https://sanctionsmap.eu/#/main.

[10] https://www.wassenaar.org/control-lists/.

[11] Common Military List adopted by the Council on 18 February 2019 (CFSP) (2019/C 95/01), Official Journal of the European Union 12.3.2019 C 95/1.

The probability that a European research centre or a university will transfer an item listed to a third state is rather low as it seems that research related to conventional weapons in nearly all European States is mostly conducted outside universities directly by the concerned industry. However indirect university cooperation to the development by a third State of weaponry listed could not be completely excluded. E.g. a cooperation project to improve and test the efficiency of a civil satellite navigation system that remains below controlled parameters but due to research findings, the results will incidentally meet those parameters.

Moreover, certain European universities have in their founding act or have signed up to a commitment of non-contribution to military research. It is the case, in particular for some German Universities. The commitment could be taken directly by the University or in some States (Lander) it could be part of tertiary education laws. Therefore, in one of the five landers who have adopted this "civil clause" as part of their tertiary education law, the principle will be compulsory for any university receiving funds from the Lander[12].

2.2. Dual Use Items

If for weapons, the risk of transferring an item listed by the Munition list of Wassenaar Arrangement or by the EU Common Military List is rather low due to its dedicated end-use, the situation is more complex for dual-use items. For EU operators including universities, dual-use items are listed in the Regulation 2021/821[13]. The list is divided in numerous entries and included 10 categories. Some of those categories, like electronics, computers, aerospace or sensors and lasers, are echoing directly research activities that might be conducted in university research laboratories. Contrary to industrial operators who are mainly transferring equipment and material, universities are not manufacturing and their transfers are essentially technology often in an intangible form or the provisioning of technical assistance. It could consist, for example, in a transfer by virtual means of data, software, research findings to end-users located in a third country. Therefore, controlling their dual-use items related activities are confronted by two main difficulties.

The first is the awareness of scientific community that some of their activities might fall under the scope of the trade control legislation and might require an authorisation from their public authorities. In this regard, the principle of allowing a public authority to review and potentially refrain from a collaboration between two laboratories might be perceived by researchers as an infringement to the principle of academic freedom. This perception will be reinforced by the fact that most academics consider that their research objectives are not related to weapons of mass destruction or any other prohibited activities. This understanding is intrinsically linked to the misperception of the dual-use items concept. The scientific community

[12] Klaus Boehnke, Is the German 'Civil Clause' a model to prevent the involvement of psychologists in military atrocities?, presidential symposium of the International Union of Psychological Science, International Congress of Psychology, Yokohama, 2016. The document is available at https://www.iupsys.net/dotAsset/afc2207c-a7e9-43c6-a9ef-ae51a90292d0.pdf.

[13] Council Regulation (EC) No 2021/821 of 20 May 2021 setting up a Union regime for the control of exports, brokering, technical assistance, transit and transfer of dual-use items (Recast), Official Journal of the European Union 11.06.2021 L 206/1.

usually understands that the reason to control dual-use items lays in its direct contribution to prohibited uses foreseen by the researcher or his counterparts in the third country when for the authorities it is only the risk of a potential contribution that requests the necessity to control the transfer.

The second is the difficulty for the researcher to identify if the item is listed by the Annex I of the EU Dual Use Regulation. As stated, academics are, in most cases, not transferring material or equipment, but rather technology usually in an intangible form or providing technical assistance. Moreover, subcategories of the controlled list are not necessarily matching the description of activities and items involved in their research. E.g. data transfer of a virtual resistance test under certain conditions of a listed material. In this case, the researcher in the EU has access to a virtual listed item on which he will apply the test resistance. The transfer to his counterparts established in the third country is neither the items, nor the technology but a set of data resulting from the resistance test. Does such operation fall under Annex I of the EU Regulation and requires an authorisation?

2.3. Torture related items

The list of items related to torture and capital punishment are defined by Regulation (EU) 2019/125 of 16 January 2019[14]. This list is divided in two parts: a prohibition list and an authorisation list. The first included items which have no practical use other than for the purpose of capital punishment or for the purpose of torture (guillotines, electric chair, some whips,…). The second includes items that could be used for the purpose of torture or other cruel, inhuman or degrading treatment or punishment (equipment for the dissemination of incapacitating or irritating chemical agents, some barbiturate anaesthetic agents, pelargonic acid vanillylamide).

