At the (Semi)Periphery

The Development of Science and Technology Studies in Portugal

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Abstract: This article presents an account of the development of STS in Portugal. It pays particular attention to two dimensions. The first regards the domains typically studied by STS scholars in Portugal, grouped in four sections: studies on the scientific system, laboratory ethnographies, research on science and society and risk case studies. The second is the institutional setting in which STS are undertaken, detailing the institutions, groups, journals and associations in this field. The paper attempts to tie the specificities of Portuguese STS with the characteristics of the local scientific system, showing how themes and analysis are influenced by the "semi-peripheral" condition of science in Portugal.

Keywords: science and technology studies; laboratory ethnography; science system; scientific community; public understanding of science.

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1. Introduction

Despite the universalist ambition of science, Science and Technology Studies (STS) have demonstrated over and over again that local conditions do matter in the production of science. And the same can be said for STS as such, as this section on Cartographies shows (see, for instance, Schubert 2011 or Prpić 2013).

Science in Portugal is marked by a "semi-peripheral" condition, that some authors have labeled as "the stepchildren of Galileo" (Nunes and Gonçalves 2001; Nunes 2002). Weighted down by social and cultural factors such as the restrictions of Catholicism, the persistence of low literacy levels well into the late 20th century, an authoritarian regime that distrusted and repressed scientists and barely invested in scientific research, and

an economic fabric that relies little on innovation and technological development (Nunes and Gonçalves 2001), Portuguese science developed late and feebly. Even though the indicators show an astonishing growth in the past few decades (R&D expenditure has soared from 0.27% of GDP in 1982 to 1.52% in 2011; the number of researchers in Full-Time Equivalent has gone from 3,963 to 50,061 in the same period; the number of publications in indexed international journals rose from 1,619 to 41,840 in the same time frame – DGEEC 2013).

Portuguese science is marked by (Nunes 2002, pp. 194):

- internal heterogeneity, especially as expressed in the fluid or floating boundaries between disciplines and fields of research, the heterogeneity of scientists' careers;
- unequal involvement of groups and research institutions with transnational worlds of science;
- strong feminization (in relative terms) of many research areas, in parallel with the difficulty of access of women to top positions of scientific and academic careers and management positions in research institutions;
- sharp dependence on funding from European programs;
- the overlapping between the worlds of science and academia, together with the pivotal role of scientists with "atypical" disciplinary careers and the high dependence of transnational networks for establishing scientific reputations.

Portuguese STS are doubly affected by this "semi-peripheral" condition. On the one hand, STS scholars are part of this system and have endured the same constraints and benefited from the same opportunities as their colleagues in other fields. On the other hand, the choice of research issues and subjects in STS cannot be but influenced by the particular characteristics of the Portuguese scientific system.

There is very little work done on the history of STS in Portugal. Nunes and Roque (2008), in an introduction of an anthology, provide a brief overview of STS in Portugal, setting them against the backdrop of Portuguese science and exploring their mains specificities and thematic dimensions. Much at the same time, Duarte (2009) published a quite detailed working paper on the sociology of science in Portugal, describing its main actors (authors and institutions), subjects of study and methodologies.

The present article purports to be an overarching but not exhaustive account of STS in Portugal, based mostly on books and articles published in journals and conference proceedings. It leaves out many adjoining fields, such as philosophy and history of science or innovation studies, as well as works of theoretical nature, which according to Nunes and Roque (2008) are anyhow scarce. These authors point this as a handicap for Portuguese STS: by focusing on the empirical research of the "national case",

themes and research problems were "endogenised", but excluded Portuguese researchers from wider international debates.

In particular, this article pays attention to two dimensions of STS in Portugal. The first regards the domains typically studied by STS scholars in Portugal, grouped in four sections: studies on the scientific system, laboratory ethnographies, research on science and society and risk case studies. The second is the institutional setting in which STS are undertaken, detailing the institutions, groups, journals and associations in this field.

2. The Pre-history of STS in Portugal

The end of the 1980s and the first half of the following decade in Portugal were marked by an emerging interest in science by the scientific community itself that would spark first internal reflexivity and later on the advent of STS.

