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Dual Use – the Underlying Value Dimensions of an Emerging Issue in Science and Technology Governance

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Abstract

This paper deals with conceptual and ethical dimensions of the dual use of science and technology innovation and its governance. Although the term and the related problems are not new, there is growing concern about dual use in Europe. This is mainly due to a number of recent developments in the security and related technologies, and specifically the debate about international terrorism and related threats has been a significant cause for concern. The paper will start with an analysis of different conceptualisations and meanings of dual use, and a discussion of the respective implications. It will then lay out the major ethical concerns related to the dual use discussion. Then, we will articulate the relationship between these concerns and identifiable underlying values, which themselves appear to be partly complementary and partly contradictory. Based on the first three steps, we will address major issues with regard to the question of how governance of science and technology in Europe should take into consideration the value dimensions of dual use.

I. Different notions and meanings of dual use

There are some fundamental ambiguities in the notion of "dual use" rendering concept unclear. Dual use can be understood as the possibility to use a technology for both 'good' and 'bad' purposes. In that sense, it is also mentioned in the European Textbook on Research Ethics. Dual use can also be understood to refer to the ambiguity of civil and military uses - medical uses in particular. This use was dominant before the terrorist attacks of 9-11 2001. At that time dual use meant to refer to the use of technologies that were developed for non-military uses for military purposes. Already then, the term came to refer to a reverse shift of function as well (Molas-Gallart 1997). As a result of these definitional issues it is very difficult to assess which values pertain to the concept of dual use. For the purpose of this paper, we conceive of values as both the basis and result of processes evaluating something as positive or negative. Values are rationally and emotionally binding, and they give long-term orientation and motivation for action. In that sense values are underlying structures that shape opinions, attitudes, preferences etc. Values are not always articulate. They can be seen as part of value sets and – viewed more broadly – more or less implicit world-views adhered to by different people, communities, institutes and organisations. Values do not directly prescribe specific actions and therefore are different from principles or interests. Principles are often taken as the basis for ethical assessments of science and technology, whilst interests are taken to be the pragmatic basis for policy making.

Initially, the dual use issue referred to the problem that a technology might be used for purposes the original developers did not intend, did not have in mind and would not have supported. The moral issue that it referred to was how the values of a researcher, a research group or a specific discipline were affected by such a shift in use, be it potential or actual. The debate did not necessarily extend to the issue of whether and when military uses of technologies were justified or not. In effect, this does not imply beforehand that all civil use is good and all military bad, although the issue of technology know-how and products winding up in the wrong hands was of course a connected issue. After 9-11, dual use became associated with the dilemma that scientific research has the potential to be used for bad as well as good (Selgelid 2009; [Pustovit](#), and [Williams](#). 2010), therefore introducing a moral dimension that extended beyond the values of a researcher, a research group or those embedded in a specific discipline. Dual use became a significant issue in humanities research (van der Bruggen 2011). In this shift of meaning, dual use increasingly came to be associated with bioterrorism, the debate on which has its own separate history in the ethics of technology with regard to issue of responsibilities of scientists, engineers, and institutions (e.g. Schweber xx on Atomic Bomb/Energy). This debate actually predates the shift in meaning of 'dual use', but has merged with it. Either use of the term has some implications. For example, the first definition (good/bad use) departs from the implicit view that technology is to be regarded as neutral. As a result, moral judgments would only would be attached to the (intended) means and ends, not to the technologies themselves. The second meaning of dual use that distinguishes between military and non-military use is more complex. In situations where paramilitary bodies gain more and more importance, the distinction between military and non-military uses is not always obvious. The question of 'good and 'bad', or justified and unjustified uses applies to the technologies themselves, and the intentions embedded in their design. As a result, the values pertaining on dual use issues connected to these types of technologies is more difficult to assess.

