Science for Policy in Portugal

Discussion Paper

Vítor Corado Simões

8th November 2021

As part of the European Commission's Joint Research Centre (JRC) action "Connecting and strengthening science for policy ecosystems across Europe"

Joint Research Centre

How to cite this discussion paper:

Simões, Vítor Corado (2021), 'Science for Policy in Portugal', Discussion Paper prepared for the workshop on *Science for Policy across the EU: Portugal*, organised by the European Commission's Joint Research Centre (JRC) and the Fundação para a Ciência e a Tecnologia (FCT), Portugal, November.

Disclaimer:

The views, thoughts, and opinions expressed in this discussion paper reflect the assessment of the author and may not in any circumstances be regarded as stating an official position of the authors' employer, organisation, other group or individual.

This Discussion Paper was commissioned by the European Commission's Joint Research Centre (JRC) as an input to the "Strengthening and connecting ecosystems of science for policy across Europe" project.

This Discussion Paper will be officially released in a different format and layout at a later stage, and is now made available for fostering discussion in preparation of the workshop on "Science for policymaking in Portugal" to be held on the 16th November 2021.

Contents

Acknowledgments

The author would like to thank Lorenzo Melchor and Kristian Krieger, from the European Commission's Joint Research Centre (JRC), for their inputs and comments to the discussion paper as well as for the fruitful intellectual exchange. I also thank Lorenzo Melchor for the careful editorial work. The key support provided by José Bonfim (FCT) in identifying the organisations surveyed, in commenting on the survey instrument and in exchanging views about the development of the report is very gratefully acknowledged. His knowledge about Portugal's scientific and technological system as well as about the Portuguese Public Administration were extremely helpful to carry out this report. The dedicated research assistance by João Pedro Rocha and his graphic skills deserve a very special reference. Thanks are also due to Constantino Sakellarides, Helena Carreiras, João Caraça, João Ferrão, José Paulo Esperança, Manuel do Carmo Gomes, Manuel Mira Godinho, Mara Almeida, Maria Manuel Mota, Miguel Correia Pinto, Ricardo Mamede, and Tiago Santos Pereira for providing relevant contributions at different phases of the development of this report. I also thank the intermediation of Graça Damião, Teresa Morais and Sandro Mendonça in the surveying process. The cooperation of the respondents to the Science-for-Policy survey, who invested time and effort to provide us with detailed information, deserves a special message of gratitude. The usual disclaimer applies.

About the author

Prof Vítor Corado Simões has served for many years as professor at ISEG – Instituto Superior de Economia e Gestão (University of Lisbon), until his retirement in April 2020. He has also served as policy maker, namely in the Ministry for the Industry and Portugal's Foreign Investment Institute. He has been a member of the Consultative Council of PROINOV and the Technological Plan. His research addresses three main fields: International Management, Innovation Management, and Science, Technology and Innovation Policy. He participated in the evaluation of research at the University of Uppsala (2012). He has worked as consultant to OECD, UNIDO, and the European Commission. With Manuel Mira Godinho, he has developed yearly reports on Portugal's Research and Innovation Policy for the EU Research and Innovation Observatory (JRC). He has published in Portuguese and international journals. Most of his publications focused on competitiveness and internationalisation, foreign investment flows, born globals and platform companies, and the scientific research and innovation system in Portugal. Prof Simões served as President of the European International Business Academy (EIBA) in 1993, and is now Fellow of this Academy. He is leading (with John Cantwell and Philippe Gugler) the research project on the History of EIBA.

Executive Summary

The purpose of this discussion paper

The context for the project. This discussion paper was developed to support the workshop 'Science for Policy-making in Portugal', organised by the European Commission's Joint Research Centre (JRC) and the Foundation for Science and Technology (*Fundação para a Ciência e a Tecnologia* – FCT). It has taken into consideration similar reports on Denmark and Greece. But it went further, by undertaking of a survey aimed at mapping the linkages between demand and supply for scientific advice in Portugal, in a few selected fields (Defense, Economy, Employment, Environment, and Health).

Science for policy in a VUCA world. This paper draws on a VUCA perspective. We live in a context characterised by volatility, uncertainty, complexity and ambiguity. Against this background, we intend to provide a view on scientific advice in Portugal. More specifically, our purpose is three-fold: (1) to identify distinct organisational forms for provision of scientific advice; (2) to map the network of relationships between the demand and the supply for such advice; and (3) to assess the profile of science for policy in Portugal.

The method

A mixed methods approach. A three-pronged methodological approach was followed, encompassing: desk research; a survey addressed to the demand and the supply of scientific advice as well as to experts; and a set of interviews with selected experts.

A cautionary note. The use of different methodological tools enabled the paper to shed light on different issues, and to provide a multi-faceted perspective of the science for policy landscape in Portugal. However, due to the low reply rate, the results of the survey should be taken with care.

The relevance of scientific advice

The challenges of policy-making are heightened in a VUCA world. To tackle them, appropriate scientific advice is needed. The emergence of populist challenges, denying the role of science and disputing the role of experts, make scientific advice of key importance in today's environment of pandemic threats, climate change and artificial intelligence developments. There is a growing need for evidence-informed policy-making.

The interaction between science and policy-making is not easy. They correspond to distinct epistemic communities with different values, cultures, perspectives and timeframes. The recognition of such differences is essential for a productive dialogue.

Different governance approaches and structures for scientific advice are available worldwide. They include: Advisory councils; advisory committees; national academies, learned societies and networks; and a chief scientific adviser. The identification of the most appropriate

structure for Portugal is out of the scope of this paper. But our research suggests that the merits (or flaws) of distinct approaches are contingent upon history, cultural traits, and how the process of scientific advice works in practice in each country.

Science for Policy in Portugal: The main findings

There is not a single science for policy ecosystem in Portugal. There is not a closely interconnected set of scientific advice relationships, with specific cross-cutting coordination mechanisms. Rather, distinct science for policy clusters driven by common interests, concerns and linkages do co-exist.

There is a diverse set of organisational mechanisms for scientific advice in Portugal. These may be clustered in eight groups: Research organisations; public laboratories; permanent and *ad-hoc* advisory committees; scientific and consultative councils; expert panels, working groups and task-forces; policy observatories; contracted advisors; and consulting firms.

The assessment of the quality and diversity of objectives of scientific advice is relatively uneven. Both demand and supply organisations rank them better than experts. Advice mostly stems from a request by policy-makers and is more concerned with knowledge synthesis and brokerage than with knowledge generation. Evaluation does not appear to figure very high among advisory functions.

Policy-making bodies do not seem to be fully aware of the importance of science for policy. There is a somewhat paradoxical situation. On the one hand, there is a widespread acknowledgement by the political community of the quality and dynamics of the Portuguese scientific community. On the other, the awareness about the merits and advantages of scientific advice is relatively limited. Different rationales coexist to request scientific advice: to identify options and their implications and relative advantages; to respond a crisis; and to search for a confirmatory position to validate decisions already taken or envisaged.

The influence of international instances is increasing. This is envisaged as a positive trait, since it introduces more formal procedures and fosters international policy learning. However, there is a risk of importing 'ready-made' approaches, with little adaptation to the specific conditions of the Portuguese situation.

The present statute of University career discourages the practice of scientific advice. The low relevance assigned to extension and scientific advice activities in the evaluation of academics leads many researchers to abstain from such activities, concentrating their time on higher career-rewarding tasks.

