



European Foresight Platform

supporting forward looking decision making

www.foresight-platform.eu

Institutionalisation of Constructive Nanotechnology Assessments: Challenges and Opportunities for Brazil and Portugal

EFP Brief No. 215

Authors: Paulo Fonseca dopaulo@gmail.com; paulofonseca@ces.uc.pt
Sponsors: Scholarship from Monesia – Mobility Network Europe South America: An Institutional Approach – EC/EACEA; advisor: Dr. Tiago Santos Pereira
Type: Comparative and Analytical Study
Organizer: Center for Social Studies, Faculty of Economics – University of Coimbra
Duration: 2010-2013 **Budget:** N/A **Time Horizon:** ~2015 **Date of Brief:** Feb 2012

Purpose

The main objective of this study is to explore possibilities of institutional capacity building for constructive technology assessment (CTA) of nanoscience and nanotechnology in Portugal and Brazil. In this project, CTA is understood as more than a specific methodology. It represents a family of approaches to broaden interaction among stakeholders and influence or modulate the design process. One of its tenets is to consider and promote reflexivity about ethical, legal and social issues, along with environmental, health and safety concerns early on and throughout the technology research and development process.

Responsible Development of Nanotechnologies

A variety of science and technology studies (STS) and policy statements have highlighted the critical need for more effective mechanisms to assess emerging technologies as part of a 'responsible development' of new technologies (e.g. Macnaghten et al. 2005). Nanoscience and nanotechnology (N&N) offers many opportunities to implement such a responsible development paradigm in the context of emerging technologies. The constructive technology assessment (CTA) model is regarded by many as one of the most effective approaches to implementing such a paradigm, as it considers ethical, legal and social issues (ELSI) and environmental, health and safety (EHS) concerns in the early stages of development, thus avoiding risky and undesirable outcomes (for further details, see: Schot & Rip 1997).

The 'Irresponsible' Catch-up Process

While many of the leading countries in N&N research have explicit directives and initiatives to consider ELSI and EHS aspects in the early stages of N&N research and development (R&D), most peripheral and semi-peripheral countries have made few efforts to promote more *ex ante* and democratic technology assessments. This seems to be true in the case of Brazil and Portugal as well where, despite government support of N&N research, there is a complete lack of institutionalised pro-

grammes and/or initiatives related to CTAs. Moreover, surveys to assess the public understanding and acceptance of science and technology in Brazil and Portugal have shown a societal demand for more accountability and democratic participation in S&T development.

This work is part of a PhD project in sociology, focused on the possibilities of implementing responsible development of N&N in Brazil and Portugal.

Objectives and Methodology: Institutions and Institutionalizations

The main objective of this study is to characterise the kinds of policies and institutions that are responsible for implementing and sustaining mechanisms of CTA of N&N in the UK, US and Netherlands as well as the existing N&N policies and institutions in Brazil and Portugal in order to understand how to further promote CTA in Brazil and Portugal. More specifically, this work aims at (1) describing the main policies and institutions that perform CTA (or comparable models) in the UK, US and Netherlands; (2) characterising the main policies and institutions responsible for N&N development in Brazil and Portugal; (3) identifying key institutional factors driving successful initiatives that could be implemented in Portugal and Brazil; and finally, (4) proposing ways or sites where CTA might be better institutionalised in Brazil and Portugal.

The methodology of this study followed a qualitative, inductive approach, based on literature reviews and



content analysis of grey literature (governmental and non-governmental reports and publications, news, websites, etc.). The complete PhD research, however, in-

cludes laboratory ethnographies and semi-structured interviews. Data from the latter are not presented here.

Technology Assessment Arrangements in International Comparison

The United States: the Pioneer

While the US pioneered the establishment of parliamentary technology assessment agencies, there is a strong methodological tradition restricting technology assessment (TA) to an expert-driven analysis of technologies that are already in the production and dissemination phase. This was the case for the Office of Technology Assessment – OTA (active from 1972 to 1995). It was heavily criticised for its ineffectiveness, which was attributed to its political bias and the time required to deliver the assessment reports, which usually arrived too late for effective regulation. Today, the Government Accountability Office (GAO – 2000 to present) carries out almost the same tasks.