There are additional conceptual pairings related to dual use, like medical versus military, legitimate versus illegitimate, western versus terrorist, state versus criminal. Ultimately, these can be drawn back to the first two. In all cases and in all pairings, it is either an explicitly evaluative or an (allegedly) descriptive definition of the dual use dilemma. In an analysis of the moral issues and societal values connected to dual use, one should go further and question the aptness of all these binary oppositions and address the issues more in terms of a continuum between the extremes. Political arguments are being made in the division of phenomena on one side of the line rather than the other. If a technology with violent potential is being developed, it is often phrased to be a deterrent by its user (mostly the case with regard to western countries), whilst if it is in the hands of the enemy, it is phrased to be a weapon of mass destruction. In this political definition game, law is invoked to legitimise political choices and as a result the authority of law often polarises the divisions.

Recent political events have reified ideas of simple oppositions between good and bad: the events of September 11 shifted the definition of dual use to bioterrorism. International concern was raised on the global humanitarian and environmental consequences of possible misuse or mal-intended use of

biotechnologies. In the past decade, the perception of a bioterrorist threat increased and this demands life scientists to consider the potential security implications of their research (Kuhlau 2008). This global problem seems to demand local response by national governments and individual scientific research groups (Simms 2004). This led to the difficult question about who 'owns' the problem, who is to take responsibility to prevent misuse. But the real issue might not be that one simply needs to avoid misuse or mal-intended use, but who defines what is misuse of mal-intended use and under which global pressures such uses emerge.

Currently, the subject of dual use is debated on an international level by parties such as the World Health Organisation, NATO and other military organisations working on terrorism and civil bodies such as the sunshine project or the G8 group. International regulatory tools used are International Health Regulations the Biological Weapons Convention (BWC), and the United Nations Security Council Resolution (UNSCR). On a national level, funding agencies, research groups (universities, industry and military), health sectors, and the media play a key role in the implementation of these regulations. Several strategies are proposed: a focus on international agreements; a focus on stricter national and international legislation on freedom of publication; stricter regulation on access to potentially harmful research (for example by excluding researchers from countries that are known to harbor or yield terrorists); voluntary standards for research groups on self-restriction in publication of research results.

All parties involved confusingly use different definitions of dual use pell-mell, and often without clear specification of which definition they intend. since the anxieties and societal fears about dual use issues remain rather undifferentiated and intuitive, finding support for the policies involved is less problematic. Whilst billions are spent to counter bioterrorism and the issue of the terrorist threat potential of novel technologies is debated at public health conferences, lists of health challenges and government advisories, there are only a very marginal amount of cases of bioterrorism, the nature of which was often not even lethal (Hillel et al. 2005). Our current treatments of the dual use issue might enhance the true underlying global issues and that the problem might be overstated. Furthermore, it obscures the problem that bioterrorist threats are often low tech rather than high tech. Domestic products such as castor oil and fertilizers can be used to produce bombs much more easily than state of the art products of complicated biotechnology research. Furthermore, the true issues involved in shifts of use may rather lie in domestic military technology development rather than foreign threats. The somewhat simplistic definition of dual use as ethically justified versus ethically unjustified uses of technology does not help assessing the problem of the multi-applicability of technology. The definition opens a debate on all ethical issues involved in scientific research and technology innovation. We believe it is necessary to give a more sophisticated account of dual use that takes into account such issues.

II) Some major ethical concerns related to the dual use discussion

In all definitions of dual use there are overlapping issues. This is especially true for the issue of responsibility: the more risky a certain type of research is, the more this demands scientific responsibility. In this respect, there are several approaches to the concept of responsibility. Ehni (2008) for example defends that scientists only have a responsibility to avoid complicity in the sense of a weak indirect causality, that their ethical responsibility does not go much further, but the scientists have the most direct access to the science and technology in question, and they can respond much more effectively to a potential threat. Voluntary standards seem to be a way to control many emerging and potentially dangerous technologies, but they may not be sufficient. More restrictive regulations may sometimes be called for. But the two definitions used most frequently in reference to dual use lead to different moral vocabularies. If dual use is understood as non-military research being used for military purposes, the moral issues that emerge will likely focus on the extent to which scientists have influence on how their research is used, to what extent they can use that influence to contain its uses, and the extent to which the military is allowed to use technologies for their own purposes. If however dual use is defined simply as 'good' versus 'bad' uses of technology, it is likely that a debate will emerge on how to contain scientific research in general, to what extent access to research should be secured and to what extent researchers are to be controlled by governmental bodies.

