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Moving Beyond Technology Transfer: The Case for Technology Assessment

So-called "green technology" is now a major feature of the Rio+20 "green economy" vision. G-77 countries are, understandably, focused on facilitated access to useful technologies that can contribute to sustainable development; the best way to make sure the right technologies are transferred to the right places in the right way is to subject them to meaningful assessment. An emphasis on the positive potential of new technologies requires a concomitant emphasis on a strengthened global, regional and national capacity to monitor and assess technologies. Anything less will incite distrust and invite disaster. Powerful new technologies (such as nanotechnology, synthetic biology and geoengineering) are being proposed and promoted without prior evaluation and no regulation. If technology assessment is deemed too costly or time-consuming, we are likely to find that the cost of *not* assessing technologies is even greater. Sir Martin Rees, Astronomer Royal in the UK and past-president of the Royal Society, estimated in 2003 that the odds of a technological disaster wiping out at least 1 million lives by 2020 are 50-50.[1] If he is right, history will consider a failure in Rio to commit to technology assessment an egregious negligence.

The need for technology assessment was recognized already 20 years ago in Rio's action plan on environment and development (Agenda 21, Chapter 34).[2] Just one year after the Earth Summit, however, the UN's capacity to assess technologies was virtually wiped out.[3] With less capacity for assessment than in 1992, the need for capacity is more urgent because:

- the pace of scientific and technological development has accelerated;
- the capacity of governments to understand and regulate emerging technologies has declined;
- convergence in previously discreet fields of scientific inquiry has multiplied the impacts of resulting technologies: for example, the convergence of informatics, nanotechnology, genomics and synthetic biology makes possible the creation of artificially engineered life forms, with far-reaching implications for sustainable development;
- a small number of transnational corporations control both technologies and resources and their power is augmented through intellectual property regimes;
- more and more of the natural world is seen as ripe for extraction and commodification, and new speculative financial instruments are undermining democratic decision-making.

The Historical Arguments Against Assessment: Technology developers and investors have argued against monitoring and assessing new technologies by claiming that it would be premature or otherwise inappropriate:

"Too Soon:" The technology is too embryonic to monitor, they argue, and regulation will stifle its incipient potential. Governments and societies are assured that significant deployment is far off because fundamental scientific knowledge is lacking and commercialization is not yet feasible. In reality, technological deployment often comes long before scientific understanding. The energy and chemical industries, for example, used chemical catalysis for decades, spending billions on manufacturing facilities that would depend on it, without any clear understanding of the science behind it.[4] A 2007 report from the European Environment Agency estimated that only 14% of more than 2000 high production volume chemicals have basic toxicology information; 65% have less than base-set data, with 21% having no data at all.[5] Since the 1940s, US agribusiness has been annually dumping as much as 25 million pounds of antibiotics into animal feed without understanding how the antibiotics ratchet up livestock weight.[6] Likewise, the biotech industry has been selling modified DNA for decades while scientific understanding of the double helix continues to evolve.[7] Industry doesn't need to know what it's doing in order to make money, and even more alarming, technologies can turn a profit even when they fail. Industry can use the hype surrounding a technological breakthrough to sidestep anti-competition and other regulatory barriers, intimidate competitors, and create demand for an inferior or ineffective technology.

"Too Old:" Industry also argues (outside the context of intellectual property) that the new technology is unworthy of regulatory attention because it is nothing more than a modest tweak of an older, time-tested technology. Biotechnology is just a slight advancement on beer, wine and cheese making, for example. Transgenics is just the next modest step in plant breeding and DNA crosses species boundaries all the time. Glassblowers in Ancient Rome used nanotechnology, and climate change (and, hence geoengineering) began with the mass killing of large mammals, the smelting of copper for coins, and the 12,000 year long spread of agriculture.