One of the earliest indicators of this trend is the creation of the Association of Science and Technology for Development (ACTD) in 1985 (Delicado *et al.* 2013), an advocacy group formed by scientists from across a wide range of fields (as well as business representatives) that aimed to "raise public and politics awareness of the importance of science in economic and political decision" (Gonçalves 1996). This association promoted scientific meetings, organised the first interactive science exhibitions in the country and published a journal, *CTS Science Technology and Society,* between 1987 and 1994, that included some articles reporting the results of ST studies at a national level and translations from leading international authors.

In 1992 ACTD, together with the newly formed FEPASC Portuguese Federation of Scientific Societies and Associations (Delicado *et al.* 2013), organised the conference "Scientific Community and Power" (Gonçalves 1993), that brought to Lisbon leading figures of STS, such as Steve Yearley and Sheila Jasanoff, but also provided an opportunity for Portuguese researchers to present their work on STS issues (see below). Similar events were organised in 1995 ("Science and Democracy", with Bruce Lewenstein, Toy MacLeod and Erik Millstone, among others – Gonçalves 1996) and in 1997 ("Science, Scientific Culture and Public Participation", with Ulrike Felt, Brian Wynne and Steve Yearley, among others – Gonçalves 2000).

In the early 1990s several books on Portuguese science are published under the aegis of José Mariano Gago, a physicist and founding member of ACTD, that had been President of the JNICT Portuguese National Board for Science and Technology (1986–1989) and later on the first Minister of Science in Portugal (1995-2002 and again between 2005 and 2011). Two of these books are edited volumes devoted to an overview of

scientific research in Portugal (published by the Committee for Europalia 91, an arts festival held in Brussels in 1991 to celebrate the cultural heritage of Portugal), the other an extended essay written by Gago himself. *The State of Sciences in Portugal* (Gago 1992a) comprises 11 chapters, organized by scientific field, divided in small sections by scientific discipline, authored by leading researchers (but not STS scholars) and which proffer a brief stock-taking of research in each of the disciplines. A fairly similar endeavour would be undertaken almost a decade later by the Observatory of Sciences and Technologies (an organization within the Ministry of Science), through the publication of 16 volumes named *Profiles of Scientific Research*. Each contains statistical data and an introductory text signed by an expert (or group of experts) regarding a particular discipline, in most cases derived from an evaluation of research units report (Caraça 2001).

Science in Portugal (Gago 1992b) is a smaller volume that also has four chapters devoted to particular scientific disciplines (chemistry, social sciences, language sciences and biomedicine), but in addition contains a list of research centres in Portugal and three essays that can be seen as one of the earliest publications in STS: one on the history of science in Portugal in the 16th to the 18th centuries; an overview of science institutions and policies (a synthesis of a not yet finished PhD thesis which would have become a proper book later on – Ruivo 1998); an assessment of scientific outputs based on statistical data (publications and human resources, between 1973 and 1986).

Gago's own book, *Manifesto for Science in Portugal* (Gago 1990), is in fact a policy program, providing both an outline of the development of science in Portugal and a set of proposals on how to stimulate that same development. Particular attention is paid to international cooperation (Portugal had become a member of several international or European organisations), scientific education and the promotion of public understanding of science (which would become, during Gago's term as Minister, some of the main dimensions of science policy).

In the same period, another book (Caraça 1993), mostly based on statistical indicators and an analysis of policies (but with a particular emphasis on business R&D and technological innovation), also took stock of the development of science and technology in Portugal. The book derived from a series of articles published in the social sciences journal *Análise Social* (Caraça 1980, 1983) and was authored by another physicist that also had a leading administrative position: João Caraça, head of the Science Department of the Gulbenkian Foundation (the main non-profit organisation in Portugal) since the mid-1980s (and until 2011).

Even though these cannot be considered as STS works, they are a relevant source for characterising the Portuguese scientific and technological system prior to its rapid growth of the past two decades (and before the regular publication of statistical data on S&T, first by the Observatory of Sciences and Technologies, currently by the Statistics Department of

the Ministry of Education and Science) and can be taken as a signal of an interest in science as an object of inquiry. Something that would have soon be taken up by academia in Portugal.

