Tensions Between Science And Society

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Abstract  What are the “costs” of science besides its expected benefits? Specifically, how “tense” does the relation between science and society become in the light of the ever-increasing pressure of the latter on the former? In this paper I am going to discus the increasing global inequality deriving from phenomena such as the “brain drain” and from the problems relative to the relationship between ethics and science. I will conclude by considering the tension that arises out of the disciplinary structure of science and the non-disciplinary structure of the most pressing problems that society is faced with and has to react to.

Keywords  Science · Society · Brain drain · Morals · Global disparity · Transdisciplinary research

1 Background

It is quite obvious that the aim of science is the improvement of human life—in all possible respects. It is also quite obvious that this enterprise is at least partially successful. However, this comes at certain costs. There is sometimes a tendency to overlook these costs because our attention is mainly directed towards the expected benefits (some cultural critics are an exception to this rule, of course). However, it is important also to discuss these costs seriously because they can endanger the realization of our goals.

My topic in this paper is a specific segment of these costs: the generation of tensions between science and society due to successful scientific activity. By “science” I mean, according to common parlance, the natural sciences; I will not discuss the social sciences (nor the humanities). There is a variety of such costs but I
will only discuss three of them. First, I want to discuss the increase of global disparity due to a science-induced brain drain. Second, I will address conflicts between science and morals. Finally, I want to discuss the tension that arises out of the disciplinary structure of science and the non-disciplinary structure of the most pressing problems that society is faced with and has to react to.

2 Brain Drain

There seems to be a certain consensus that a very important pillar of reasonable development aid is the development of the educational and the science system in less-developed countries. Here is a pertinent quote from the World Bank:

Knowledge and advanced skills are critical determinants of a country’s economic growth and standard of living as learning outcomes are transformed into goods and services, greater institutional capacity, a more effective public sector, a stronger civil society, and a better investment climate. Good quality, merit-based, equitable, efficient tertiary education and research are essential parts of this transformation. [...] The capacity for countries to adopt, disseminate, and maximize rapid technological advances is dependent on adequate systems of tertiary education. Improved and accessible tertiary education and effective national innovations systems can help a developing country progress toward sustainable achievements.¹

Thus, the development of the educational system at all levels and of the science system seems to be one of the most promising policies leading to sustainable development in less-developed regions. However, there is a problem. People who have obtained a good education in their less-developed home country may seek jobs abroad, and people from those less-developed regions who continue their education or take on a research position in higher developed countries (e.g., by doing a post-doc) may not return to their home countries. The motivation for this behavior is obvious: better work conditions like better wages and better living conditions in general and better conditions to pursue research in particular.²

However, this sort of development often called “brain drain” is quite damaging for the less-developed countries concerned. In this way, they are not only losing highly educated manpower but also the capital that they had invested in the education of those people. Obviously, both resources are extremely sparse in less-developed regions. It seems particularly perverse that in this way, developed countries profit from the less-developed ones by a redirection of resources that these countries themselves need most.

There are two principal types of this brain drain: spontaneous brain drain and brain drain intentionally initiated by highly developed countries. This distinction is quite obvious. As an example of an attempt at an intentional brain drain of recent

times, I may mention the attempt to lure 10,000 computer scientists from India to Germany by issuing special Green Cards to them. What I found particularly striking in this case was that in the public discussion of the issue, only the advantages and disadvantages for Germany were in focus. The question what that regulatory action would mean for India was virtually absent from the discussion. I find this fact rather troubling because what was attempted here regarding the advantages for the German economy was, on the other hand, contradicting explicitly articulated goals of developmental cooperation.

Probably mainly due to spontaneous brain drain, the situation in Africa is especially troubling, although statistics on the brain drain are scarce. According to the International Organization for Migration (IOM), Africa has already lost one-third of its human capital. It is continuing to lose its skilled personnel with an estimated 20,000 doctors, university lecturers, engineers and other professionals leaving the continent annually since 1990.

My suggestion is that we should be aware that a possible side effect of an effective European research policy on the developing countries is a brain drain from these countries, counteracting measures we employ in our development cooperation. Thus, in parallel to the development of our research system, we should implement measures that simultaneously offer opportunities for further education for people from the less-developed world, and generate incentives for these people to return to their home countries.