"Too Late:" Once a new technology is fully invested and deployed, however, the argument is that it would be impossible to withdraw it. Absent a major and politically-embarrassing catastrophe, industry argues that regulations, or recall, will undermine national competitiveness, destroy jobs, devastate the economy or smother innovation. These – essentially political – arguments intimidate regulators and policymakers. Even when a technology – or one of its products or processes – is found either too risky or reprehensible to remain, industry has been remarkably successful at delaying change until it has wrung out all the profit it can from the old practice or product. During the 20th century there was an average 30-year gap between the early warnings of scientists and the late "listenings" of governments (see table below). Industry succeeded in delaying the removal of a long list of toxic chemicals such as PCBs, halocarbons and DES until profitable alternatives were comfortably available.[8] More recently, when lead was found in toys manufactured in China, the US government gave retailers almost a year to pull them off the shelves. Because of the adverse publicity, the big retailers sold their Chinese toy consignments to small retailers who took advantage of Christmas sales to dispose of their toxic inventory.[9] Almost without exception, products and technologies are withdrawn only when (1) industry has found an alternative product or process that it can control and profitably exploit; and (2) when it has fully written off – and is ready to replace – its manufacturing facilities to adapt to the new requirements.

Again and again, industry's goal is not so much to win as to delay. Once the technology is mature and established and the gaggle of start-up companies has been merged or massacred and a handful of lead enterprises are in place, regulation is a welcome barrier to entry for newcomers; patents are a tool to intimidate interlopers and governments provide "plausible denial" that allows companies to shift responsibility – reducing insurance risk and litigation costs.

Early Warnings without Early Listeners

Early Warning	Problem	Late Listening	Years Delayed
1602	**Tobacco**[10]	1970s	>370
1896	**Radiation**	1928	32
1897	**Benzene**	1977	80
1898	**Asbestos**	1931	33
1899	**PCBs**	1972	73
1907	**CFCs**	1977	70
1938	**Halocarbons**	1997	59
1938	**DES**	1971	33
1945	**Antimicrobials**	>1970	>25
1952	**Sulfur dioxide**	1979	27
1954	**MTBE**	2000	46
1962	**DDT**	1969	7
1970	**TBT**	1982	12
1970	**Hormones**	1982	12
>1970	**BSE**	1996	>20
1980	**GMOs**	2003	23
2002	**Nanoparticles**	>2003	?

Source: Adapted from *Late Lessons from Early Warnings*: *The Precautionary Principle 1896-2000*, Environmental Issues Report, EEA, 2001, with additional examples from ETC Group.

Cases: Costly Technologies Deployed without Precaution

Technologies are, by definition, cultural artefacts that may function differently in different cultures and environments. The engine lubricant that works year-round in Kenya will seize up in a Canadian winter. Technologies that have been assessed to function well in one climate or culture may cause problems in another.

The risk environment has also changed dramatically. Prior to the dominance of the steam engine, new technologies (products and processes) were usually introduced by people known to the recipients and retribution and recall were relatively straightforward. As the pace of technological change sped up and its incubation became more remote, more complex systems for insuring against disaster became important. Today, technology impacts can be global and instantaneous,

which requires early identification and ongoing assessment before the new technologies are commercialized. There is now need for both a global overview as well as regional or national technology assessment to address different environments and cultures.

A trusted, transparent pathway for technological advancement would be beneficial for societies, governments and those proposing new technologies. Innovators and their backers seek to minimize risk. Especially, re-insurers and investors welcome steps that make government intervention and/or public responses more predictable.

No one can accurately predict the past but had the UN maintained its monitoring capacity over the last two decades – and had civil society been vigilant – the world might have saved itself billions of dollars, millions of lives, and much time. A few examples of the high cost of failing to properly assess technologies, all since the 1992 Earth Summit…

1996 **Mad-cow disease/Bovine spongiform encephalopathy (BSE):** Although British regulators knew in the 1970s that the public was being exposed to BSE, the information was covered up until 1996.[11] A transparent global monitoring capacity could have made the secrecy less possible. The fallout from the regulatory failure has meant continuing societal distrust of scientists and regulators.