In regard to the main federal policies for N&N, there are directives that explicitly require including ELSI and EHS concerns in the early stage of development. The National Nanotechnology Initiative (NNI), implemented since 2001, reserves funds for research concerning the early assessment of N&N risks and impacts, and the 21st Century Nanotechnology Research and Development Act (2003) legally supports the initiative and corroborates its vision.

These policies have resulted in the funding of many research projects aimed at CTA and the creation of institutions designed to research and implement such activities. For example, the National Science Foundation has funded the creation of the Nanotechnology in Society Network, which pursues research and promotes CTA and similar activities, such as Real Time Technology Assessment (Guston and Sarewitz 2001) and Midstream Modulation (Fisher et al. 2006). The institutes funded are on the leading edge of global research concerning EHS and ELSI of N&N, for instance the Center for Nanotechnology in Society at Arizona State University, the Center for Nanotechnology in Society at the University of California and the Nano Center at the University of South Carolina.

In addition, there are strong non-governmental institutions, like the Woodrow Wilson International Center for Scholars and the Loka Institute, that have lobbied policymakers to implement CTA activities related to N&N development.

The United Kingdom: Policy Learning

The British parliamentary agency for scientific and technological policy advice, the Parliamentary Office of Science and Technology (POST), has been active since 1989.

One of the most important guideposts for global policy-making in N&N has been the British Royal Society (RS) and Royal Academy of Engineering (RAE) report 'Nano-

science and Nanotechnologies: Opportunities and Uncertainties' of 2004. The British government appears to have considered the arguments presented in this study by one of the most prestigious academies in the world. This has been attributed to a kind of 'institutional trauma', or a legitimacy crisis, caused by the government's previous reactions to the biotechnology controversies and the BSE crisis. One year later, in 2005, the government's response to the RS and RAE report was published. Among the many recommendations, they agreed on the necessity to promote public engagement in the upstream phase of the technological development. Since then, the government agency Sciencewise-ERC has designed and coordinated activities for an 'upstream public engagement' on nano, such as the Nanodialogues, the Nanotechnology Engagement Group and the Nanojury.

Another important endeavour reflecting the will, not only of the public but also of the private sector, to shape R&D activities into more socially robust arrangements is the development of the code of conduct for nanoresearch by the Royal Society along with the Insight Investment and Nanotechnology Industries Association (NIA).

The Netherlands: Birthplace of CTA

The Netherlands is the place of birth of the CTA approach. It was first applied in the late 1980s and 90s at the NOTA – Netherlands Office for Technology Assessment, which is now called the Rathenau Institute. It still promotes TA activities and public engagement in science and technology issues. The Dutch model has been acknowledged as a successful approach to TA, as it recognizes the importance of deepening the understanding of the co-production of science, technology and society for the responsible governance of emerging technologies.

The main national policy, called NanoNed, is organised by a consortium of universities and industries. One of the main activities of the NanoNed programme is technology assessment, which explicitly refers to the CTA paradigm. It is coordinated by one of the developers of this approach, Dr. Arie Rip. NanoNed has provided 2-3% of the total funding for CTA activities. The TA enterprise is mostly conducted by PhD projects oriented exclusively to the analysis of the co-evolution of science, technology and society and concerned with issues such as nanotechnology and sustainability, risk and responsibility, and methods to map the socio-technical dynamics of N&N. The programme also supports researchers in the field of N&N to include a component of TA in their work. There are also recurrent interactive workshops and other feedback activities.

Portugal: Vitalising Science

Portugal has recently elected a new government, which has not yet published the new policy for the N&N sector.