3. Studies on the Science System

The first major research project on STS can be dated to the early 1990s, when the Gulbenkian Foundation commissioned a team of sociologists from CIES-ISCTE to characterise the behaviours, attitudes and expectations of Portuguese scientists. For that, the team applied a questionnaire survey to a sample of a thousand scientists working in higher education and other public institutions (leaving out business companies, where the number of researchers was insignificant), from all scientific fields. The survey encompassed three main dimensions: the social and cultural structure of science, the representation of scientific knowledge and the interaction between science and its contexts, as well as a socio-demographic characterisation of researchers (Jesuíno 1995). This study allowed the analysis of issues such as scientific practices of publication and interdisciplinarity (Stoleroff and Patrício 1995), the representations of science held by scientists (Jesuíno and Ávila 1995; Jesuíno 1996), identities, borders and communication networks (Vala and Amâncio 1995), class origins of scientists (Machado *et al.* 1994), the internal stratification of the scientific field (by measuring the distribution of scientific capital – Ávila 1997), the creation of a typology of researchers according to their patterns of activity (Ávila 1998), and the views of scientists regarding public opinion and science policies (Costa el al. 1995; Costa 1996).

Since then, surveys of scientists have been fairly frequent, but never again with the same broad scope. Some of these studies focused on particular groups of scientists, whereas others resorted to surveying heterogeneous samples of the scientific community on specific issues.

Some examples of the first type of studies are Patrício and Stoleroff's (1996) enquiry on project coordinators and on how they managed their teams and divided labour within research; or Conceição's (2003) study of independent inventors (a rather marginal group in the science sphere), concerning their choice of problems, their sources of information, and their struggle to get their inventions recognised and applied. Costa *et al.* (2009) were commissioned by the Gulbenkian Foundation to examine the career paths of the recipients of the Incentive to Research Prize (1994-2006), a group of a hundred young researchers below the age of 30 that received funding for a one-year project. Their analysis was based on the CVs of the researchers and sought to assess the effect of scientific awards, to identify different trajectories in science careers and the variations by scientific field. Gonçalves coordinated a wider study of a whole scientific field in Portugal, biology, which encompassed a history of the disciplines,

surveys of professional biologists (inside and outside academia) and of secondary education students, media analysis, overviews of educational offer in universities and of job prospects in the private sector (see Gonçalves and Freire 2009).

Regarding the second set of studies, some examples can also be pointed out. Pereira (2001) analysed the international collaborations of Portuguese scientists, both through statistical data and interviews with researchers. In her PhD thesis, Silva (2004, 2005) surveyed researchers on their use of the internet as a tool for scientific knowledge sharing and communication, both with peers and with the public, at a time that this subject had yet to reach the massive proportions it has today. Moutinho *et al.* (2007) conducted a survey on scientists in public sector research organisations (including universities) and on their practices and representations regarding patenting. The practices and perceptions of scientists regarding "open science" (more precisely, the publication in open access journals and other forms of making freely available to the public and to the scientific community research data and results) were the subject of a more recent survey (Cardoso *et al.* 2012). Delicado *et al.* (2013) conducted a survey on scientists concerning the membership of scientific associations in their research project.

Other studies on the scientific system relied mainly on statistical data produced by official sources, some delving on scientific publication (Silva 1992, Silva *et al.* 1993; Pereira 1996; Patrício 2010), others on R&D expenditure and human resources (Gonçalves and Caraça 1984, Moura and Caraça 1993; Pereira 2002; Godinho 2007; Horta 2010; Heitor and Bravo 2010; Heitor and Horta 2012; Heitor *et al.* 2013). Some are quasi congratulatory works, celebrating the impressive growth of the system in the past few decades in terms of input and output indicators. But others also point out to chronic weaknesses of the systems, such as the lack of business investment in R&D (Caraça 1980; Gonçalves and Caraça 1983; Moura and Caraça 1993; Godinho 1993) and academic inbreeding at universities that drive away highly trained human resources (Pereira 2004; Horta 2009; Heitor *et al.* 2013).

International scientific mobility is a subject that has garnered an increasing interest by STS, particularly so in sending countries, concerned with the potential for "brain drain". Portugal is no exception and several studies have attempted to ascertain the inbound and outbound flows, the motivations for leaving but also for returning, and the impact of mobility in the production of science (Pereira 2002; Fontes 2007; Delicado 2010a, 2010b, 2011; Fontes and Araújo 2013; Fontes *et al.* 2013). Conversely, few studies have broached the subject of foreign researchers in Portugal and their role in placing the country in a "global platform of circulation of researchers" (Reis *et al.* 2010).