Genetically modified crops: Civil society initially warned that the biotech industry was developing herbicide-tolerant plant varieties in 1981. In several parts of the world, small-scale producers immediately opposed the GM seeds as a potential threat to their environment, their health and their markets. Likewise, many food retailers and their customers opposed GM foods in the absence of scientific evidence that the products were safe – or had even been tested. A decade and a half later, more than 130 types of "herbicide tolerant" weeds have infested an estimated 60 million acres in the motherland of herbicide-tolerant crops, the United States.[12] Now the biotech industry is scrambling to develop GM crops that are tolerant to two or more herbicides at once – including more toxic and environmentally hazardous ones.[13] Government regulators, instead of learning from having failed to consider the long-term implications, are fast-tracking the approval of the super toxic superweed killers.[14] Not to mention the cost of bringing a single genetically engineered crop trait to market: according to analysts, the cost was $136 million per trait from 2008-2012,[15] compared to approximately $1 million to develop a useful, conventional inbred line.[16] The story of GM crops is the textbook example of how governments and industry should not function.

2001 **Foot and mouth disease:** The regulatory scandal and financial losses from the outbreak of foot and mouth disease in the UK (and then Europe) again undermined citizen confidence in government regulation. In the end, the outbreak's cost totalled $16 billion in the UK, where 7 million sheep and cattle were killed. Governments haven't learned from 15 other outbreaks of the virus – including another in the UK in 2007. According to the US government, the risk of an accidental escape of foot and mouth disease virus from a federal lab is 70% over 50 years at a cost between $9 billion and $50 billion. The US National Academies says the government's estimate is low.[17]

2006 **Nanoparticles:** The estimated annual global market for nanotechnology varies widely between about $100 million and $100 billion and predictions for the near-term range from hundreds of billions to almost $3 trillion. There is agreement, however, that governments have spent more than $50 billion on nanotech R&D since 2001 and industry is now outspending governments in nanotech research. Several thousand products – including pesticides, sunscreens and cosmetics – are in the marketplace today. Where so much money has been spent (and so many products are already on the shelf), it is unlikely that governments will respond well to scientific concerns for health and environmental risk. There is still neither an inter-governmentally accepted definition of nanotechnology nor agreed methods for measuring or evaluating nanoparticles. Literally every week, scientific uncertainties related to health and environmental impacts emerge; the only certainty is that nanotechnology is virtually unregulated anywhere in the world. If nanoparticles turn out to be – as some researchers suggest – the "new asbestos," governments will have jeopardized more than $50 billion in taxpayer money – along with the taxpayers.

2007 **Agrofuels:** In October 2011, a special report commissioned by the High-Level Panel of Experts of the UN Committee on World Food Security concluded that the world food price crisis that became evident at the end of 2007 was greatly exacerbated by the rapid rise in production of so-called bio- or agro-fuels. Since 2007, industry has insisted that a second or third generation of biofuels will soon be available that will allow cars and people to be fuelled and fed simultaneously. Five years later, the world is still waiting. Europe and the United States have been spending $11 billion per year in biofuel industry subsidies.[18] If the UN had had a technology assessment capacity in place, the biofuels illusion would not have prevailed and many of the 170 million newly malnourished people could have been spared.

2010 **Deep Water Drilling:** The BP Gulf of Mexico oil disaster of 2010 is well documented. Less known is that in 2008, a near-disastrous offshore gas leak in Azerbaijan led to the biggest personnel evacuation in the driller's history. That company, too, was BP and a WikiLeaks disclosure says that company officials at the time blamed the leak on faulty cement casings – the same problem identified in BP's Deepwater Horizon spill 18 months later.[19] BP estimates that the cost of the Gulf of Mexico spill could reach $40 billion.[20] 760 million litres of oil spill into the world's oceans annually – that's a BP Gulf disaster every year.[21]