Last but not least, there is a lack of formalisation of scientific advice procedures. There are no general regulations regarding relevant themes such as the criteria and conditions for searching advice, conflicts of interest or confidentiality. Informality undermines governance, impairs the

establishment of clear rules of behaviour and reduces transparency. Insufficient formalisation emerged as a key problem in Portugal's science for policy scenario.

The basic challenges

Enhancing the recognition of the advantages of scientific advice among policy-makers at different levels. Political powers do not seem to be fully aware of the relevance of scientific advice. There seems to be a need for 'evangelisation' regarding the role of scientific advice to support evidence-informed policy-making.

Promoting an increased dialogue between science and policy-making. It is essential to stimulate cooperation in the definition of the key questions to be addressed. This may be a good starting point to enable a more productive dialogue, beneficial for science, policy-making and the society as a whole.

Going beyond personal trust to institutional trust. Portugal is a small country in which at higher rankings 'everybody-knows-everybody' but in which there are groups, often defined by political *cum* personal affinities and trust. While trust is an essential ingredient in science for policy, there is a need to stimulate institutional trust. This requires an effort to enhance Public Administration's capabilities.

Stimulating academic engagement in policy-making. The low weight assigned to scientific advice in the evaluation of academic performance needs to be addressed. It discourages many high-skilled researchers to engage into science for policy, when otherwise they might provide relevant contributions to evidence-informed policy-making.

Increasing transparency. Lack of transparency is not always deliberate: in many cases it stems from insufficient organisational capabilities and/or skilled human resources. But it may also be a way to avoid scrutiny and to have more leeway for taking decisions. The problem is expressed in different ways: information on the selection of advisers; information about potential options; information about the rationale for decision-making; and information for societal participation and scrutiny.

Governance challenges in a VUCA world: key questions

How to promote formalisation? Being a small country with a very informal culture, Portugal suffers in general from a lack of formalisation. An institutional approach towards science for policy is needed. This is key to enhance the governance of science for policy. The formalisation approach has to provide appropriate regulation of procedures and inter-actions while avoiding bureaucratisation and keeping flexibility to enable a proper working of the interactions.

How to establish a multi-layered and diversified but consistent governance? Formalisation entails the need to promote organisational change to respond volatility, uncertainty, complexity and ambiguity. The challenge is to make scientific advice a key vector in an improved, multi-

layered governance system encompassing distinct sovereignty bodies and a wide set of demand and supply organisations, within and outside public administration. It requires the participation of multiple stakeholders, and the design of forms of coordination to enhance the quality and effectiveness of scientific advice.

How to respond societal challenges stemming from fast change in multiple fields? This requires a turn in the prevailing approaches to science for policy. It is not a matter of relying on science to respond a crisis. It is mainly a matter of drawing on science advice to anticipate change, by identifying options and designing possible scenarios. Examples of such challenges, some of them already hitting us, are robotisation, artificial intelligence, platform companies, employment opportunities, systemic risks, ageing diseases, the socio-digital divide and new feeding sources.

Opportunities

The widespread recognition of the important role of science. Both the Portuguese society and the political players recognise the role of science and are proud of the achievements of the Portuguese scientific community. In contrast to other countries, the relevance of the groups denying the role of science is low. Most political parties converge in praising science. There is room for establishing a social consensus about the need for creating conditions for a better governance of science for policy in Portugal.

The pandemic has highlighted the key role of scientific advice. In Portugal, public opinion has learned to rely on the qualified opinions from public health specialists, epidemiologists or virologists to keep abreast of the situation and to forecast the future. This provides an opportunity for building up a coalition for change towards an improved and more institutionalised role of science for policy.

The existence of bridge-makers. It is relatively common in Portugal the assignment of government responsibilities to academics. There are also cases, though relatively less common, of academics that have served for some time as high-level Public Administration officials. The circulation through different jobs is likely to enable such individuals to play the role of facilitators or ‘bridges’ between policy-makers and the academy, contributing to reduce the frictions in the dialogue between them.

The Recovery and Resilience Plan (RRP) provides an opportunity to improve the skills of Public Administration’s human resources, including its rejuvenation. A serious hindrance to science for policy is the relatively low level of skills and the ageing of Public Administration staff. The RRP may contribute to enhance such skills, from the recruitment of younger and more qualified staff to the training of existing staff. This opportunity window should be accompanied by an effort to ensure a consistent policy of selection of high-level Public Administration officers chiefly based on capabilities instead of political affiliation.

The (difficult) recognition of the need for improved governance. Taming the pandemic threat is likely to take other issues to the forefront, including the recognition of the weakness of

governance in Portugal. This may lead to more open, multi-layered and participatory approaches, generating new opportunities for institutionalising science for policy interactions and enhancing coordination.

Research and action for the future

The present paper as the starting of a research stream on science for policy in Portugal. Due to time and budget constraints, this paper is just a first attempt to scratch the surface of a complex and multi-faceted reality. Further research initiatives on science for policy are seriously required to foster evidence-informed policy-making in Portugal.

Action is needed. This paper has identified a large set of issues to be addressed, going from the capabilities and the openness to dialogue to the need to improve governance and formalisation. We do hope that the workshop may also be a call for action on this regard, paving the way for a medium-term programme on science for policy in Portugal involving multiple stakeholders.

1. Introduction

This discussion paper aims to provide a first, tentative and limited, assessment of the Portuguese science for policy ecosystem(s) and map their relationships. It supports the workshop 'Science for policy-making in Portugal', organised by the European Commission's Joint Research Centre (JRC) and the Foundation for Science and Technology (*Fundação para a Ciência e a Tecnologia – FCT*), to be held online on the 16th November 2021.

This paper was supported by the JRC and has taken into consideration similar reports regarding Denmark (Pedersen and Hvidtfeldt 2021) and Greece (Ladi, Panagiotatou and Angelou, 2021). However, several changes were introduced after an exchange of views with the JRC with a view to develop a more accurate mapping of the linkages between demand and supply for scientific advice in Portugal in a few selected domains (Defense, Economy, Employment, Environment, and Health).

While policy for science is a well-established field, with a large tradition, a consolidated set of information and renowned academic journals (*Research Policy* was launched in 1971), the same does not happen with science for policy. While its roots may date back as early as the 17th century, with the posthumous publication of Francis Bacon's *New Atlantis* in 1626, research in the field is not firmly established. In Bacon's novel, governance in the utopian country was assigned to a learned council of men with significant scientific achievements (Godinho and Caraça, 2008). The Enlightenment provided new opportunities for the development of science (Mokyr, 2009 and 2016). However, the implementation of scientific developments for enhancing society's well-being has been mainly led by public health doctors or engineers (Johnson, 2010). In the 20th century, scientific specialisation led to a decoupling of the sciences from other societal subsystems, thereby entailing a weakening of the connection between science and policy[1]. This does not conceal the fact that "the potential for wealth creation in advanced societies is thus strongly rooted in science-driven technological change and artifacts" (Godinho and Caraça, 2008: 2). Therefore, in recent years, there has been an increasing stream of literature dealing with science for policy, including contributions by international organisations and practitioners (OECD, 2015; INGSA, 2017; Gluckman, 2016 a, b; Group of Chief Scientific Advisors, 2019; SAPEA, 2019; Topp, Mair, Smillie and Cairney, 2018; Mair, Smillie, La Placa, Schwendinger, Raykovska, Pasztor and van Bavel, 2019; Šucha and Sienkiewicz, 2020) as well as academics (Oreskes, 2004, 2018 and 2021; Jasanoff, 2013; Pielke Jr., 2015; Cairney, 2016a, b and 2020). The JRC's *Knowledge management for policy* (KMP) comes in this vein, providing an interdisciplinary assessment of 'soft' issues and challenges regarding 'evidence-informed policy' (Topp et al., 2018; Mair et al., 2019). Paradoxically, the emergence of populist challenges, denying the role of science and disputing the role of experts, make scientific advice of the utmost importance in today's environment of pandemic threats, climate change and artificial intelligence developments (Gluckman and Wilsdon, 2016; Mair et al., 2019; Innerarity, 2021).