Another particular trait of the Portuguese scientific community is the unusually high proportion of women researchers (46% in 2011, according to official data – DGEEC 2013), even though, just like elsewhere, this

share is lower in the top echelons of the scientific career. Thus, the issue of gender in science has merited several works, some more general (Ruivo 1986, 1993; Amâncio and Ávila 1995; Reis *et al.* 2010; Amâncio 2003), other focused on particular disciplines (Almeida 1986), others in connection with other themes, such as international mobility (Delicado and Alves 2013).

Science policies have been a frequent object for analysis. Ruivo's PhD thesis, later published in book form (1998) is an in-depth analysis of science policies and their impact on the development of the Portuguese scientific system between 1967 and 1989, paying particular attention to the impact of the transition to democracy and to the role of international organisations. Caraça (1999) updated this analysis, by focusing in the transformations occurred in the 1980s and 1990s, mainly as a result of European structural funding and the creation of the ministry of Science. Heitor and Horta (2012) provide an English language overview of science and technology in Portugal, covering the whole 20th century and the early 21st century, with a particular focus in the past few decades and in policies concerning human resources, research institutions and international networks.

Other works have focused on particular sections of science policy. Gonçalves (1993, 1996) and Pereira (2004b) published articles on the construction of public policies on science and the role scientists play (or failed to play) on it. Henriques (1999) also examines the consultation processes behind R&D funding decisions and the establishment of peer review as the procedure for allocating project grants. Pereira (2004a, 2004b) analysed the public debate surrounding policies concerning the funding of research institutions in Portugal, tracing the transition from traditional models based on greater autonomy to models promoting increasing accountability and government control.

Several studies (Pereira 2002; Patrício 2010; Horta 2010) examined the role of science and higher education policies in promoting the internationalisation of Portuguese universities and researchers. Heitor *et al.* (2013) argue that policies aimed at building advanced human capital are key for the development of S&T systems, illustrating their argument with the case of science policies in Portugal between 1986 and 2010, though it should be mentioned that the main author had direct responsibilities in this matter, since he was the Secretary of State for Science between 2005-2011.

Of a different nature is a survey of members of the Portuguese Parliament on science and science policy, conducted in 1995, that revealed a mismatch between the high valuation of science by parliamentarians and the low levels of government funding for science (Gonçalves *et al.* 1996).

4. Laboratory Ethnographies

The previously mentioned studies are characterised by an "external", Mertonian approach to STS, focused on the characteristics of the scientific community and of the S&T system. A second, though less voluminous, strand of studies concerns the analysis of the production of scientific knowledge, achieved mainly through laboratory ethnographies. But how can the observation of scientific practices in Portuguese laboratories highlight local differences and specificities? Scientific standards are set at the core of the science system and differences at the periphery are caused not just by local "cultural" specificities but also by the unequal power relationship associated with a peripheral condition.

The first laboratory ethnographies were conducted in Portugal in the early 1990s. Martinez was an anthropologist employed by a chemistry and biology research centre in the outskirts of Lisbon who teamed up with sociologists to write one of the first Portuguese laboratory ethnography, combined with document analysis and a survey (Martinez *et al.* 1994). The authors applied Callon and Latour's concepts of translation and actor-network, examining also the cultural patterns and modes of organisation within the research centre.

Cristiana Bastos' PhD thesis on the interactions between AIDS activism, the medical establishment and scientific research in the US and Brazil was partly based on a laboratory ethnography conducted in Brazil. Though the fieldwork was conducted outside Portugal, it is still an influential work in Portuguese STS, since it was published both in the US (Bastos 1999) and in Portugal (Bastos 1997, 2002, 2008). Bastos' host institution is one of the leading research centres in Portugal and she has trained and supervised plenty of STS scholars.

João Arriscado Nunes conducted his first laboratory ethnography at a cancer research laboratory in Oporto. He paid particular attention to the local division of scientific work and to the constraints placed by the lack of resources that force researchers into technical or managerial tasks, typical of a "semi-peripheral" position in the world system of science (1996, 2001). These local conditions are invisible in the "finished product" (the publications) and are also ignored by laboratory studies conducted in more "central" countries, driving researchers to seek allies in international networks and outside the scientific sphere (in public and private funding and regulating bodies). His observations also allowed him to derive inferences regarding the use of microscopy in constructing and learning visualisation (Nunes 2000). In a later work, Nunes (2008) examines how a particular biological and biomedical entity (in this case, a bacteria thought to be responsible for stomach cancer) is enacted as an object of knowledge and "an entity making a difference in the world" (a notion derived from Daston).