It is difficult to estimate if activities in universities might be concerned by those items. If for the prohibition list, the probability that the transfer will occur is almost unconceivable, the situation might be different with the authorisation list as long as it includes items that are primarily used for law enforcement purposes and items which, taking into account their design and technical features, present a material risk of use for torture or other cruel, inhuman or degrading treatment or punishment. Therefore, like for dual-use items an indirect academic contribution to a potential misuse by an end-user in a third country could not be completely excluded. Therefore, an authorisation might be required if the research activities involve the transfer of items listed to a third country.

2.4. Conflict minerals

If academic proliferation focuses essentially on risks that listed items might be transferred to a third country, the EU trade control system also includes measures to

[14] Regulation (EU) 2019/125 of the European Parliament and of the Council of 16 January 2019 concerning trade in certain goods which could be used for capital punishment, torture or other cruel, inhuman or degrading treatment or punishment. Official Journal of the European Union 31.1.2019 p. 1–57.

avoid that research activities will, by ordering items from certain suppliers, indirectly finance armed conflict or are mined using forced labour. Presently, two regulations are ruling those imports. The first one is dedicated to four minerals (tin, tantalum and tungsten[15] and the second concerns raw[16] .

For diamonds, it consists in the commitment of the operator to order and use only certified raw diamonds. In principle, in the EU only Kimberley certified raw diamonds can be supplied. Therefore, the risk that research activities might use diamonds that are not certified is almost non-existent except in the case of collaboration with a research laboratory not established in the EU. Consequently, we could wonder if such hypothesis might be conceivable and if researchers in the EU should not require certain guaranties to their counterparts.

For the four minerals the situation is slightly different. The due diligence obligations established by the Regulation does not concern Union importers for which the annual import volume of each of the minerals or metals concerned is below a certain threshold. Those quantities are higher to what might be used by research laboratories and it is doubtless that they are buying minerals without passing by intermediaries. Therefore, due diligence obligations shall normally be supported by university suppliers. However, it will be up to researchers to control if his suppliers are performing due diligence to their supply chain and if they are supplying minerals from Conflict-Affected and High-Risk Areas (CAHRA). To support the implementation of the Regulation and to facilitate the acquisition of non-CAHRA minerals, the Commission should publish a 'white list' of global smelters and refiners[17]. Some industries related to the mining sector have also taken the initiative by adopting a ***Responsible Minerals Initiative***[18]. In particular, it includes a ***Responsible Minerals Assurance Process (RMAP)*** that consists of a system to help companies make informed choices about responsibly sourced minerals and allow them to identify potential suppliers that are acting responsible which is reflected in their supply chain.

2.5. Control of not controlled items

Finally, some academic activities might be controlled, not for items they use or transfer, but rather for the researcher or the research centre with who they intend to collaborate.

It could firstly be consequences of sanctions adopted by the UN Security Council. Some of its Resolution is targeting individuals, entities or the whole country with who

[15] Regulation (EU) 2017/821 of the European Parliament and of the Council of 17 May 2017 laying down supply chain due diligence obligations for Union importers of tin, tantalum and tungsten, their ores, and gold originating from conflict-affected and high-risk areas, Official Journal of the European Union, 19.5.2017, L130 p. 1–20.

[16] Council Regulation (EC) No 2368/2002 of 20 December 2002 implementing the Kimberley Process certification scheme for the international trade in rough diamonds, Official Journal of the European Union, 31.12.2002, L 358 p. 28 – 48.

[17] The document has not been published yet.

[18] http://www.responsiblemineralsinitiative.org/membership/.

collaboration and exchanges are prohibited. E.g. Resolution 2321/2016 concerning Democratic Republic of North Korea decides that all States should, in principle, suspend scientific and technical cooperation involving persons or groups officially sponsored by or representing this country[19].

Factors constraining the envisaged collaboration are not necessary potential misuse of its specific scientific outcomes or the transfer of listed items. The reason for a potential control could be completely independent to WMD or prohibited uses and may fall under others motivations linked to the respect of human rights or the preservation of peace. For instance, the Council Regulation (EU) No 36/2012 of 18 January 2012 concerning restrictive measures in view of the situation in Syria prohibited the transfer of equipment and technology for the oil and gas industry. Therefore, any research cooperation projects related to this sector or using one of the items listed will be prohibited[20].