3 Science and Morals

A second source of tensions between science and society derives from the aim of science to produce new and even novel knowledge and the fact that science has been enormously successful in realizing this aim. Within the area of the sciences, two groups can roughly be distinguished: the “laboratory sciences” like (most of) physics, chemistry, molecular biology, or pharmacology on the one hand and the “historical sciences” like paleontology or cosmology on the other hand. By this distinction I do not mean to imply that the historical sciences never use a laboratory and are purely observational sciences. The distinction between these two types of sciences consists in a difference between their intended results. The historical sciences aim at historical information, for instance about the factors that caused the dinosaurs to disappear from Earth. The laboratory sciences, on the other hand, aim at knowledge that can be tested and applied in the laboratory. In our context, the important fact is that scientific knowledge produced by the laboratory sciences is always technologically usable. This is due to the fact that every successful laboratory testing procedure in principle generates a successful technological application of that knowledge. To illustrate with one example: the successful testing of some pharmaceutical substance in a clinical trial immediately generates the possibility of a successful application of this substance for therapeutic purposes.

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Therefore, novel scientific knowledge from these laboratory sciences automatically leads to novel opportunities of technological action.

All human actions must be assessed according to their moral admissibility. In the case of novel technological actions, this postulate sometimes raises grave problems. Due to their novelty, their moral admissibility is often very hard to assess. There are two principal sources of this difficulty. First, with respect to some technological novelty the pertinent moral norms may be easily identified but their application to the cases in question may be far from clear. The technological progress in the medical sciences provides a plethora of examples. The basic norms include the protection of human life and the obligation to provide and improve treatments for diseases; these norms appear to be absolutely clear and undisputed. However, the application of these norms to a case like stem cell research proves to be highly problematic. Clearly, stem cell research opens promising avenues to new treatments of various diseases, but in many cases of stem cell research the human embryo involved does not survive. Although it only consists of a small number of cells, clearly the embryo is a form of human life. Therefore, the problem arises as to whether promising research on early stages of human embryos is morally admissible or not. The answer to this question depends on the moral status of the embryo: Does the norm of the protection of human life imply that it is absolutely inadmissible to end the life of an embryo for purposes of medical research that could save countless lives later, or should a process of moral weighing be admitted in cases like this?

The second source of difficulties in the evaluation of the moral admissibility of novel technological possibilities is that in some cases it is not even clear precisely which norms are relevant. Consider, for instance, information technology. Technologically, it is now possible to collect a great variety of data about individuals. It is obvious that in the future, this possibility will greatly increase and will in fact even include genetic data. The ethical issue that arises in this context concerns the question regarding the norms that should govern the collection and distribution of various data about individuals. The novelty of this technological possibility is so radical that no set of traditional moral norms is able to subsume this case. Thus, we must first be clear about what the moral issue is exactly, which rights of individuals are threatened, and what sort of protection is needed.

It is important to note that many of these problems of the two types that I mentioned have one feature in common: they are expressions of a conflict between moral norms. This is fairly obvious in the case of the first source of difficulties typical of the biomedical sciences. For instance, in stem cell research, there is the conflict between the protection of life of the human embryo and the necessity of medical help for humans. Or take the example of medical research on animals, especially on non-human primates. Of course, the well-being of animals should be protected but the need of medical help for humans means experiments on animals that may harm or even kill them. The conflicts between moral norms necessitate a weighing of these norms. This weighing process is, first of all, painful because these norms usually come with a claim of unconditional validity. Furthermore, usually the weighing of moral norms rarely leads to an unequivocal and therefore uncontentious result. On the contrary, as the public controversies in many countries about, say, stem cell research or abortion indicate, people strongly disagree about what the
result of the weighing process should be. Thus, we should be prepared that we will have to live with the resulting conflict without hope that it may be resolved one day by means of convincing arguments. Even ethics committees cannot offer much help because experience shows that they are confronted with exactly the same problem: they encounter the same weighing problem as the public at large without having inter-subjectively valid argumentative procedures that might resolve the issues. Instead, the only way out of that impasse seems to be the invocation of democratic processes in order to come to a decision. However, it must be admitted that with regard to ethical issues about life and death, democratic processes may appear to be extremely unsatisfactory.