Some of Bastos and Nunes' students went on doing similar laboratory ethnographies, both at research labs (Faria 2001) and at other scientific

settings, such as forensics labs (Costa *et al.* 2000; Costa and Nunes 2001) or meteorology services (Praça 2008).

5. Science and Society

Though the issue of public understanding of science (under its multiple labels, from "scientific culture", to "public engagement with science", to "science for and with society", in the latest EU parlance) has become transversal to all countries, it has perhaps gained a heightened attention in STS in Portugal due to the priority it was given in science policy. This priority was mainly expressed through the creation in 1996, under the Ministry of Science, of a national agency (*Ciência Viva*) in charge of promoting a wide array of science dissemination activities (for students and the general public) and setting up a network of science centres (Gonçalves and Castro 2002, 2009; Heitor and Horta 2012).

The (lack of) understanding of science by the Portuguese public was early on identified as a problem that begged to be measured and solved. Following the lead of Eurobarometer surveys in 1990 and 1992, the Observatory of Sciences and Technologies conducted national surveys on scientific culture, measuring the (low) interest in and knowledge of science of the Portuguese population between 1996 and 2000 (OCT 1998; Ávila *et al.* 2000; Rodrigues *et al.* 2000; Freitas and Ávila 2000;). Much like in other countries, these surveys came under criticism from Portuguese STS scholars for their simplistic views on science (Ávila and Castro 2002) and were abandoned since then, even though similar Eurobarometer studies still continue to be conducted and their data is at times used by some authors (Costa *et al.* 2009). In a slightly different vein, two social psychologists, Castro and Lima (2000) also devised a questionnaire survey to assess the variability of notions of science and environment within the public, according to values and identities, and how the two are articulated.

In 2000, the Gulbenkian Foundation commissioned a study on the publics of science in Portugal by a team from CIES-ISCTE. The Foundation was aiming to assess the interest of resuming the publication of their magazine for scientific dissemination *Colóquio/Ciências* (published between 1988 and 2000). Costa *et al.* (2002) thus conducted a national survey on the practices and representations of the population regarding scientific dissemination. The authors derived from the data a typology of ways of relating to science, heavily influenced by educational levels, which comprised seven type-profiles. However, two thirds of the population fell on the three profile-types that are characterised by a significant distance to science.

CIES-ISCTE also conducted other studies on scientific culture, most notably the evaluation of the *Ciência Viva* competition for schools and

some of its other activities (Costa *et al.* 2005), characterising the effect of the activities of this Agency as having generated a "social movement" in Portugal. This team, among others (Delicado 2004), have also striven to extend scientific dissemination to the social sciences and to write about their own experience (Conceição *et al.* 2008).

There are fewer works on the other party of science communication: the scientists. Gonçalves (1996, 1997, 2004; see also Jesuíno and Diego 2002) surveyed the researchers from the Faculty of Sciences of the University of Lisbon aiming to elicit their views on scientific culture and scientific dissemination. Machado and Conde (1997) interviewed science disseminators in order to ascertain their trajectories and dispositions, their place in the scientific field, their practices and notions of dissemination. However, these two works predate the substantial growth in science dissemination activities in Portugal, which has resulted in the involvement of a greater number of scientists. Despite the fact that government funding programmes increasingly demand dissemination activities, it remains to be seen whether this has affected the reward system or the distribution of scientific capital within the scientific field.

The development of science museums and science centres in Portugal in the past few decades has also spurred a significant number of studies on their characteristics, from monographs of particular institutions (e.g. Caldeira and Antunes 2005; Duarte 2007) to wide-ranging works (Delicado 2006, 2009; Andrade 2003, 2010), from surveys and interviews with visitors (Casaleiro 2000; Coelho 2009) to assessing the effects of visiting exhibitions, in particular in school aged children (e.g. Botelho and Morais 2003, 2004; Faria *et al.* 2010).

Another recurrent object of study in Portugal in this particular area of STS has been the presence of science in the mass media and the representations of science they convey (Machado and Conde 1997; Mendes 2002; Schmidt 2008), as well as of particular scientific issues, such as scientific controversies (Correia 2000, 2002; Garcia 2001), climate change (Ramos and Carvalho 2008), biotechnology (Jesuíno *et al.* 2001), or biology (Fonseca and Gonçalves 2009).