An ethical issue connected to the problem of scientific responsibility concerns the potential effects on academic liberty. Voluntary standards would protect academic liberty and demonstrate that liberty also goes with responsible researchership (Keuleyan 2010), but it may not create sufficient control over more risky forms of academic research. Furthermore, it is becoming more and more difficult, from a technical point of view, to contain scientific research: due to the potential of internet and other 'new' communication technologies, scientific and engineering research have become much more easily accessible. As a result, non-voluntary regulations may not resolve the issue either: although there is a problem in the extent to which voluntary self-regulation can resolve the issue of dual use, traditional government controls and treaties are increasingly less effective in regulating research practices (Maurer & Fischer 2010).

Containment of information has become very dependent of individual research groups, it cannot easily be enforced in a top down fashion. Still, this also means that security becomes very much dependent of the goodwill of such individual research groups. National and international legislation may aid in creating a stronger structure for such voluntary self-regulation. The moral obligations demanded from life scientists may include the obligations to prevent bioterrorism; to engage in response activities; to consider negative implications of research; not to publish or share sensitive information; to oversee and limit access to dangerous material; and to report activities of concern (Kuhlau 2008). In the case of dual use defined as military versus non-military uses, the instruments for life scientists to contain their research are even less effective. It is much more difficult to contain the use of one's research by one's own government than by potential malevolent parties.

Although bioterrorism might be perceived as an imminent threat, it may be beyond the capacity and therefore beyond the responsibility of life scientists either to prevent or to respond effectively (Kuhlau 2008). One cannot go much further than asking for due consideration potential negative implications of a scientist's research, make protected access to sensitive material, technology and knowledge, mandatory and ask scientists to report activities that are perceived to be of concern. Seen the fact that this latter one may demand of researchers to enter into conflicts of loyalty, reporting of activities of concern may hold negative implications for the researcher in question, therefore decreasing the inclination to actually follow up on such matters of concern. Scientific responsibility is therefore restricted to obligations concerned with preventing foreseeable and highly probable harm, whilst unforeseeable, unpredictable and unlikely harms are not taken into consideration. And often, it is only assessed in hindsight what should have been foreseen.

A clear example of a foreseeable harm is the infamous publication of the sequence of the 1918 flu virus in *Nature* and the reconstruction of the virus in *Science* (von Bubnoff 2005). Although viewed as a landmark by many virologists and although potentially contributing to finding a cure or prevention for a possible future flu pandemic, the publication of these findings raised concern in both the public and the scientific world that terrorists might recreate the virus to create rather than prevent a new flu pandemic. It is logical that the idea of resurrecting a deadly virus raises the public's concerns. Although researchers may want to use such research for beneficial purposes, both the resurrected virus and the knowledge used for such a resurrection may hold harmful consequences. These harmful consequences may concern a problem with precaution, but also with dual use. The case is a paradigmatic illustration of how little the government can do to keep information what poses a biosecurity threat from becoming public knowledge. This is what we should have learned from the smallpox virus research (Tucker 2006). The event gave rise to an agreement between editors from top scientific journals to scan submitted papers for information that might yield misuse of scientific knowledge (*Nature* 421, 774; 2003).