[1] I thank Kristian Krieger for calling my attention to this point.

Drawing from the perspective of a VUCA world, that is, a world characterised by volatility, uncertainty, complexity and ambiguity, this discussion paper aims to provide a grounded perspective of the reliance on scientific advice in Portugal, in line with the JRC science for policy line of activities. Our research suggests that there is not a single science for policy ecosystem in Portugal. There is not a closely interconnected set of scientific advice relationships, with specific cross-cutting coordination mechanisms; rather, distinct science for policy clusters driven by common interests, concerns and linkages do co-exist. Contrary to what happens in Canada, New Zealand, the United Kingdom, Israel, or Estonia, Portugal has neither a Prime Minister's Chief Scientific Adviser (CSA) nor a network of science advisers appointed to each ministerial department. Neither there is a central mechanism for promoting and/or managing scientific advice within the Government or the Parliament. From this perspective, the situation in Portugal has some similarities with the Danish one, as reported by Pedersen and Hvidtfeldt (2021)[2].

This report may be envisaged as a 'mirror image' of the reports written in the context of the JRC's Research and Innovation Observatory - RIO (see, for instance, Simões, Godinho and Sánchez-Martinez, 2018). The latter was focused on Research and Innovation policy, identifying the key policy measures aimed at promoting Research and Development (R&D) and innovation in the country. They presented research and innovation policy measures, and assessed their likely implications, without delving much in depth on the process leading to policy decisions. Now, the challenge is to go the other side of the 'mirror': to identify the organisational processes and the contribution of scientific research towards national policy-making. The challenge is significantly different. It requires another look, different from the one entailed by traditional Research and Innovation (R&I) policy. It is worth noting that, in line with our above argument on the higher epistemic status of policy for science with regard to science for policy, a few respondents to our survey were biased towards a science policy approach.

The report encompasses seven sections, including the present introduction. Next, the key issues regarding science for policy will be addressed, followed by a brief reference to earlier initiatives on this regard in Portugal. Section 3 provides the methodology followed to respond the challenge raised by the JRC. Then, a general perspective of science for policy in Portugal is provided, identifying the key organisational approaches adopted in the field. The main findings of our survey and interviews with experts is presented in section 5. The following part is intended to provide an assessment of the contribution of scientific advice for policy making in Portugal, followed by the identification of the main challenges and opportunities. The report closes with a synthesis of the main conclusions.

[2] However, this does not conceal the existence of significant differences in both the way how scientific advice takes place in practice and the organisational infrastructure for scientific advice.

2. The Issues

2.1 Science for Policy in a VUCA World

We live in a VUCA world. Initially developed in a military setting (Whiteman, 1998), the VUCA framework has been used as a research and policy tool in different fields, from general management (Bennett and Lemoine, 2014), international management (Buckley, 2020; Clegg, Voss and Chen, 2020) and innovation management (Millar, Groth and Mahon, 2018) to education (Rouvrais, Gaultier Le Bris and Stewart, 2018; Waller, Lemoine, Mense, Garretson and Richardson, 2019; Fernandes and Afonso, 2021) and sustainable development (Schick, Hobson and Ibisch, 2017). As underlined by SAPEA (2019), complexity, uncertainty and ambiguity are three conditions of scientific knowledge. VUCA adds a fourth element, often pervasive in today's social, economic and environmental conditions: volatility.

The different vectors of VUCA -Volatility, Uncertainty, Complexity and Ambiguity- are inter-related, generating systemic interactions. Volatility refers to the nature and dynamics of change, including its underlying forces and catalysts. From a sociological perspective, volatility is related to Zigmunt Bauman's concept of "liquidity" (Bauman, 2000), expressing the weakness of attachments and individualistic behavioural patterns. Volatility also portrays a key feature of the COVID-19 pandemics, namely the emergence and fast diffusion of new COVID-19 strains. Being related to uncertainty and risk, volatility invites flexibility and options thinking (Buckley, 2000; Moore and MacKenzie, 2020). Uncertainty is related to the incapacity to predict the future. It corresponds to "a situation characterised by a lack of knowledge, not as to cause and effect but rather pertaining to whether a certain event is significant enough to constitute a meaningful cause" (Bennett and Lemoine, 2014: 5). Uncertainty is also present in human behaviour, as Kahneman, Sibony and Sunstein (2021) have underlined by developing the concept of noise. This is intended to show the variability of human judgements, because they may be affected by multiple factors, leading Kahneman, Rosenfeld, Ghandi and Blaser (2016) to argue that "humans are unreliable decision makers". Complexity "refers to the difficulty of identifying and quantifying causal links between a multitude of interdependent variables, under conditions of time dependencies and feedback loops" (SAPEA, 2019). This entails non-linear transitions and multiple cause-effect pathways, with consequences such as financial bubbles or climate change. Innerarity (2021) has attempted to develop an "epistemology of complexity" (Innerarity, 2021: 59), underscoring that it involves not just what we do know but also what we do not know, especially the 'unknown unknowns'. In his view, complexity has to be addressed by interdisciplinary and polycentric approaches; the latter encourage experimental efforts at multiple levels, enabling a comparison to the results obtained in different settings (Ostrom, 2014). Ambiguity has to do with situations in which relevant information is available but the overall meaning is still unknown. Applied to scientific advice, it expresses the multiplicity of scientifically justified perspectives regarding the meaning and implications of scientific evidence (SAPEA, 2019). Experiments reduce ambiguity while allowing analysts to assess the weightings to be assigned to different elements in complex

environments (Buckley, 2000). Ambiguity is also related to communication uncertainty, a key feature in the context of scientific advice (SAPEA, 2019; Mair et al., 2019).

Twelve years ago, Bijker, Bal and Hendriks (2009) advanced the "paradox of scientific authority". This refers to the contradiction between the increasing use of scientific advice and the diversity of reactions to such advice. With the re-emergence of populism and the COVID-19 outbreak, such contradictory forces have heightened. For populists, the response relies on identity, mythologising the 'good old times' when things were assumed to be simple and clear (Inneratity, 2021). Instead of VUCA, populism appeals to a black-and-white view, characterised by stability, certainty, simplicity and clarity. The problem is just that such world does not exist. As Innerarity (2021) argues, one cannot get rid of complexity. Rather, there is a need to "improve democracy, by making it more complex" (Innerarity, 2021: 22). This requires the acceptance of complexity (and the other elements of VUCA), responding through evolution and the co-design of new instruments that might meld the potentially conflicting elements together.