If the issue of the public understanding of science has already an established tradition in Portugal, the public engagement with science still has a long way to go. One of the few published records of a consensus conference in Portugal is described in the article by Coutinho and her team (2004). Carvalho and Nunes (2013) promoted a focus group on nanotechnology (integrated in the European research project DEEPEN – Deepening Ethical Engagement and Participation in Emerging Nanotechnologies) that was characterized by the innovative introduction of Paulo Freire's Pedagogy of the Oppressed and Augusto Boal's Theatre of the Oppressed. In fact, the increasing involvement in European projects by Portuguese academics (and even by the Agency *Ciência Viva*) has the potential to lead to the proliferation of engagement endeavours, but more published evidence has yet to emerge.

6. Risk Studies

Another issue that has gained significant prominence in STS in Portugal is the controversies generated by environmental risks and the interactions between science, policy and public participation in the management of such hazards. The late development of science in Portugal, a lack of administrative tradition in resorting to scientific advice for policy decisions and a weak civic culture that hinders public participation were the backdrop to many of these studies, although the seeds of change can be seen in many of them.

Among the earliest 'risk studies' in Portugal is a problem that transcended national borders: the mad cow disease that in the late eighties became a public health problem in most of Europe (Gonçalves 1996, 2000; Gonçalves *et al.* 2007; Pereira 2002, 2004). As in other countries, the government first tried to deny the problem, disregarding (and even discrediting) expert advice, but it was ultimately forced by its membership of the European Union to follow international safety guidelines and take preemptive measures. This zigzag did little to enhance public trust in government but put Portuguese science in the spotlight for perhaps one of the first times.

Another case that sparked the interest of STS researchers was the discovery of pre-historic engravings at the site of a planned construction of a dam hydroelectric in the north of the country (Gonçalves 2000, 2001, 2002). Engineers and archaeologists started a dispute that would spill over to the media (Garcia 2001) and garnered the public interest, eventually leading the (newly elected) socialist government to decide in favour of the engravings and against the construction of the dam. A similar case but with the opposite outcome was studied later by Bento (2008).

Probably the most extensively studied environmental risk in Portugal is the co-incineration of hazardous waste, a controversy that spanned almost a decade (Nunes and Matias; Matias 2004, 2008; Gonçalves *et al.* 2007; Gonçalves and Delicado 2009; Jerónimo 2010; Jerónimo and Garcia 2011). The government's proposal for solving the problem of hazardous industrial waste by incinerating it in cement factories raised a strong opposition from local coalitions of actors (residents, local authorities, environmental organisations), which forced the government to request further expert advice (which was met with mistrust, both from the local actors but also from members of the scientific community, acting as counter-experts). This in turn led to successive delays and changes in policy (with each change in government), lawsuits and other forms of resistance, until the procedure was finally implemented in 2009.

The issue of controversy and participation in environmental impact assessments has also motivated several studies. Gonçalves (2002a, 2002b) examined how changes in the civic culture of Portuguese society had an impact over legislative and institutional frameworks, leading to improved scientific and technical grounding of decisions and more democratic legit-

imacy. Lima (2000) presented the results of a survey of populations living near a projected waste incineration facility, in order to show that this sort of surveys constitute a more adequate way of assessing social impacts and public perceptions than simply scrutinizing the (scarce) participation in public consultation. However, Casto and Lima (2002) have also examined the transcripts of the public consultation for the same facility, in order to analyse the discourses of different actors (engineers, environmentalists, business representatives, local authorities, scientists, citizens) and how science is used to justify contrasting arguments. A later work (Lima 2006) also used survey data to predict attitudes towards the incinerator, namely variable such as perception of risks and justice, expectations, trust, and distance of residence.

Other STS works have dealt with environmental and health risk in work settings, such as an oil refinery plant in Sines (Granjo 2004) or the uranium mines in Urgeiriça (Mendes and Araújo 2010).

7. Institutional Settings

Despite the wealth of STS research in the past few decades, this area of knowledge still lacks some institutional foundations, such as journals, associations, or research units.

STS researchers in Portugal are mainly sociologists by training, although some come from anthropology, social psychology and law. Unlike what is common in other countries, few researchers are from the natural sciences or engineering. STS is barely present in undergraduate education and few post-graduate courses are on offer: a PhD Programme in Knowledge, Governance and Innovation at the University of Coimbra that started in 2005; a Master in Economics and Management of Science, Technology and Innovation at the University of Lisbon that started in 1995 (aimed at the training of science managers that work in companies, R&D units, universities, S&T parks and government bodies responsible for science); and a Master in Science and Technology Studies at ISCTE University Institute of Lisbon that started in 2009 but was suspended in 2012 due to the lack of applicants.