The problem is that much research that may yield potential misuse is not that easily identifiable as dual use research, since the younger definition of dual use as good versus bad uses of science and technology has become dominant. The current primary use of the concept of dual use is to prevent 'bad' uses, leading to a discourse of securing the population against potential threats, but as such, its older definition of non-military versus military uses has become obscured, and as a result there are questions of exerting power, advancing propaganda, and maintaining economic status quo that are no longer posed. The definition of dual use as 'good' versus 'bad' uses is also unproductive and obscurantist since it simplifies the discourse on legitimacy. One cannot easily assess which uses are to be seen as legitimate and which ones are not. Although the powerful nations in the world may feel justified in using technology to counter specific terrorist threats, such uses may go beyond the acceptable. A very important dimension is currently missed since the issue of marginalised groups is not addressed. What is seen as justified military use of technologies domestically and by dominant parties in society, may well be perceived of as 'terrorist' or in any case aggressive by other groups, or in other parts of the world. After all, it is there that the problem of terrorism starts in the first place: it is not as clear as often portrayed who are the 'good guys'

and who are the 'bad guys', Marginalised voices are automatically not taken into consideration. This not only holds a negative effect on the quality of the policy making process in question, it also serves to radicalise the marginalised groups in question, construing an enemy whilst presuming one is battling an already existing enemy. On the one hand it reifies them as an invisible enemy that escapes further control due to their absence at this table, on the other, it only serves to increase societal concern and strengthen sentiments of fear and irrational xenophobia: the true problems are not solved, and the way the currently dominant definition of dual use is implemented in policy may even function as a self-fulfilling prophecy. Therefore, it is of the utmost urgency to take tendencies in current policy on for example security through biometrics and research restrictions to tackle security risks due to dual use potential under close scrutiny. It needs to be investigated whether the reasons behind current policies are still valid, whether the argumentation behind their implementation is sound or based on irrational internal motivations rather than real-life issues, which underlying values are at stake, which public concerns are not addressed and which parties are excluded from the debate.

III) The relation of ethical concerns in the dual use dilemma to sets of underlying values

Resolving the discussion on how to deal with dual-use is not merely a question of disentangling the information knots involved, exposing issues on which not enough information is available and then making rational choices based on adequate information on any risk of unwanted use of technology. What is valued in society plays an important role as well. Values that play into the dual use dilemma include autonomy, safety, security, intellectual ownership and property rights, scientific responsibility, prudence and precaution, rationality and proportionality and transparency. These values are all interconnected in different ways. With regard to autonomy for example, it is important to know which parties value liberty in scientific research over security issues. A next necessary step not only for ethicists would be to assess whether they are justified in doing so. The two values mentioned may not even necessarily be at a par. And ensuing question is whether a perceived risk to dual-use should lead to a closed mentality in scientific research or whether openness of scientific research may also be a means to solve these issues. Debates on dual use that follow from such questions are very much influenced by the explicit and implicit values held by different groups, communities and stakeholders. Another issue connected to autonomy concerns the marginalisation of certain groups in society and certain communities in the world. Their perceived lack of autonomy may lead to radicalisation, thereby feeding into the threats associated with the first definition of dual use. With regard to safety and security, it is a question of priority whether the responsibility for such issues should be put at the level of the state or at the level of the researcher. With regard to intellectual property rights, one is to ask the question to what extent the legal owner of a technology or a piece of research is to be limited.

The issue of autonomy is strongly related to existing research values: we attach certain values to scientific research, both with regard to its intended goals and as a field with value in its own respect.

Modern science has proven to be successful due to its adherence to the values of freedom of inquiry, free speech and free dissemination and transparency of results. These three however do pose a problem in the light of possible use with bad intentions. It is difficult to make rational decisions with regard to the extent to which these liberties should be restricted. It demands assessing who is to hold responsibility over the use of such technologies, and where the moral and intellectual ownership of the inventor ends. Research has several further internal values such as alleviating suffering, saving life, curing diseases. Research conducted in this context will often be conducted by people who specifically adhered to such values, such as the traditional goals of medicine.

Another value relevant to the dual use dilemma is prudence: precaution and issues of risk and risk perception have a major influence on how one deals with dual use issues. More specifically, the dual-use dilemma is related to issues of risk of use with a bad intent. Although parties with a perceived bad intent would not perceive of their goals as a 'hazard', parties responsible for research and development of novel technologies should take precautionary measures.