So far, the strategy has not taken the form of a specific program for nanotechnology, but there is an evident orientation to pursue innovation in the N&N sector. There are two national laboratories concerned specifically with nano R&D and many other N&N projects among 26 similar institutes. The main focus of the government's action plan has been to establish the Iberian Nanotechnology Laboratory (INL). It is a partnership with Spain, with the goal of gathering highly qualified international experts to advance research at the frontier of N&N.

There is no governmental office for technology assessment. Although there were some foresight exercises for policy decisions, usually the technical controversies have been addressed by *ad hoc* commissions. Still, Portuguese and German researchers of future-oriented technological analysis have created a PhD programme in technology assessment in 2009, hosted at the University of Lisbon.

The Ministry of Science and Technology and High Education has one strong programme of science communication, the '*Ciência Viva*' (Live Science). Although its goal is to develop a national 'scientific culture', it mostly promotes traditional activities of scientific education and communication and so far has not stimulated public deliberative activities.

Brazil: Emerging Concerns

Brazil has a specific federal government programme for nanotechnology, the PNN (*Programa Nacional de Nanotecnologia*), which has created several networks in N&N specific areas. Although the necessity to research the

impact of emerging nanotechnologies is mentioned in the programme, it does not consider their assessment in the early stage of development. For example, the government agency for industrial development has promoted a prospective study of nanotechnology suggesting that ELSI and EHS issues should be addressed only in the final stage of technology development. Still, the Ministry of Development, Industry and Trade promotes the Nanotechnology Competitiveness Forum, which organises periodic open meetings dedicated to discussing N&N and orienting policymakers accordingly. Many of the issues raised by the participants deal with risks and regulation of nano research and products.

Although there is no parliamentary technology assessment agency, there is some government-sponsored research on technology assessment. For example, the Ministry of Health has a specific programme for TA. There is also a National Technical Commission, consisting mostly of experts but also of civil society representatives, responsible for assessing and regulating new biotechnologies.

Since 2005, there exists an institutionalised network named RENANOSOMA (Nanotechnology, Society and Environment) that promotes discussion and public communication about N&N. It was initially funded by the government agency for S&T, CNPq (National Council of Technological and Scientific Development). Unfortunately the funding was not renewed. Based on the efforts of the individual researchers involved, it has continued its activities with a very restricted budget and limited outreach.

Institutional and Policy Similarities

"Best Practice" Countries

In all countries, it is possible to identify in the policy discourses a commitment to improve and widen direct democratic governance. Moreover, there is know-how and a tradition of parliamentary and other kinds of technology assessment. There is a deep collaboration within private and public R&D institutions. Every country also has a strong STS institution of some kind. The latter, along with influential non- or semi-governmental institutions, such as the think-tank DEMOS, lobby for policy decisions to promote a more responsible innovation process, especially by advocating the role of public engagement in the early process of R&D.

Some analysts identify not only a trauma from recent S&T controversies but also perceive the advance of the knowledge society paradigm and the need to address social concerns as inevitable to assure best economic outcomes (Thorpe 2010).

TA activities are mostly promoted within the academic environment and are funded by national government agencies. The exception is the UK where upstream pub-

lic engagement activities are directly promoted by governmental agencies.

Although the institutional arrangements may vary, governments have adopted the 'responsibility paradigm', either in the form of research institutions concerned with public engagement and the foresight of technology impacts at the early phase of development or by stimulating the integration of a TA component in core areas of N&N research.

Portugal and Brazil Lagging Behind

Both Portugal and Brazil have never had a permanent or general parliamentary technology assessment institution, which may indicate a lack of human resources qualified for the task. Even though both countries have made efforts to foster cooperation between industry and academia to improve innovation capacity, R&D in the field of nanotechnology so far has mostly been done by public institutions.

Although the Brazilian programme for science and technology has specific directives on social inclusion, there is a common orientation in the policy discourse to the linear model of innovation and the deficit model of the public understanding of science, with little concern about public engagement in S&T. This goes along with a centralised top-down approach in S&T policymaking and a weak influence

of STS scholars on S&T policy, despite the high quality of research and significant results of particular initiatives.