The reason to control academic activities could also be extended to an item not identified in a control list if the end user has the intention to use it for something prohibited like a contribution to the elaboration of new surveillance technology that might be used to perpetrate human rights violations. The difficulty to implement such provision will be for the researcher to be aware and able to anticipate the end user's intention to misuse the research cooperation agreement. It requests to have a comprehensive view of the activities of the University with who he is cooperating which is usually possible for a long and established cooperation but difficult with new projects.

This principle of controlling non-listed items by focusing on the end-user is called catch-all clause and most national trade control systems have included it. There are three levels of the catch-all clause that progressively increase the researcher's liability. The mechanism constrains the researcher to inform his authorities if he has been informed by his authorities of the sensitivity of the end user, if he knows the intention of the end user to perpetrate human rights violations and if he has ground for suspecting the malevolent intention of the end-user. The liability extension and the proactivity requested for academics was motivated by the fact that he is the one who has the better view of the research objectives of his counterparts. However, it will remain challenging for universities to implement. E.g. it is not obvious that the researcher is fully conscious of all activities conducted in the lab of the collaborating party. Therefore, a cooperation project in one specific field might be sensitive, only if it is considered in the broader context of all activities conducted by the research centre.

[19] Paragraph 11 of the UN Resolution 2321 (2016) adopted by the Security Council at its 7821st meeting, on 30 November 2016 (https://documents-dds-ny.un.org/doc/UNDOC/GEN/N16/407/50/PDF/N1640750.pdf?OpenElement).

[20] Council Regulation (EU) No 36/2012 of 18 January 2012 concerning restrictive measures in view of the situation in Syria and repealing Regulation (EU) No 442/2011, Official Journal of the European Union L 16, 19.1.2012, p. 1–32 amended lastly by Council Implementing Regulation (EU) 2021/29 of 15 January 2021 (Official Journal of the European Union L 12I , 15.1.2021, p. 1–2).

2.6. Politically sensitive countries

The risk of an academic cooperation or collaboration with a partner in a country under sanctions adopted by the UN Security Council[21] or by the EU Council[22] or unliterary by their State Authorities seems hypothetical even if it could not be excluded. To be prohibited, it will require an interaction between researchers of the two countries involving the transfer of something listed or the collaboration with an entity or someone identified by the sanction resolution or the decision. Most of sanctions decided by the UN and the EU involve the freezing of assets of listed persons and entities, travel restrictions on persons listed or export prohibition of conventional weapons. Dual use items and cyber surveillance equipment are categories most often related to academic activities and not often subject to sanctions. In the list of sanctions adopted by the UN or by the EU only Belarus, Democratic Republic of North Korea, Myanmar, Iran, Russia, Syria and Venezuela are targeting dual use items or cyber surveillance equipment. Therefore, risks associated to academic activities are not a contribution to a potential misuse of an item or a technology identified by a sanction but rather a potential collaboration with a listed person or entity. The difficulty in the implementation of those sanctions lays in the fact that academics must be aware that their counterparts are targeted by restrictive measures.

If for countries like North Korea, Iran or Syria academic collaborations will certainly be considered carefully by the researcher due to their proliferation track records, the situation might be different with countries like Ukraine, Turkey or Russia where the knowledge by the researcher of a potential proliferation risk is not as widely covered by the media.

A similar difficulty might be identified for a potential collaboration with individuals listed by UN or EU sanctions. Hosting him in an EU research laboratory will be, in principle, impossible as his visa application will not be granted by the hosting state authority who usually screens applications against sanction databases. The situation is more challenging if the research collaboration with a listed individual is done via virtual exchanges or when exchanges occur in the third country. In this case, it will rely on the knowledge by the EU research laboratory that such individual is listed.

[21] Sanctions adopted under Chapter 7 of the UN Charter.

[22] Sanctions adopted under article 215 of the Treaty on the functioning of the European Union.

3.