Different parties in the world hold different ideas over what is good. Some parties feel they have to resort to threats and violence to reach their goals. Those parties that are traditionally considered to be 'good' from the west resorted to such means in the past as well, and in some cases they still do in the present. Can we always make clear cut polarised judgments on which uses and intentions are good, and which aren't? Who sets the norm, and sanctions certain uses and users whilst excluding others?

Common opinion is that technologies, as any instrument, are neutral, and that it is the user that renders it an instrument to either good or bad. There always was an opposing thought that some instruments are geared or rigged for specific purposes, that this includes whether they are used for a specific political goal, and that they should therefore be. A classical example is dynamite, of which it was already discussed at the time it was a novel invention whether it was a neutral invention or an invention that framed itself for aggressive purposes. One cannot refrain from taking a position towards the nature of science and technology as either neutral and instrumental to its user's goals or normative, having been imbued with implicit good or bad intent.

With regard to the prevention or resolution of dual use, transparency forms a very important and not only instrumental value. With regard to the ethos of science (cf. Merton xxxx, also Kant: *Publizitätsgrundsatz*) and also facing specific problems of current science and technology like patenting, third party funding etc., transparency appears not only as a basic value but moreover also a central principle for action. Scientific research needs transparency to be able to communicate with the public especially with regard to policymaking and governance. The system of (open) peer review comes at a price of risk of mal-intended use. But implementing regulations to restrict access to scientific data may also go beyond its intended goal, hindering research and barring innovation. A related important instrumental value in the context of dual use is the value of proportionality. Although technologies may carry along several benefits for society, there is also reason for concern. Connected to all tension fields with regard to dual use is the issue of whether the restriction of research to prevent mal-intended use is proportional or disproportional with regard to the intended goals.

IV) Governance

The central moral question that emerges from the debate on dual use is to what extent one is to limit a primary activity for certain purposes because of a perceived risk to secondary purposes (be they 'bad' purposes or merely purposes not primarily intended or desired by the researcher or research group in question). This question is gradually becoming obscured by the non-articulate shift in meaning of the concept. It seems that choices made around the definition of dual use are essentially political choices. This raises the question of who is a legitimate definer of dual use, and which definitions that ensue are really productive and which definitions obscure what is actually at stake. In this sense, the ambiguous nature of dual use as a concept is part of the problem of making sense of it in an academic situation.

Innovation in the bio-medical sciences comes under an increasingly rapid pace. This calls for an adaptive pluralist approach. Expertise is ever changing as disciplinary boundaries are being torn down and rebuilt in unexpected and unpredictable ways. Knowledge is no longer the expertise of one individual researcher, not even of one discipline, but of a multifaceted range of disciplines. Issues of dual use are therefore necessarily connected to issues of multi-, inter- and transdisciplinarity. Relevant disciplines include microbiology, virology, molecular genetics, immunology, infectious diseases, immunology, nano-technology, veterinary medicine, but also specialists in agri, nutri and aqua). Tackling dual use issues means that it is necessary to involve specialists in security, legislation, risks assessment, psychology and mass psychology etc (Keuleyan 2010). It would also demand an involvement of different stake- and shareholder groups in society. It would entail a cooperation between scientific professional, civil, military and humanitarian organisations. Simplified binary oppositions on all levels (I-III) tend to blur the complexity of the problems. At the same time, reference to plurality and relativity of values as well as perspectives is as clear-cut as it is a non-starter for helpful governance advice.

V. Conclusion

The societal and political discourses on the values and prices of 'safety' have not been sufficiently taken into account. The simple division in 'good' versus 'bad' applications of science and technology has gradually replaced a more nuanced discourse on scientific responsibility and moral intellectual ownership. Currently, concerns for terrorist threats are leading to restrictive regulations whilst the actual proportions of such threats in relation to science and technology are not properly assessed. As a result, unfounded claims on safety and security do not diminish the actual problems at hand, and potentially bar research and innovation.

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