Both countries have increased the effort to catch up in terms of scientific and technological capacities, especially by stimulating more private R&D and fomenting collaboration among public and private institutions. They

have a common history of brain drain and technological dependence along with weak connections between universities and industries. Finally, most of the research on nanotechnology, even in nanoparticles and nanostructured materials, is in its initial stages although they have already developed some patents and products.

Steps toward CTA in Portugal and Brazil

The obvious sites for CTA activities are the public institutions where nano R&D is already going on. Here there is a need for incentives for more collaboration between social and natural scientists in the R&D laboratories and other settings. In this sense, PhD projects focused on assessing emerging nanotechnologies – as the way much of the activities are done in the NanoNed programme – seems to be an adequate and viable path of initiating a culture of CTA. This approach does not require much funding, and it engages transdisciplinary collaboration between social and natural scientists.

In Portugal, for example, there could be an integrated technology assessment department at the INL and other national laboratories, ideally coordinated by the Portuguese Foundation for Science and Technology (FCT).

In Brazil, TA could be added as a mandatory element to the statutes of all the National Institutes of Science and Technology (networks of researchers organised around specific scientific topics). The present policy obligates these institutes to promote science communication, but they usually proceed according to the deficit model of the public understanding of science, that is, they engage in a one-way type of communication.

Of course, there should be more (or any) funding for academic projects focused on nano CTA, ideally inside the N&N institutes. This could not only provide qualified human resources and scientific data but it could contribute to fomenting more reflexivity among N&N researchers.

Big programmes of public engagement in nanotechnologies, such as those promoted in the UK, do not seem feasible in a short time horizon. The limited budget and the historical apathy of Brazilian and Portuguese citizens in terms of engaging in S&T controversies are evidence to a lack of institutional support.

Final Remarks

The information presented here reflects the early results of an in-depth study. The recommendations and suggestions above are not based on primary data or extensive sociotechnical analysis. Nonetheless, the study has already made clear the relevance of answering the following questions: How is the concept of responsible innovation of nanotechnology understood among policymakers, developers and interested civil society members? What are the perceptions and understandings of different stakeholder groups in Portugal and Brazil about CTA approaches? What are the particular methodological needs of CTA in the realities of these two countries? In what specific N&N sub-sectors is CTA more urgently needed? Finally, how feasible is the implementation of CTA in Brazil and Portugal in the short-term?

Sources and References

British Royal Society (RS) and Royal Academy of Engineering (RAE) (2005). *Nanoscience and Nanotechnologies: Opportunities and Uncertainties*. London: RS&RAE

Guston, D. H., & Sarewitz, D. (2001). Real Time Technology Assessment. *Technology in Society*, 23(4), 1-17.

Fisher, E., Mahajan, R. L., & Mitcham, C. (2006). Midstream Modulation of Technology: Governance From Within. *Bulletin of Science, Technology & Society*, 26(6), 485-496.

Macnaghten, P., Kearnes, M., & Wynne, B. (2005). Nanotechnology, Governance, and Public Deliberation: What Role for the Social Sciences? *Science Communication*, 27(2), 1-24.

Schot, J., & Rip, A. (1997). The past and future of constructive technology assessment. *Technological Forecasting and Social Change*, 54(2-3), 251-268;

Thorpe, C. (2010). Participation as Post-Fordist Politics: Demos, New Labour, and Science Policy. *Minerva*, 48(4), 389-411.

About the EFP: Policy professionals dealing with RTD, innovation and economic development increasingly recognize a need to base decisions on broadly based participative processes of deliberation and consultation with stakeholders. Among the most important tools they apply are foresight and forward looking studies. The EFP supports policy professionals by monitoring and analyzing foresight activities and forward looking studies in the European Union, its neighbours and the world. The EFP helps those involved in policy development to stay up to date on current practice in foresight and forward looking studies. It helps them to tap into a network of know-how and experience on issues related to the day-to-day design, management and execution of foresight and foresight related processes.