4 The Disciplinary Structure of Science and the Non-disciplinary Structure of Many Long-Term Societal Problems

It is an unfortunate fact that most large-scale pressing problems of today’s world do not directly correspond to already well-established scientific disciplines that could treat and solve them. Think of the world hunger problem, the world poverty problem, the many problems of sustainable development, the various problems connected with national and international health systems, or the causes and the impact of climate change together with the possible reactions to it. The reason why these problems do not directly correspond to any one discipline is easy to state: it is the multi-faceted character of these problems, typically having both complicated technological and not less complicated social aspects. As a consequence, science tended to see these problems as falling outside its area of competence, or, at least, science did not take them up spontaneously. To be more precise: neither individual scientists nor the (formal) representatives of particular scientific disciplines saw these problems as falling into their area of competence so that they did not feel responsible for their solution. However, three things are obvious. Firstly, these problems need to be tackled. Secondly, due to their complexity common sense is certainly not sufficient to solve these problems; we need reliable knowledge about them. Finally, the only institution that can possibly produce the desired reliable knowledge is science. Therefore, society demands the sciences to supply the knowledge that is relevant to tackle the global as well as the more local problems mentioned above, and many more.

As I mentioned above, in the scientific disciplines no-one is directly competent to generate and supply the relevant knowledge, and therefore, the sciences tend not to answer to these societal needs. The resulting tension between science and society can be very aptly described in a metaphorical way that was, for instance, prominently used at the UNESCO and ICSU funded World Conference on Science in 1999.4

In general, the relationship between science and society can be described by the existence of a virtual contract. Note that this is not a real contract as we usually know it, i.e., a contract that is explicitly laid down in a legally binding document and is signed by both parties. Instead, the relationship between science and society is organized in such a way as if a certain contract existed; thus a “virtual” contract. The subject matter of the virtual contract between science and society is the production of knowledge: science is granted financial means (and appropriate legal and institutional structures) by society, and science delivers scientific knowledge in return. However, the concrete details have to be set out in this abstract characterization of the virtual contract between science and society, and they change in the course of history. We have to distinguish an “old” contract in the highly developed nations roughly valid in the 2nd half of twentieth century, and a “new” contract that is under development now.

Here are the essentials of the old contract. There are three principal areas where science gets money (and the relevant institutions and legal means) from society. Firstly, scientists get money from *industry* in order to produce knowledge relevant for the production of marketable goods. Secondly, scientists get money from the *government* in order to produce knowledge relevant for the realization of short and middle range societal goals that the private sector does not usually care for. A typical example is state funded goal-directed research, for instance for military defense or for public health. Finally, scientists get money from the *government* in order to carry out non-directed basic research. Why should a government do so? The answer to this question can be looked at from several angles. From the point of view of society, a very important argument for the funding of non-directed basic research is economic. As history has shown, the investment into non-directed basic research is a very good investment in the long-term. Much of today’s technology on which we vitally depend is the fruit of non-directed basic research of earlier decades. For instance, all technology that has electronic components or in-built lasers is a fruit of the development of quantum mechanics that first set out to explain why matter is stable (and does not collapse into nothing) and why atoms produce very specific kinds of light. These were questions very remote from any technological application at their time. Extrapolating the connection between science and technological progress in the future justifies an investment into non-directed basic science. However, there is also a cultural aspect of non-directed basic research. Basic research tries to explain to us how the world is and why it is how it is. It thus quenches our fundamental thirst for knowledge about the world we inhabit. This desire is so strong that some constitutions even guarantee the freedom of research (under certain constraints). In this way, under the regime of the old contract, basic research became a strongly value-laden element of culture on which especially the researchers themselves put much emphasis.

However, as is obvious in many countries, society is partly dissolving the third area of the old contract. In many countries, there is an obvious decrease of investment in non-directed basic research carried out within established scientific disciplines. Instead, there is a need for transdisciplinary research directed towards the long-term pressing societal problems mentioned above. The scientific system reacts very reluctantly in responding to this need resulting in tensions between science and politics. Before discussing the offer by society of a new (virtual)
contract between science and society, let us have a closer look into the reasons why science is not spontaneously taking up the new problems. This analysis is necessary if one wants the new contract to work effectively—and this new contract appears to be unavoidable given our general situation.