ACADEMIC PROLIFERATION BY RESEARCH OBJECTIVES

Academic contribution to weapons development is a controversial topic among the scientific community. For states who have ratified the NPT, CWC, BWC and TPNW, it is clear that any contribution of their scientific community to the development of a WMD is prohibited. The situation might be different for conventional weapons that are not prohibited by an international act excepted for some specific categories like blinding laser weapons[23]. Therefore, it will be up to each researcher, if his state authorities respect the academic freedom, to decide to contribute or not to a weapon research program.

However, the difficulty lays in the distinction between research which may have weapon relevance and that, which does not. In 1984, Milton Leitenberg wrote in an unpublished document about military and non-military that the distinction was even irrelevant and not only for applied research: ***"that is not because science has changed but because military "requirements" and what is military relevant has. Weapons are now universally dispersed in all environment – space, sea depths, artic, jungle – and new weapons, communication, systems, sensors and support equipment involve so many energy forms and materials that there is no area of scientific research that is not now of interest to the military. The answers to questions of how materials and energy will behave in these newer environments into which weapons systems has moved can only be answered by what is clearly basic research"***[24].

40 years later the question of military and non-military relevance of academic research remains controversial.

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[23] Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects adopted in November 2003 (http://untreaty.un.org).

[24] Milton Leitenberg, Studies of Military R&D and Weapons Development, 1984, page 17, unpublished but available at https://fas.org/man/eprint/leitenberg/intro.pdf.

3.1. Academic contribution to conventional weapons

If the distinction remains difficult to define, the researcher's decision to contribute or not to weapons research programs is intimately related to the fundamental academic freedom principle that states "freedom in research and training is the fundamental of university life"[25]. Such principle for EU universities is also laid down by the Charter of Fundamental Rights of the European Union in article 13 stating that: "the arts and scientific research shall be free of constraint. Academic freedom shall be respected".

Therefore, for universities that commit themselves to this principle, the choice to contribute or not will be an individual decision of the researcher. Nevertheless, for some European Universities a decision to not contribute to military research has been taken for their entire research community by the adoption of a general prohibition principle[26]. Others have established systems of raising human security awareness to help researchers to identify a potential problematic cooperation.

If contribution of EU universities to conventional weapons research programs were limited, the adoption of the EU Defense Fund (EDF) might change the situation. For the period 2021/2027 an allocation of 7,9 billion Euros has been foreseen (2,6 for research actions and 5,3 for development actions)[27]. This is more than ten times the amount for the previous period of 2017-2020 which was 590 million. If in principle this fund doesn't support basic research, it may "include defense-oriented fundamental research likely to form the basis of the solution to recognized or expected problems or to create new possibilities"[28]. As mentioned above, the distinction is almost irrelevant, therefore most of basic research might be eligible.

Some ethical boundaries have been established by EDF regarding project eligibility. All projects should comply with "ethical principles, such as those relating to the welfare of human beings and the protection of the human genome, reflected also in relevant Union, national and international law, including the Charter of Fundamental Rights of the European Union and the European Convention for the Protection of Human Rights and Fundamental Freedoms and, where relevant, the protocols thereto"[29]. All proposals will be screened by the European Commission and if necessary, will be subject to an ethical assessment. Finally, some weapons development like certain lethal autonomous weapons are not eligible.

Considering the difficulty to finance their research, it seems doubtful that universities will renounce to apply to this fund. Nevertheless, excepted when a

[25] Magna Charta Universitatum, fundamental principles 3 available at http://www.magna-charta.org. The charter is by 904 universities from 88 countries.

[26] See above XXX.

[27] Regulation 2021/697of the European Parliament and the Council of 29 April 2021 establishing the European Defense Fund and repealing Regulation 2018/1092, Official Journal of the European Union L 170, 12.5.2021, p. 149–179.

[28] Preamble 7 of Regulation 2021/697, Op. Cit.

[29] Preamble 50 of Regulation 2021/696, Op. Cit.

general prohibition has been adopted by the University, it remains an individual decision of the researcher.

Some researchers have initiated a petition signed by 1049 (May 2021) researchers around the EU asking to prevent the research to be financed and used for military purposes: *"Investing EU funds in military research will not only divert resources from more peaceful areas, but is also likely to fuel arms races, undermining security in Europe or elsewhere. The EU, recipient of the Nobel Peace Prize in 2012, should instead fund more innovative and courageous research which helps to tackle the root causes of conflict or contributes to the peaceful resolution of conflict. Therefore, as a scientist, academic and/or researcher I call on the European Union to refrain from any further steps towards the funding of military research and development programmes"*[30].