The implications for scientific advice are clear: to deal with a VUCA world, there is a need to promote a better interaction between science and public policy. It is important to note the room for tension, misunderstanding and ambiguity between both fields (Cairney, 2016a, b; Gluckman, 2016a, b). They correspond to distinct epistemic communities, with different values, norms, cultures, languages and time frames (Mair et al., 2019). Some scientists appear to implicitly assume that they are touched by the grace of Athena, being the holders of 'true' knowledge. They forget that, as Keith Pavitt (1998) put it, there is a body of understanding and a body of practice, both being relevant and legitimate. Furthermore, while science can provide new insights into political behaviour, including on how and why emotions, values, identity and reason affect the ways we think, talk and take decisions on political issues, both scientists and policy-makers may be biased by their personal sets of values, identities, *weltanschauungs*, and emotions[3] (Mair et al., 2019). The point in which science, not scientists themselves, differs has to do with its process of developing knowledge: this is a communitarian, social process, through which scientists interact, develop propositions, and submit them to their peers' criticism (Oreskes, 2021). It is hard for policy-making to develop a similar evolutionary approach, the more so as different political affiliations or even partisanships undermine the development of 'commons'. However, taking a long-term perspective it is possible to find an evolutionary development of 'democratic commons' across many European political parties, to a large extent promoted by the very *acquis communautaire* (Innerarity, 2021).

Positions taken in recent literature highlighted the need for both clarifying the boundaries between the two fields and providing tools to encourage trust, dialogue, and cooperation. A key point is "defining together the questions to be addressed", taking a systems perspective (Group of Chief Scientific Advisers, 2019: 19). Another consensual approach concerns the need to espouse a

[3] Not to speak about possible conflicts of interest. The Group of Chief Scientific Advisers (2019), recommends to refine the approach on this regard to ensure expert impartiality while keeping valuable expertise.

multi-disciplinary approach to scientific advice (Cairney, 2016b; Group of Chief Scientific Advisers, 2019; Mair et al., 2019; SAPEA, 2019). Scientific knowledge is key to safeguarding that systematic evidence is part of the collective decision-making process (SAPEA, 2019). However, while "scientific outputs often represent the best available systematic knowledge on a given subject, […] this is not the only relevant or necessary knowledge that decision-makers should use" (SAPEA, 2019:14). In fact, the relevance of scientific advice is contingent upon the issue at stake and the context, and there may be a need to match advice from different disciplines; therefore, scientific advice should not prescribe but rather inform policy-making (SAPEA, 2019). Developing collective intelligence processes, based on transdisciplinarity, is very relevant to enable satisficing policy solutions[4]. Policymaking poses particular challenges to collective intelligence because of the need to identify trade-offs between different competing values, interests and policy-options (Mair et al., 2019). This leads to the argument that scientific advisers should behave as "honest brokers of policy alternatives" (Pielke Jr., 2015). Advice is led by a concern of clarifying or even augmenting the scope of policy alternatives. Thus, Gluckman, Bardsley and Kaiser (2021) argue that brokerage may play a key boundary function in the science-policy interface. In their view, knowledge brokers should abide to three sets of principles: trust, transparency and legitimacy; respect for diverse knowledge systems; and acknowledging values and biases, a point also made by Mair et al. (2019) and SAPEA (2019).

These observations lead to another important issue in science for policy: the institutional framework in which scientific advice is provided - or, in Gluckman (2017)'s words, the "science advisory ecosystem". The picture emerging from international analyses of such frameworks in different countries (Wilsdon, Allen and Paulavets, 2014; Šucha and Dewar, 2020) is of a diverse mosaic of approaches, reflecting different national historical trajectories, political cultures, and experiences. Such diversity is to a large extent the result of evolutionary processes, marked by punctuated equilibria, to borrow the concept from Eldredge and Gould (1972). In other words, it stems from different national historical trajectories, closely linked to the characteristics of political systems, which generate patterns of managing the interface between science and policy-making (Jasanoff, 1998). Wilsdon, Allen and Paulavets (2014), relying on brief case studies from 20 countries or regions, identified four main approaches: Advisory Councils (Japan, USA); Advisory committees (also in Japan and the USA); National academies, learned societies and networks (Canada, China, Germany, Netherlands, South Africa); and CSAs (Australia, Cuba, India, Ireland, Malaysia, New Zealand and the UK). In contrast, Šucha and Dewar (2020) highlighted two distinctive clusters in the above-mentioned mosaic: government science advisers, mostly in Anglo-Saxon countries; and boundary organisations (and often a combination of different types of such organisations). In spite of such diversity, all approaches face similar challenges: "how to protect the independence of advice while ensuring that it is listened to; how to develop a trusted

[4] The use of the term 'satisficing' instead of 'optimal' is deliberate. Following Herbert Simon (1959), we argue that the main concern for policy-makers is to find 'satisficing' solutions rather than optimal ones. Furthermore, such solutions, as the overcoming of paradoxes, are always temporary, thereby requiring the design of new solutions, after a shorter or longer time span.

relationship with policymakers, while maintaining transparency and accountability in the eyes of the public and the science community alike; and how to undertake appropriate quality assurance" (Wilsdon, Allen and Paulavets, 2014: 7-8).

An often-raised issue is, which approach is the best? This question has come to the fore in Portugal as a result of the challenges raised by the COVID-19 pandemic. Pereira (2021) addressed the issue in an interesting way, calling for the need to appropriately combine scientific and political perspectives, but abstaining from advocating an approach. In contrast, in an opinion article published in the press at the peak of the second wave of the pandemics, Carlos Fiolhais, a renowned Portuguese scientist, was quoted as stating that "we do not have a Dr Anthony Fauci or a Sir Patrick Vallance [UK's CSA]" (Ribeiro, 2021). While the comment might be justified by the Government's decision changes to respond the pandemics, in our opinion it does not hold: it is not the existence of a Chief Medical Adviser to the President, as in the case of the USA, or of a CSA, as in the UK, that ensures a better approach. Scientific advice is *prima facie* a collective endeavour, involving inter-disciplinary contributions and the combination of distinct views and perspectives. Šucha and Dewar (2020: 24) shrewdly argue that "[d]ue to the complexity and importance of the decisions, it seems wiser to put in place advisory groups or structures, rather than relying on single individuals acting as a Government Science Adviser". Having said this, it is important to recognise, however, that different approaches cannot be assessed on the basis of the institutional structure *per se*. As my colleague Manuel Mira Godinho put it, it may happen that "governmental structures [in place may be] able to formulate good judgements and to appropriately support the decisions" or, alternatively, "sources of advice external to the decision-making body" may be sought (Godinho, 2021). The merits (or flaws) of the distinct approaches are also contingent upon history, political cultures, and how the very process of scientific advice works in practice.

2.2 The literature on science for policy in Portugal

Research on science for policy in Portugal is limited. Most research has a sociological tone, while contributions from economists or political scientists are less common. The literature mainly covers issues concerning community engagement and responses to climate change (for instance, Gonçalves, 2000, 2003 and 2007; Jerónimo and Garcia, 2011; Rinaudo, Montginoul, Varanda, and Bento, 2012; and Fernandes-Jesus, Carvalho, Fernandes and Bento, 2017) and especially technological assessment (Gonçalves & Caraça, 1987; Moniz, 2009; Moniz, Velloso and Maia, 2015; Böhle and Moniz, 2015; Almeida, 2015b). From a science for policy perspective, a brief analysis of the literature can be organised along four main themes: the view of science from the perspective of policy makers, namely in the Parliament; earlier initiatives to reflect about science for policy issues; the learning from specific case studies; and recent assessments of evidence-informed policy-making in Portugal.

First, a research project on 'Science in the Parliament: An analysis of the frontier between science and politics' contributed to shed new light on how the *Assembleia da República*, the Portuguese Parliament, addressed science issues in the first decade of this century. Pereira, Rodrigues,

Carvalho e Nunes (2010) argued that the Parliamentary view of technology issues had not changed significantly since the survey carried out in the mid-1990s, where 41% of the members of the Parliament (MPs) had little or no interest in science policy and 74% assessed scientific information available for the Parliament to be insufficient and/or inappropriate. The analysis of parliamentary sessions in two cases (nuclear power and medically assisted procreation) showed how limited MPs' preparation and capacity to delve into scientific issues were.