First of all, it is very important to note that the reluctance of science to respond to the new needs and the resulting offer of a new contract is not just the result of inertia and egotism on the part of science. One sometimes gets the impression that political representatives tend to make this sort of judgment when gauging science’s reluctance to carry out more research that is immediately relevant to society. There are, however, structural reasons why science is reluctant to take up the new challenges. By “structural reasons” I mean reasons that are inbuilt in what the essence of science so far is. This is important because structural reasons of this sort carry much weight and cannot be overcome by superficial means or force.

There is an epistemic and a corresponding sociological source of reluctance on the part of science to take up transdisciplinary research. The epistemic source derives from the fact that science is in need of and has indeed established a tight system of quality control for claims to scientific knowledge. Of course, such a quality control system is absolutely essential because scientific knowledge is supposed to be especially reliable. The quality control system that science has developed over the last centuries is to an extremely high degree discipline specific, even sub-discipline specific. With regard to their scientific quality, new scientific claims can only be judged by the pertinent specialists in the respective sub-discipline and by no-one else. As a consequence, to scientists practicing their trade in some specific discipline, the quality assessment of transdisciplinary research appears to be extremely problematic. Different specialists may be able to judge the quality of that part of the research that belongs to their discipline, but for an assessment of the quality of the overall, specifically transdisciplinary project they lack standards. This is a situation in which scientists feel extremely uncomfortable because it transcends the competences for which they are trained and where they feel confident.

This already points to the corresponding sociological source of reluctance on the part of science to take up transdisciplinary research. As is known from the sociology of science, the professional identity, the professional reputation system and career paths in science are extremely discipline specific. With regard to the first point, scientists do not just feel they are scientists but they feel they are physicists, or chemists, or biologists, or, even more specifically, theoretical solid state physicists, organic chemists, or plant biologists. This implies, and this is the second point above, that the recognition they attempt to receive is the recognition of their peers in the respective (sub-)discipline: only their peers are able to judge the quality of their work and it is therefore only their recognition that counts. Furthermore, the recognition scientists may gain in terms of career paths is also discipline specific which concerns the third point above. Everyone in a disciplinary scientific community knows what its high-prestige institutions are, and membership in one of them indicates high scientific status. All this is extremely relevant because scientific reputation is a very important if not the most important motive for scientific work. Given this sociological situation and its impact upon the individual scientist’s motivation, it is obvious that scientists often feel very uncomfortable with
transdisciplinary research, especially when they have been successful within the
discipline they have been trained for. To do transdisciplinary research partly means
giving up one’s disciplinary identity and being in a situation in which a reputation
system is not yet really in place (partly because of the lack of a functioning quality
assessment system), and in which career paths are yet ill-defined. In addition to the
last point, leaving one’s own discipline for transdisciplinary work is often seen as
disreputable by one’s peers, nourishing their suspicion that one is not able to do
productive work in the home discipline.

Now, as society is aware of the need for transdisciplinary research addressing
urgent long-term problems, it is about to establish a new contract between science
and society by granting less money for basic, undirected research and luring
scientists into transdisciplinary research. The obvious and main incentive for this
redirection of scientific interest is, apart from appeals to the responsibility of
science, of course, money. For instance, a quick glance at the Seventh Research
Framework Program (FP7) of the European Union shows the direction research
activities in Europe are heading by offering research opportunities of various sorts.5

However, any research policy that is mainly based on financial incentives can
only have limited effectiveness.6 In contrast to many activities in the economic
sector, financial incentives are certainly not always the main factor in the decisions
that individual scientists make. Thus, an effective science policy that tries to
establish the new contract between science and society for the best of Europe’s (or
even mankind’s) future should not only fund the desired transdisciplinary research.
In order to make this research attractive for the very best scientific minds, additional
measures are necessary. These measures have to address and counteract the two
sources of reluctance I discussed above which tend to make transdisciplinary
research unattractive. Firstly, more research should be funded in the cognitive
evaluation of transdisciplinary research. Secondly, institutions should be set up that
help to make career paths and the reputation system for transdisciplinary research
transparent and desirable. These institutions should be as close as possible to the
established disciplinary institutions with the same purpose so that the scientists
involved obtain maximum recognition and acceptance.

References

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6 I am neither saying nor implying that the European Commission is not aware of this problem: I have not
the slightest idea who in the European Commission knows what and whose knowledge becomes operative
in some program. I want to bring the problem to the public’s attention.