There is no research unit solely dedicated to STS, so researchers in this field are integrated in social sciences centres that cater to different areas of study. STS academics usually are part of broader research areas or groups that deal with issues such as environment, health, knowledge society, innovation, or work: the research group on science, economy and society of the Centre for Social Studies (University of Coimbra), the research area on sustainability, environment, risk and space of the Institute of Social Sciences (University of Lisbon), the research groups on Knowledge society, skills and communication and on Work, Innovation and Economy at CIES-ISCTE (University Institute of Lisbon), the re-

search area on Science, Technology, Health and Professions at SOCIUS (ISEG, University of Lisbon) and the one on Culture, Science and Identity at CICS (Minho University). Finally, there is also IN+, the Centre for Innovation, Technology and Policy Research, integrated in the Engineering School IST (University of Lisbon), plus a few researchers scattered in other sociology or anthropology departments.

There are currently no specialised STS journals in Portugal. As mentioned above, there had been two journals dedicated to science issues, launched in the 1980s, but that failed to take advantage of the growth of the field: *CTS,* published by ACTD between 1987 and 1994, and *Colóquio Ciências,* edited by the Gulbenkian Foundation between 1988 and 2000. A bibliographic study (Duarte 2009) concerning sociology of science in Portugal, in the period between 1988 and 2008, shows that there have been 169 publications in this period, mainly in national social sciences journals and books. The rate of publication was regular since the mid-nineties and increased significantly from 2000 on. International publication is on the rise, driven by participation in international networks and by funding policies that reward articles in indexed journals.

Likewise, there is no STS association in Portugal. The Portuguese Sociological Association (APS) has a thematic section on Knowledge, Science and Technology since 2010, which organized its first conference in November 2011. The section has only 15 registered members, however, in the last national congress of APS around 60 papers were presented in this section. Concurrently, even though the EASST conference in Lisbon in 1998 was an important event for disseminating STS in the country, just 11 Portuguese researchers are actually EASST members.

Funding for research in STS has been granted from two main sources, the Foundation for Science and Technology (integrated in the Ministry of Science) and the Gulbenkian Foundation. In 2008, the Foundation for Science and Technology created STS as a separate field in its R&D project funding calls (traditionally, STS projects were part of the sociology or anthropology fields). Between 2008 and 2012, 12 projects were funded, totalling close to 1.5 M€. The Gulbenkian Foundation, the leading non-profit organization in Portugal, had already played a very relevant role in the development of science in Portugal, from the 1950s onwards, funding the training of Portuguese researchers abroad at a time when government intervention was very limited and commissioning research (rather than launching open calls) in its main areas of interest.

Portuguese STS researchers have also participated in European projects, funded by the Framework programme and other initiatives, such as "Building a common database on scientific research and public decision on TSEs in Europe" (1998-2001), "ADAPTA: Assessing Debate and Participatory Technology Assessment" (1998-2000), "EUDEB: European Debates on Biotechnology" (1999-2000), "OPUS: Optimizing Public Understanding of Science" (2000-2003), "LSES: Life Sciences in European Society" (2000-2004), "STAGE: Science, Technology and Governance

in Europe" (2001-2005), "Deepening Ethical Engagement and Participation in Emerging Nanotechnologies" (2006-2009), or "Researching Inequality through Science and Technology – ResIST" (2006-2009).

8. Conclusions: The Future?

We end as we begun, by briefly exposing the constraints and opportunities that STS in Portugal are currently facing, in tandem with Portuguese science. Though as a weakly institutionalised field, STS are perhaps in a more vulnerable position than others.

Portuguese science is experiencing testing times. Due to the financial crisis and to policy options, government funding is dwindling. A science system built on shaky ground (heavily reliant on public funding and based on a workforce made of temporary contracts and grants) threatens to collapse. Membership of international organisations is at risk, the number of students in tertiary education is starting to decline, institutions struggle with lack of funds to build and maintain networks, and the exodus of highly trained researchers is already visible.

How the science system will respond to these challenges and how scientific practices will be transformed by this new "leanness" of resources will be an enticing matter for future STS research. Provided the field of STS also survives these testing times.

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