Though mainly focused on technological assessment, the work by Mara Almeida provides relevant information regarding the Parliament's capabilities (or lack thereof) on science and technology issues (Almeida, 2015 a,b). In line with the findings by Pereira et al. (2010), it was found that the Parliament lacked the means to develop "an opinion based on evidence", since expert advice was "episodic rather than systemic" (Almeida, 2015a: 230); furthermore, it was difficult for political parties to translate such advice into political opinion. A relevant conclusion from a science for policy perspective is "that policy-making processes related to S&T are not sufficiently informed by relevant sources of knowledge and do not sufficiently take into account the input of key stakeholders, their interests and priorities" (Almeida, 2015a: 236). Efforts have been made by the Parliament to establish a Technology Assessment unit (Almeida, 2015b; Böhle and Moniz, 2015), but they have not been successful; the only consequence was Portugal's entry as associate member of the EPTA Network[5].

Second, turning to the science-policy nexus, a relevant initiative was the seminar promoted by the Service of Science of the Calouste Gulbenkian Foundation (FCG), an independent philanthropic foundation, in January 2008. The seminar, attended by top-level Portuguese scientists and policy-makers and by foreign experts (namely David Mowery and Henry Etzkowitz), was aimed at assessing how scientific advice to policy-making was perceived and carried out in Portugal. Two main conclusions emerged. First, the perception and practice of scientific advice experienced significant changes in the beginning of the 21st century. Second, the need was felt to restore a climate of confidence surrounding the politics/science/public triangular interactions. Interestingly, a similar concern is at the core of Bijker, Bal and Hendriks (2009) book, published shortly thereafter. The report of the above seminar highlights that "[g]iven the increased professionalisation of science, the scale of the resources society now devotes to scientific research, and the complexity of the problems scientists are asked to provide help, new institutional developments might however be sought to improve the contribution of science" for policy-making (Godinho & Caraça, 2008:3).

Third, another strand of literature draws on case studies in specific fields. Based on two case studies (including one on the co-incineration of hazardous industrial waste in Portugal), Gonçalves and Delicado (2009) analyse how policy-makers resort to scientists and experts. They found the existence of specific tensions within the scientific community, a feature that, in their view, belongs to a society in which the development and consolidation of the scientific system are

[5] Portuguese representation is assigned to the Observatory of Technology Assessment (OAT) of CICS, the Interdisciplinary Center for Social Sciences, of Universidade Nova de Lisboa.

recent phenomena. Likewise, Jerónimo and Garcia (2011) underlined how the existence of different technical scientific and political attitudes are closely related to democratic legitimacy issues. Carvalho, Schmidt, Santos and Delicado (2013) focused on climate change. They addressed three main themes: scientific knowledge and assessment; policy analysis and evaluation; and public engagement in the issues. Significant gaps in research were found, especially regarding the economic costs of climate change in Portugal, and the costs and benefits of adaptation. The constraints to evidence-based policy making in Portugal were analysed by Boavida, Moniz and Laranja (2014), on the basis of two case studies: an electric mobility policy and the setting up of an Iberian nanotechnology laboratory (now INL). The research shows that, in the first case, the best available evidence was deliberately not used: formal scientific studies and a forecast from grey literature were purposefully ignored. In the second, the best available evidence was used, although with significant differences between the countries concerned (Portugal and Spain), with regard to the types of evidence, the sources and the depth of information. The use of evidence appeared to be contingent upon the needs to justify the same investment in two different policy-making settings.

Lastly, a general perspective on evidence-informed policy making (or the lack thereof) in different policy fields emerges from the annual reports *O Estado da Nação e as Políticas Públicas* (The State of the Nation and Public Policies), edited by Ricardo Paes Mamede and Pedro Adão e Silva (Mamede and Adão e Silva, 2019, 2020 and 2021). The SGI (Sustainable Governance Indicators) Report (Jalali, Bruneau and Colino, 2020) indicates that the quality of governance in Portugal is relatively low (#29 in 41 countries). Weaknesses were found namely on what regards the use of evidence tools in policy-making, the degree of strategic planning and input into policy-making, the level of societal consultation, the quality of policy implementation and the envisaged degree of institutional governance arrangements reforms. It was underlined that “governance capacity pertains not only to decision-making arrangements, but also to broader oversight mechanisms” (Jalali, Bruneau and Colino, 2020: 5). This is a relevant issue that, as it will be shown later in this report, also impacts upon the characteristics of the science for policy landscape in Portugal.

3. Method

As previously mentioned, this discussion paper is aimed at mapping of the Portuguese science for policy eco-system(s). While the Danish report (Pedersen and Hvidtfeldt, 2021) provided a reference, we undertook an in-depth analysis of the relationships among the key players in scientific advice for policy making in Portugal. Thus, our project design included two vectors: first, presenting the main actors in the science for policy ecosystem(s) in Portugal, in line with Pedersen and Hvidtfeldt (2021) and Ladi, Panagiotatou and Angelou (2021); second, mapping the relationships between the demand and the supply for scientific advice in Portugal. The procedures followed to collect and analyse information to address each of these vectors is provided below.

3.1 The main players in science advice in Portugal: desk research

Considering Portugal's political system and culture, and drawing on earlier evidence on similar themes, namely Almeida (2015a) on technological assessment infrastructure, and Godinho, Simões and Zifciakova (2016), on the governance of the Portuguese research, development and innovation systems, a desk research was undertaken to identify the main players and processes in the "science advice ecosystem" (Gluckman, 2017) in Portugal.

As a structure for the analysis, the taxonomy of organisations developed by Pedersen and Hvidtfeldt (2021) was taken as a starting point. However, the analysis of Portugal's scientific advice landscape led us to introduce changes to better reflecting both the institutional setting and the legal regime for R&D bodies in the country (Decree Law 63/2019, of August 16th, 2019). Table 1 shows the typology of scientific advice organisational approaches used in our report.

The results of the desk research are presented in section 4. To enable a more in-depth perspective, such results were complemented with information from the Science for Policy survey (see 3.2), and with insights stemming from the interviews with experts.

3.2 Mapping inter-relationships: the Science for Policy Survey

As mentioned above, the second vector of our project design was aimed at mapping the inter-relationships in the ecosystem(s). The purpose was to draw a graph depicting the multiple relationships among the organisations engaged in Portugal's science for policy network. There were, however, constraints related to both budget and time. The budget assigned was limited, but the challenges raised by the work ahead have fostered our commitment towards a deep engagement in the project. Time, however, was an inescapable limitation. Initially, the time assigned was around two and a half months, with August in-between[6]. A thorough survey was obviously unfeasible: a focused approach was required. Therefore, a pragmatic approach to the survey design was needed to comply with such a short timetable.

[6] At a later stage, due to agenda constraints, the workshop was postponed from October 26th to 16th November 2021, thereby providing an extra-time allowance. However, when the method was designed this could not have been anticipated.