If scientific support to the elaboration of a nuclear, biological and chemical weapon is almost prohibited by international treaties, do we have to consider that exploring technical possibilities of development of such weapons – like the artificial development of a virus to check if it is technically feasible or not – to consider potential counter measures is prohibited as well?

Answering such a question is delicate. As the State has committed itself by the ratification of the TNP, CWC or BWC to not elaborate, assist, support the development of such weapons, it seems impossible for its universities to be involved in such research even if the final objective will be to counter the development of a weapon or to elaborate measures to limit its effects in case of illicit use. However, some international conventions, like the CWC, allow states to produce, acquire and use some sensitive chemicals for "protective purposes"[31]. In this context, we could wonder if a scientific investigation to explore a new technique to produce schedule one chemicals might not be considered legitimate as long as the final objective of the research will be to develop counter measures.

3.2. Academic proliferation by unaware contribution to weapons research programs or human right violations

Researchers' responsibility of potential misuses of their research outcomes by a third party are included in most national trade control systems. Researchers usually fall in the category of exporter and some of their activities are controlled transactions requiring the application of a transfer authorisation. Due to the specificity of their activities, it is often difficult to identify if the technology they are using in their laboratory is subject to the categories of the export control list. As stated previously, how shall a cooperation between two Universities dedicated to test the resistance in extreme conditions (heat, pressure, ..) of a controlled item be considered when such testing is done only by virtual means? In other words, none of the two universities will handle controlled items, only data retrieved from virtual calculation will be exchanged.

[30] https://researchersforpeace.eu/form/researchers-pledge-form.

[31] Article VI and verification Annex, Part VI of the CWC. Available on the CWC website (opcw.org).

Researcher awareness of potential misuse remains one of the most challenging issues especially when the research is not involving controlled items or is not directly related to sensitive activities.

Academic and research outcomes consist essentially of technology exchanges within the scientific community via electronic means (email, public cloud), participations to seminars and conferences (speeches, working papers, posters, …) and finally publications. So, two considerations should be raised. First, how to know if the transfer of technology, not involving a controlled item, might be submitted to an authorisation. Second, when and where the liability of the researcher starts and stops.

For the first consideration, the situation is not different from the one of an industrial operator attempting to implement a catch-all clause requiring to inform trade control authorities if he is aware of the potential misuse of the item transferred. However, for researchers the act of transferring might be difficult to identify. E.g., presenting research outcomes in an international conference that will be recorded and posted afterwards by the organisers on a web platform, mailing a scientific article to a publisher who if accepted will send it for peer review that are established in a third country. In those examples, the researcher is not even aware that the transfer took place and consequently assessing the risk of misuse by a potential end user will be impossible.

For the second consideration on the liability of the researcher, the situation is even more challenging. If we do consider that the transfer to a publisher and subsequently to peer reviewers is an operation that might require an authorisation, does the liability of the researcher stop after the transfer to the publisher or includes as well the transfer to the peer reviewers? If yes, how could he identify a potential risk of misuse considering the peer reviewers remain anonymous?

International trade control regime guidelines don't include specific provisions to academic proliferation and globally don't make differences between operators[32], therefore, such questions remain unanswered and have to be tackled nationally.

Research activities organised in Academia are in principle categorized between fundamental and applied research. The tipping point between fundamental research and applied research has been extensively debated but no common understanding has been adopted by the scientific community. For trade control, the difference is that fundamental research is usually exempted from authorisation but applied research is not. All international trade control regimes and national trade control systems include an exemption for basic or fundamental research defined as "Experimental or theoretical work undertaken principally to acquire new knowledge

[32] Only the Wassenaar Arrangement mentioned in its "Best Practice Guidelines on Internal Compliance Programms for Dual-Use Goods and Technologies (Agreed at the 2011 Plenary" Academic institutions. However, they are included like enterprises in the term "exporter" and no dedicated provisions have been adopted.

of the fundamental principles of phenomena and observable facts, not primarily directed towards a specific practical aim or objective"[33].