2011 /
2012 **Nuclear power:** The Fukushima tragedy that began March 11, 2011 is the latest in a succession of scandals involving the commercial nuclear power industry since its inception in 1953. The Fukushima facility was assessed to be tsunami-resistant because a 35-metre cliff separated the construction site from the ocean.[22] Immediately following this assessment, however, the cliff was removed to allow boats to bring heavy equipment to the site. Following the tsunami, Fukushima was plagued by a number of other technical and political failures, which are expected to cost Japan at least $64 billion.[23] The nuclear industry's failures are not confined to Japan, of course: recent studies reveal that 88 of the world's 442 operational nuclear plants have been built on seismic faults.[24]

According to the International Atomic Energy Agency, 138 commercial power reactors had been permanently shut down at the beginning of 2012; at least 80 more are slated for shut-down in the next decade.[25] Only 17 of these have been dismantled and made permanently safe, due to both technical difficulty and expense. For almost 60 years, the industry has struggled with nuclear waste disposal. Despite constant assurances, no country has solved the problem. A 2011 UN report noted that the industry originally adopted nuclear-powered submarine standards that prioritized compactness and mobility and undervalued safety – standards unhelpful to commercial power plants.[26] The decision caused delays and cost overruns. By the 1970s, the nuclear companies were confronted with new regulations every day, forcing the near-collapse of one of the world's most powerfully-backed technologies.

The Case for Technology Assessment at Rio+20:

UNEP's latest Foresight Report, "21 Issues for the 21st Century," notes that the pace of introducing new technologies has increased while the role of regulatory bodies in protecting the public from the consequences of new technologies has diminished.[27] The report urges policy makers to "consider, for example, organizing a new international governance system which would produce, and potentially oversee, new international procedures to identify dangerous side effects of technologies and chemicals before they are produced."[28] It suggests that such a governance system would be anticipatory (to avoid the difficulties of regulating technologies and chemicals once they move beyond the laboratory); impartial (to avoid situations in which influential actors are in control of matters of safety and security relating to their own products); aware of the need to deal with the risks arising from interactions among multiple technologies developed for different purposes; universal (in order to address the global reach of new technologies); and ensure that individual countries and their corporate interests do not unilaterally make decisions that can have global impacts.[29] According to the report, policymakers should work together with the scientific, environmental and other stakeholder communities to determine what a new governance system should look like.[30]

Indeed, governments cannot properly evaluate technologies on their own. Enormous financial and political interests are often mobilized to block "game-changing" new technologies from disrupting the *status quo*; or, as often, to propel new technologies into the marketplace prematurely to gain first-mover advantage. Given the importance of new technologies in government and social planning, "backup" assessment mechanisms are necessary. The intergovernmental assessment system must be supplemented by a civil society mechanism that can offer alternative perspectives.

The United Nations' Role: Rio+20 should commit to expeditiously develop the institutional capacity to identify and monitor significant technologies, including an evaluation of the technologies' social, economic, cultural, health and environmental implications. Assessments must be completed before a new technology is released. In order to minimize waste and risk, the monitoring process should accompany the development of the technology from science to shelf. UN monitoring and assessment of new technologies must be based on the Precautionary Principle.

The crucial role of technology monitoring and assessment lurks between the lines of the Zero Draft, but demands explicit mention in the Outcome Document, particularly given the current emphasis on technology development, scale-up and transfer. There is ample opportunity in the Draft to bring technology evaluation into the light: the reaffirmation of the Rio Principles, for example, supports technology assessment at the global, regional and international levels as a concrete operationalization of Principle 10 on access to information, public participation and access to justice on environmental matters. Likewise, technology monitoring (especially horizon scanning) and evaluation should be a particular concern of the proposed Ombudsperson or High Commissioner for Future Generations. Importantly, technology assessment should be an additional function of the bodies responsible for international environmental governance (IEG), whether within a strengthened UNEP or a new specialized agency for the environment.

Whether governments in Rio decide to strengthen the current CSD or to transform it into a Council on Sustainable Development, technology assessment should be part of the mandate and work program, which should include the creation of a regular body whose focus is technology monitoring and assessment.