Table 1: Typology of organisations providing scientific advice

Organisations	Brief characterisation
Research organisations	Universities, R&D units, Associated Laboratories, International laboratories, Contract research organisations, and Research institutions of public interest
Public laboratories	Public bodies in charge of carrying out the goals of the S&T policy defined by the Portuguese State.
Interface organisations	Bodies playing a brokerage role in the innovation system, developing and promoting research and innovation processes, with a view to accelerate the implementation by companies and the economic fabric of new, high value-added processes, services or products.
Permanent advisory committees	Advisory bodies dealing with S&T issues convened on a permanent basis
Ad-hoc advisory committees	Advisory bodies dealing with S&T issues convened on an occasional basis
Scientific and consultative councils	Standing organisations aimed at providing advice, namely on scientific matters
Expert panels	Groups of experts assigned to provide advice on an individual basis
Working groups and *task forces*	Temporary teams in charge of a specific mission, involving a significant scientific content
Policy observatories	Bodies assigned the mission of collecting data and providing multi-disciplinary analysis on specific policy issues
Contracted advisors	Experts contracted by public organisations on a long-term or *ad-hoc* basis to provide advice on specific S&T matters.
Consulting firms	Specialist firms, often with an international scope, contacted to provide advice on well-defined issues.

Source: Developed by the author. The contribution by José Bonfim for the design of this typology is gratefully acknowledged.

The survey design included five main tasks: (1) Defining the scope; (2) Designing the survey instrument; (3) Administering the survey; (4) Carrying out in-depth interviews to clarify specific issues; and (5) Presenting and analysing the results.

Defining the scope. Having decided to follow a focused approach, there was a need to select the target policy-making domains. A dialogue with JRC (Lorenzo Melchor) and with José Paulo Esperança and José Bonfim, of Portugal's Science and Technology Foundation (FCT), was undertaken. This led to the selection of five domains: Defense, Economy, Employment, Environment, and Health. These are fields in which the influence of VUCA conditions has been clear. As rationale for this selection, in Portugal, Defense is an under-researched area that raises relevant issues in terms of science for policy, namely on what concerns strategy (Reis, 2019), public sourcing and technological choices regarding warfare equipment, especially in a changed geo-strategic situation, with globalisation decline and increasing tensions between the USA and China. Economy and Employment are key fields to promote citizen's welfare, facing significant changes (the relevance of robots and artificial intelligence, for instance), thus mobilising a wide array of policy decisions in which scientific advice is relevant. Environment is nowadays one of the most challenging fields in science for policy, not just because of the threats raised by climate change but also because it is central to ensure quality of life and to open new economic and business opportunities (including the blue economy). Lastly, Health is an inescapable subject when the COVID-19 pandemics, which epitomises the confluence of VUCA conditions, is still raging. Since the outset, our research strategy deliberately eschewed the Science, Technology

and Innovation field. We were afraid that a focus on this domain might generate ambiguity and doubts with regard to objectives of the report; in other words, there was the risk of blurring science for policy and policy for science[7]. We are aware that other important domains have not been addressed. These include e.g. big data and artificial intelligence, automation and robotics, sustainable agriculture, the prevention of fires, or mineral exploration.

Designing the survey instrument. Drawing on the terminology used by Gluckman and Wilsdon (2016), we endeavoured to identify the organisations that might play the roles of 'demand' and 'supply' for scientific advice in the five domains selected. Besides such organisations, a third set of informants was surveyed: experts in such domains.

Demand basically corresponds to the government ministries concerned, including Directorates General, public agencies and institutes that are involved in the policy-making process regarding each domain. Additionally, other policy-making organisations, whose activities were felt as likely to influence demand in the five domains were included in a sixth group, labelled as 'General'. This also encompassed bodies placed at the top of the political governance system in Portugal, such as the Parliament[8], the Presidency of the Republic, and the Prime Minister's Office.

Supply was more broadly defined, covering five types of organisations included on Table 1 (Research organisations; public laboratories; permanent or *ad-hoc* advisory committees; and scientific and consultative councils). Having in mind the characteristics of some Associated Laboratories (ALs), working more close to pure sciences or in specific cross-cutting scientific disciplines, the matching with the demand domains raised difficulties that were solved on the basis of additional information collected.

The rationale for surveying experts in the domains selected was to get an independent perspective about the patterns of scientific advice and of relationships as well as an assessment of the issues faced by scientific advice in the domain concerned[9]. Experts may also provide a more global view, since they are aware about the state of science for policy from an international perspective and thus may consider such perspective in their assessment of the Portuguese situation[10]. Experts were mostly academics; however, many of them have performed duties as members of the government or of advisory bodies, and as providers of scientific advice on an individual basis.

The approach followed led to design four different survey instruments: one for the demand (questionnaire A); two for supply organisations, one of them specifically addressed to ALs (questionnaire B) and another for the remaining providers of scientific advice (questionnaire C); and the fourth one focused on experts (questionnaire D). The survey instruments for demand and supply bodies invited respondents to identify the three most important sources of scientific advice

[7] It was found *a posteriori* that the perceived risk was real. Despite the fact that we have clearly underlined the survey's purpose, some respondents were still influenced by the bias towards science policy.
[8] Although specific parliamentary standing commission were assigned to the respective domain.
[9] The support provided by José Bonfim in this process is gratefully acknowledged.
[10] I thank Kristian Krieger for this observation.

(demand) and the main beneficiaries (supply). This was complemented by a characterisation of the features of such advice, based on an adapted version of Pedersen and Hvidtfeldt (2021)'s typology of advisory functions (Table 2), using a 1-7 Likert scale. This approach enabled the depicting of a demand-supply interactions network graph. Questions were also raised about the assessment of the experience and opportunities for improvement. The survey instrument for experts used the typologies of organisations for scientific advice and of scientific advice provided on Tables 1 and 2 to characterise the main features of scientific advice in the expert's domain. It included questions regarding the reliance on and the contribution of scientific advice for policy-making as well as the identification of key features to improve the interaction between demand and supply. The four questionnaires are presented in Annex I.

Table 2: Typology of advisory functions

Types of advisory functions	Brief characterisation
Knowledge generator	Producing original scientific knowledge at the highest international level.
Knowledge synthesis	Producing reviews and integrated assessments of scientific knowledge and best practice.
Knowledge broker	Translating, mobilising and communicating research and evidence to policymakers and practitioners.
Unsolicited input	Providing advice to policymakers on the initiative of the body, e.g., if new important research is identified.
Requested input	Responding to specific requests from policymakers, e.g., risk assessment, technical reports, etc.
Advice continuity	Degree of continuity of scientific advice, from 1 (one-off) to 7 (continuous).
Rapidness	Acting rapidly in emergency situations where consequences are unknown, and uncertainties prevail.
Identify Options	Pointing to potential actions and their consequences, balancing scenarios and desired outcomes.
Monitoring	Technical monitoring of specific policy areas, and collecting data on effects (and effectiveness) of regulation.
Evaluation	Analysis and appraisal of policies and regulations, and evaluation of advisory services and functions.

Source: Pedersen and Hvidtfeldt (2021:7), with slight changes.

Administering the survey. The procedure followed led to the identification and approach of 127 entities to participate in the survey (demand: 47; supply: 59; experts: 21). The first batch was sent by late July 2021, together with a mail introducing the project coordinator and the objectives of the survey, highlighting the fact that it was concerned with scientific advice and not with science policy as such. In early September, a second call was issued, inviting non-responding entities to provide information. Response rates were 17% for demand, 31% for supply, and 33% for experts[11]. The low response rate from demand (mostly corresponding to the Government and Public Administration [PA]) is troubling, though not surprising; in fact, engagement by PA in earlier science-orientated initiatives to engage PA, such as the R&D Agendas launched by FCT, left a bit to be desired. In the domain of Health, the focus on dealing with COVID-19 pandemics may have constrained the time and availability of some bodies to address the survey. In contrast, the

[11] Details may be found in Annex II.

response rate by ALs was very satisfactory (14 out of 40, i.e. around 35%); this may have stemmed from the statement that FCT, Portugal's research funding board, was involved in the process.