To help researchers make the difference, a Technology Readiness Levels (TRL) scale is used. This scale has been elaborated by NASA in the late eighties to measure the eligibility of a technology for a space mission[34]. Other equivalent systems have been developed more recently by other national and international institutions (US DOD and EU H2020) and their scope has been enlarged to include almost every technology. The TRL consists of different points on a scale used to measure the progress or maturity level of a technology. The scale ranges from 1 to 9, where TRL 1 is the lowest and TRL 9 is the highest. When a technology is at TRL 1, it is considered as fundamental, while at TRL 9 the technology has already been proven in an operational environment.

If TRL might help the researcher to identify the level of development of his research in consideration of a potential production for its commercialization, it has not been developed to determine at which scale level fundamental research starts to be considered applied research for non-proliferation objectives. Looking at the existing different TRL models the tipping point might be between level 1 and 2[35] or after level 3[36]. Therefore, the interpretation remains at the discretion of state authorities and might vary from state to state even if it seems that for the trade control community TRL 3 (experimental proof concept) is the breaking point between fundamental and applied research.

For the research community, the distinction between both is not something that is considered unless they are applying for some funds that the limit application to a certain scale level of development defined by a TRL. In this context, the technology assessment level will be done to identify if the application will match the required conditions but not to assess the possibility to benefit from an authorisation exemption for potential technology transfers with partner universities.

Moreover, if the distinction between fundamental and applied science is a topic that might raise interest among academics, they don't necessary divide their research activities among such dual categorization or at least they are not necessarily aware of the categorization of their respective activities. In this context the perception of potential misuse of their research is already something they are not considering and consequently the analysis to benefit from an authorisation exemption or not is far from their mind. Potential applications of their research might be contemplated but

[33] See for example : Australia Group, Control list of dual-use chemical manufacturing facilities and equipment. (https://www.dfat.gov.au/publications/minisite/theaustraliagroupnet/site/en/dual_chemicals.html).

[34] Mihaly Héder, From NASA to EU: the evolution of the TRL scale in Public Sector Innovation, The Innovation Journal: The Public Sector Innovation Journal, Volume 22(2), 2017, article 3.

[35] See for example the TRL used by NASA (https://www.nasa.gov/directorates/heo/scan/engineering/technology/technology_readiness_level).

[36] "experimental proof of concept" Annex G Technology Readiness Levels, Horizon 2020, Work Programme 2014-2015 (https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf).

for most of them, they are not by principle, or due to the research scope, conducting research related to any military activities. Therefore again, it appears that any potential military or misuse of applications of their research is virtually inconceivable.

However, Universities and their researchers are encouraged to explore and develop potential applications resulting in findings via the development of spin-offs. A Research and Development Office supporting researchers to transform their innovative ideas and technologies into new high-tech companies has been established. Contrary to researchers, such offices investigate possible industrial developments of research outcomes, and might be more appropriate to identify the risk of potential misuse. Some of them already include a screening of the spin off project to identify such potential misuse in their supporting process. In this context interaction with trade control authorities might be established[37].

[37] See for example, actions implemented by Katholiek Universiteit Leuven in Flanders (Belgium) (https://set.kuleuven.be/ethicsatarenberg/expertise-center-ethics-arenberg-1/copy_of_dual-use/dual-use) or Fraunhofer In Germany (https://www.fraunhofer.de/en.html).

CONCLUSION

Contrary to industries, academia and research centres do not have a tradition of implementing trade control measures. Most of them have been confronted only recently to the necessity of implementing trade control rules even if, in principle, their activities were not exempted from the Regulation. Moreover, invoking the academic freedom principle, some researchers have been reluctant to accept the right of export control authorities to control their cooperation or collaboration activities.

However, since the recast of the EU Dual Use Regulation that clearly identified academia and research centres as part of its scope, they have had to accept to implement some controls on their activities. The difficulty is precisely to define which ones will require an authorisation and which ones will be exempted.

As highlighted all along the paper, trade control systems have been elaborated essentially to curb industrial activities that are mostly transferring tangible assets (defined in a commercial contract of items or technology) from country A to country B and or C. Academic activities are not often matching this definition. It is usually cooperation or collaboration between several research centres established in more than one country involving intangible exchanges of technology.

Considering all this, we are convinced that the only way to cope with the risk of academic proliferation will be to establish a dedicated trade control system and not try to include those activities into a system that is not meant to be used for it.


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