A better option could be to establish an Office of Technology Assessment (OTA) attached to the UN General Assembly. The OTA could undertake studies and report directly to the General Assembly. The OTA would need a strong secretariat and resources commensurate with its task, and governments in Rio would have to commit to an OTA capable of meeting its mandate.

Ideally, governments in Rio would set a timetable for negotiations to develop an International Convention for the Evaluation of New Technologies (ICENT). The Convention would have a governing body supported by a scientific panel capable of convening specific technology working groups as required, with each working group representing a diversity of experience in science and other forms of knowledge, as well as a range of stakeholders. Reports of working groups would be submitted to the governing body, which would advise governments on the problem/potential of the new technology and its alternatives. Further, ICENT should support regional and national technology assessment and work with governments to monitor and support appropriate technology transfer.

Civil Societies' Role: Recognizing the political forces at play in the acceptance or rejection of new technologies, the UN should encourage the formation of dynamic civil society mechanisms that can offer an independent monitoring and assessment capacity to accompany intergovernmental processes. This initiative should encourage the formation of self-organized civil society structures at the regional and inter-regional level that could guide Technology Observation Platforms (TOPs) capable of undertaking regionally-relevant reports on technology risks and opportunities to be considered by the UN. Secondly, the UN should encourage the formation of a "Technopedia" as an open access, web-based technology assessment tool monitored and maintained in the participatory style of Wikipedia.

Precaution Must Prevail: Test Ban on Geoengineering is Urgent

While the need to develop a multilateral independent technology assessment mechanism is urgent, it will take some time to make it properly and to make it function. In the meantime, extremely risky and dangerous technologies must be stopped or be subject to meaningful moratoria. The case of climate manipulation (geoengineering) is particularly worrying:

Geoengineering is the large-scale, intentional, technological intervention in the Earth's systems. It is increasingly being discussed as a "Plan B" for climate change. Proposals range from altering ocean chemistry for increasing absorption of CO_2 (ocean fertilization) to injecting sulfur dioxide into the stratosphere to reflect sunlight away from Earth (an example of so-called Solar Radiation Management). Artificial trees, biochar, cloud whitening and "sunshades" in space are among proposals being researched in OECD countries (US, UK, Canada, among others).

A small but influential group of scientists, with corporate backing and support from some powerful governments, is pushing to *test* these planetary-scale technologies in the absence of international agreement, despite that the 193 Parties to the UN Convention on Biological Diversity adopted a *de facto* moratorium on such activities in October 2010.[31] Furthermore, because these technologies – by definition – operate at the planetary scale, their testing is indistinguishable from their deployment. Testing them *is* geoengineering, and there is no "Planet B."

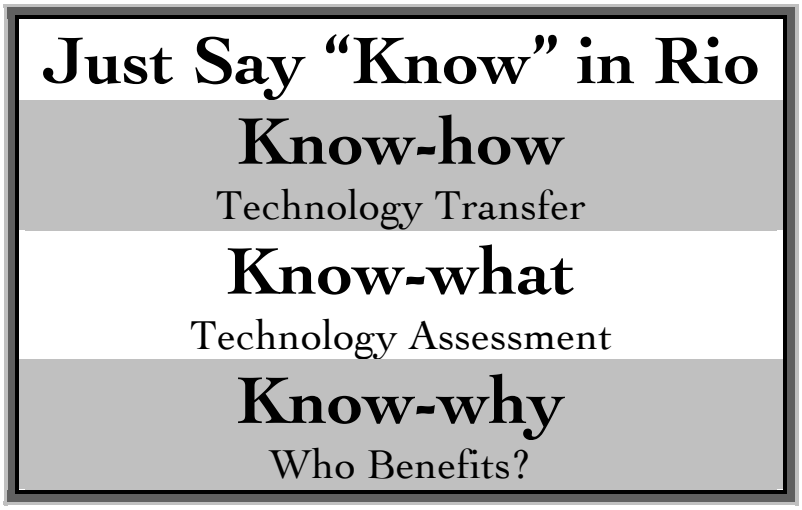
Geoengineering is the antithesis of sustainable development. Here are 10 reasons Rio+20 should strongly oppose unilateral attempts to geoengineer the climate:

1. Geoengineering cannot be tested (or deployed) safely or reliably.
2. We do not know enough about the climate to attempt recalibrating it.
3. Geoengineering will cause uneven and undesired trans-border impacts, including drought, ocean acidification, land use changes, etc.
4. Geoengineering is inherently conducive to militarization.
5. Geoengineering does not address the root causes of climate change.
6. Geoengineering takes attention and research money away from priorities already recognized by the international community, including reducing greenhouse gas emissions.
7. Geoengineering violates or undermines several international treaties.
8. Geoengineering creates technological dependence: once geoengineering has been deployed, it cannot be stopped without provoking catastrophic sudden warming.
9. It is not too late to stop geoengineering technologies from gaining ground.
10. The problem of climate change is fundamentally political, not technological.

WHAT RIO+20 CAN DO

Rio+20 must confront the most urgent issues facing the planet. We need a coherent, cautious, collective approach to supporting diverse endogenous and sustainable technologies, getting the right technologies to the countries that need them, while keeping the world safe from harmful technologies. Rio+20 must take bold steps to bring international technology policy into the 21st century by ensuring that precautionary and participatory assessment is developed and by adopting a comprehensive test ban on geoengineering.

ETC Group has published several documents on issues related to Rio+20, including *Who Will Control the Green Economy?* and *Tackling Technology: Three Proposals for Rio (Submission to Zero Draft*), available on our website: www.etcgroup.org/en/rio.



Endnotes

[1] See http://longbets.org/9/.
[2] 34.26. "The international community, in particular United Nations agencies… should: (a) Build up technology assessment capacity for the management of environmentally sound technology, including environmental impact and risk assessment, with due regard to appropriate safeguards on the transfer of technologies subject to prohibition on environmental or health grounds."
[3] In 1993, the UN Centre on Transnational Corporations (UNCTC) – the only international body capable of monitoring private-sector technologies and practices – was shut down entirely. Also in 1993, the UN all but eliminated its Center for Science and Technology for Development (UNCSTD), and moved the remnants from New York to UNCTAD in Geneva.
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[7] One recent example: R. Barrès, J. Yan, B. Egan *et al.*, "Acute Exercise Remodels Promoter Methylation in Human Skeletal Muscle," *Cell Metabolism*, Vol. 15, Issue 3, 405-411, 7 March 2012.
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[13] Such as 2,4-D, a component of the Vietnam War defoliant, Agent Orange, and dicamba, which is chemically related to 2,4-D.
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[16] Goodman, M., "Plant Breeding Requirements for Applied Molecular Biology," *Crop Science*, Vol. 44, November-December 2004, pp. 1913-14.
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[20] Guy Chazan, "BP Confident of Turnaround," *Wall Street Journal*, 25 October 2011.
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[29] *Ibid.*
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ETC Group is an international civil society organization (CSO), addressing the socioeconomic and ecological issues surrounding new technologies that could have an impact on the world's poorest and most vulnerable. We investigate ecological erosion (including the erosion of cultures and human rights); the development of new technologies (especially agricultural but also new technologies that work with genomics and matter); and we monitor global governance issues including corporate concentration and trade in technologies. We operate at the global political level. We work closely with partner civil society organizations and social movements, especially in Africa, Asia and Latin America.

ETC Group has consultative status with the United Nations Economic and Social Council (ECOSOC), Framework Convention on Climate Change, Food and Agriculture Organization (FAO) and FAO Committee on World Food Security, Conference on Trade and Development (UNCTAD), and Convention on Biological Diversity (CBD). We also have a long history with the Consultative Group on International Agricultural Research (CGIAR).