Carrying out more in-depth interviews to clarify specific issues. After receiving the replies, these were screened for inconsistencies and opportunities for further learning. Therefore, in some cases respondents were approached to clarify the replies and elicit additional information. When opportunities for learning were identified, personal contacts were made with the respondents, inviting them for a telephone or remote interview to further explore the ideas conveyed. This procedure provided additional qualitative evidence on the science for policy process in Portugal. It was helpful to enable interesting insights, in particular from experts, about challenges and opportunities.

Presenting and analysing the results. Responses to the survey were synthesised and compared, to find similarities and differences, leading to the identification of behavioural and networking patterns. Three main strands of inquiry were pursued. The first concerned the characteristics of the scientific advice provided and received. Data were collected and analysed drawing on the taxonomies provided above, and broken down according to the group of respondents and domain[12]. The second corresponded to the identification of the main players and linkages in science for policy networks in the selected domains, by matching the data of both demand and supply respondents. Interestingly, the decision to ask both groups of respondents to identify the three main sources or recipients of scientific advice opened the scope of inquiry, since it enabled to identify additional players, not considered at the outset of the research. The third line had to do with the qualitative assessment enabled by the information collected. This provided relevant elements regarding the demand-supply interaction process, participating bodies objectives and concerns, relational dynamics, opportunities for improvement, and the diffusion of information towards the larger public.

To summarise, the survey was instrumental in collecting evidence to report on the characteristics of scientific advice for policy-making (section 5.1), to map the demand-supply network (5.2), to develop an assessment of the situation of science for policy in Portugal in the domains selected (section 6), and to reflect about the main challenges and opportunities faced (section 7).

[12] Unfortunately, in some cases, analysis lost significance due to the very low number of responses.

4. Scientific advice for policy-making in Portugal: the main actors

This section is intended to provide a general view about the science for policy setting in Portugal. After a broad perspective about the Portuguese political system and its implications for policy-making, a more detailed approach is used to identify key players, following the typology of organisations providing scientific advice presented on Table 1.

4.1 Where does science fit in the overall policy-making system?

To respond the above question, it is essential to understand the key traits of the history of Portugal's political system, following the suggestion of Higgitt and Wilsdon (2013).

After more than 40 years under dictatorship, democracy was restored in 1974 and, in spite of a troubled period, a new Constitution was issued in 1976. In line with this, Portugal is now a Republic with a semi-presidential regime. Both the Parliament and the Government have policy-making responsibilities, namely through the enactment of legislation[13]. The President of the Republic has no legislative powers, but has to endorse (or not) the legislative acts from the Parliament or the Government. In the scope of President's powers, (s)he may turn back any such act should (s)he have strong reasons for disagreement, in terms of compatibility with the constitution or for another reason, including the existence of insufficient or contradictory scientific evidence to support the envisaged policy. Thus, the President of the Republic is also a player in the science for policy system. Contrary to what happens in other countries, in Portugal the role of the academies of science in providing scientific advice is extremely limited. There is only the Lisbon Academy of Sciences (*Academia de Ciências de Lisboa*), founded in 1779. It is a relatively minor player on science for policy (Almeida, 2015a), except on linguistics, field in which it is the main adviser to the government.

Until 1996, when Mr Jorge Sampaio took office as President of the Republic, there was no science adviser to the President. João Caraça, a renowned scientist and science policy thinker, from FCG and also affiliated to ISEG (University of Lisbon), was nominated for the job. For the first time ever, a President of the Republic took the decision to have a staff member exclusively focused on science, technology and innovation issues. This was a recognition of the relevance of scientific advice at the highest political level[14]. However, in 2006, under the Presidency of Mr Aníbal Cavaco Silva, the job of science adviser was discontinued. There was an adviser for the Environment, Science and the Sea and another for Innovation. The former was assigned to Tiago Pitta e Cunha, a lawyer with a master on European Law, who became an expert on sea issues, being now the president of the Blue Ocean Foundation (*Fundação Oceano Azul*). Information available at the internet makes no reference to a science adviser to the present President of the Republic. This

[13] Of course, policy-making activities are not confined to the design, development and passing of legislation. But at the present juncture, this is our focus.
[14] It was also under Mr. Sampaio's Presidency that was taken the decision to establish COTEC Portugal, a private association aimed at fostering innovation, whose membership included the biggest Portuguese firms.

suggests that the importance assigned to scientific matters is contingent upon the President in office, being low in most cases. A sustained commitment to scientific advice is lacking, although the President of the Republic may call scientists for hearings on specific themes.

Turning now to the Parliament (*Assembleia da República*), it is relevant to mention that, at present, there is a Standing Committee on Education, Science, Youth and Sport. This Committee is concerned with policies for science, rather than to science for policy. To some extent, it mirrors the executive ministerial departments. It does not provide any scientific advice, technological assessment or foresight exercise[15]. In fact, no specific body exists to provide scientific advice either to the Parliament or to the MPs. The issue of science advice to the Parliament was raised in the past (Pereira et al., 2010; Almeida, 2015a, b; Böhle and Moniz, 2015). In 2009, the Standing Parliamentary Committee on Education, Science and Culture delivered a report about science, highlighting the relevance of setting up a parliamentary office on S&T (Nico, 2009). The initiative led to the parliamentary resolution 60/2009 (*Resolução da Assembleia da República* nº 60/2009). This included three "decisions"[16]: (1) to set up a platform to enable the meeting between politicians and scientists to provide "qualified, updated and usable information on the controversies and scientific implications that lay the ground for or that are a consequence of public policies"; (2) to carry out a feasibility study on the possible creation of a Parliamentary office on science and technology; and (3) to promote the initiatives to enable the participation in the EPTA network. If the latter partially turned into reality, as mentioned in 2.2, the other decisions have never materialised. The reasons for this are mainly related to budgetary constraints and to the political ebb-and-flow, leading to the replacement of some of the MPs more committed to science for policy issues. A new round of efforts on this regard took place thanks to Mara Almeida, Portugal's member of the collaborative project on mobilisation and mutual learning actions in European Parliamentary Technology Assessment- PACITA (Almeida, 2015b), but it was not successful. In spite of the commitment to science issues by some specific MPs, including Alexandre Quintanilha, the President of the Standing Committee on Science and Culture in the 2015-2019 legislature, the assessment made by Böhle and Moniz (2015: 38) still holds to a significant extent: "Parliament is playing a strong role in public life, although it remains weak when dealing with S&T issues[; t]here is a lack of S&T competence among the [MPs], and this goes together with little interest in these matters". This is shown in the case of a vaccination decision (see section 4.4).

With regard to the Government, most scientific advice takes place at the Ministerial level. There is not a CSA to the Prime Minister, as in the UK, Ireland or New Zealand. In several Ministries there are standing committees or *ad-hoc* groups in charge of providing scientific evidence and advice for policy-making. Two main types of approaches are identified: (1) permanent structures, providing advice on a continuous base, as is the case of CNADS, the National Council for the Environment and Sustainable Development (*Conselho Nacional do Ambiente e do Desenvolvimento Sustentável*), or CNSP, the National Council for Public Health (*Conselho*

[15] I thank Lorenzo Melchor for the exchange of views on this subject.
[16] While the term used in the legal document was 'decisions', they corresponded to intentions.

Nacional de Saúde Pública); and (2) *ad-hoc* committees or working groups, as it happened with scientific advice on the COVID-19 pandemics. *Ad-hoc* committees are very often created to collect scientific advice to respond crises. While the mandates for both approaches are relatively clear, there are, however, no formal rules regarding either the working of the committees or the responsibilities of their members. In general terms, the picture is characterised by informality and insufficient consistency. Although the reliance on ways to elicit the participation of stakeholders, namely through public consultation regarding law-making initiatives, has increased in recent years, these have been criticised for taking place at a relatively late stage, when most options have already been taken. In spite of these improvements, there is still a dearth of formal structures for hearing the main stakeholders (Godinho and Simões, 2014).

Coming under the purview of the Science Law (Decree-Law 63/2019, of 16th May), the National Council for Science, Technology and Innovation (*Conselho Nacional de Ciência, Tecnologia e Inovação – CNCTI*) is intended *inter alia* to provide "scientific advice towards the development of policies and the activity of public services in all sectoral areas". This is far from the concept of a CSA, but may lead to introduce more coherence and coordination in the supply of scientific advice for policy making. The Council has started its activities in early 2021, and it is still too early to anticipate the role that it will play in practice. It comes in the vein of a string of Councils created since the foundation of the National Scientific and Technological Research Board (*Junta Nacional de Investigação Científica e Tecnológica -JNICT*[17]), aimed at coordinating and providing advice on S&T issues[18]. Experience along the last 25 years shows that the life and relevance of such advisory boards, some exclusively focused on S&T and others with a wider scope of providing scientific advice for policy-making, has been very irregular. The drive and status of the president have influenced the scope and visibility of their activities. However, the main conclusion is that generally political power, irrespectively of its orientation, is not comfortable with the possibility to be confronted with an independent voice stemming from the scientific community[19][20].

At Ministerial level, advice seems to be sought *prima facie* within the scope of the Ministry concerned, relying on a few Directorates General deemed as better prepared to provide advice, and, when available, on Studies and Planning Directorates and Public Laboratories placed under the Minister's supervision. In the present century, however, the role of the two latter structures has experienced a gradual decline. Conversely, in line with the arguments by Craft and Howlett (2013), the recourse to externalisation, relying on consultants (often large multinationals), and politicisation, drawing on (partisan) advisers inside Ministry's offices, has also increased in Portugal. The track record of inter-ministerial cooperation is relatively low, a feature that mirrors the limited cooperative drive in Portuguese culture. The successive Community Support

[17] JNICT is the predecessor of FCT, being created in 1967.
[18] For a good synthesis of such evolution, see Henriques (2006, especially Box 3.1: 188-189).
[19] This is not intended to convey the idea that the scientific community has a higher legitimacy. Furthermore, scientists have their own political preferences and biases, as it was pointed out in section 2 above. But there is a process of dialogue within the scientific community that has proved to work appropriately (Oreskes, 2021).
[20] This reminds Jasanoff's (1990) argument of scientific advisers emerging as a "fifth branch" of government. I thank Lorenzo Melchor for this insight.

Frameworks (*Quadros Comunitários de Apoio*), especially the most recent ones, have played a positive role in fostering cooperation, but the results still leave much to be desired. This issue has been stressed time and again, especially on what regards innovation policy (Godinho and Simões, 2005, 2012), but is pervasive in Portugal's policy-making. This is also evident on what concerns the supervision of Public Laboratories. The 19th Constitutional Government established a double supervision of such laboratories, making them accountable to two Ministries; however, this approach also generated some frictions between the co-supervising ministries.

Having said this, the significant increase of public investment in research along the last 25 years and the development of a vibrant research community have influenced the way how science is envisaged by policy-makers (as well as by most of the general public). There is also an increased awareness about the advantages of evidence-based policy-making (Mamede and Adão e Silva, 2019)[21]. The decision taken already in 2021 to set up, under the Prime Ministers' Office, a Competence Center for Planning, Policy and Foresight for Public Administration (*Centro de Competências de Planeamento, de Políticas e de Prospetiva da Administração Pública – PlanAPP*) seems to be a positive step. Another interesting initiative was the launch, by FCT, of calls for research projects aimed at promoting the application of data science and artificial intelligence in PA. However, the science for policy relationship does not run seamlessly. On the contrary, different assumptions and views undermine the interactions between both epistemic communities (see chapter 6), based on the evidence collected from our survey and interviews. This problem should not be dissociated from the scarcity of formal mechanisms for participatory involvement by different types of stakeholders in policy-making processes (Godinho and Simões, 2012; Böhle and Moniz, 2015; Simões, Godinho and Sanchez-Martinez, 2018).

After this overview, we will briefly introduce the main organisations providing scientific advice in Portugal. As seen on section 3, what follows is based on desk research, enriched with evidence from the survey. We will address eight types of organisations: Research organisations; public laboratories; permanent and ad-hoc advisory committees; scientific and consultative councils; expert panels, working groups and task-forces; policy observatories; contracted advisors; and consulting firms (see Table 1).

A summary of the detailed information on the various types of advisory organisations available in the following sub-sections is provided on Table 3.

[21] Evidence-based policy-making is the expression more commonly used in Portugal, in spite of the compelling arguments in favour of the evidence-informed wording (Mair et al, 2019; and SAPEA, 2019).

Table 3: Types of organisations providing scientific advice in Portugal: A synthesis

Type of organisations	Examples provided in the report
Research organisations	Associated laboratories (in general); Associated laboratories council (CLA); CIMO- Mountain Research Centre; INL - International Iberian Nanotechnology Laboratory; iMM- Instituto de Medicina Molecular João Lobo Antunes; i3S- Institute for Research & Innovation in Health
Public laboratories	Hydrographic Institute (Instituto Hidrográfico - IH); Institute for Agrarian and Veterinary Research (Instituto Nacional de Investigação Agrária e Veterinária, I.P. - INIAV); National Institute of Legal Medicine and Forensic Sciences (Instituto Nacional de Medicina Legal e Ciências Forenses, I.P. - INMLCF); National Health Institute Doutor Ricardo Jorge (Instituto Nacional de Saúde Doutor Ricardo Jorge - INSA); Portuguese Institute for Sea and Atmosphere (Instituto Português do Mar e da Atmosfera, I.P. - IPMA); National Laboratory for Energy and Geology (Laboratório Nacional de Energia e Geologia, I.P. - LNEG); and National Laboratory for Civil Engineering (Laboratório Nacional de Engenharia Civil, I.P. -LNEC).
Permanent and ad-hoc advisory committees	Permanent advisory committees: Comissão Técnica de Vacinação – CTV. *Ad-hoc* advisory committees: *ad-hoc* committees to investigate the 2017 wild fires (Comissão Técnica Independente); *ad-hoc* committee in charge of writing a white paper on the present and the future of Portugal's National Health System (SNS).
Scientific and consultative councils	Mainly consultative: Economic and Social Council (Conselho Económico e Social- CES). Consultative with significant scientific advice content: National Council for Public Health (Conselho Nacional de Saúde Publica - CNSP); National Council for Environment and Sustainable Development (Conselho Nacional do Ambiente e do Desenvolvimento Sustentável – CNADS); Council for Productivity (Conselho para a Produtividade); and National Council for Science, Technology and Innovation (CNCTI).
Expert panels, working groups and task-forces	Expert meetings held at INFARMED, the National Authority for Medicament and Health Products, to assess the developments of the COVID-19 pandemic in Portugal; Thematic Agendas for Research and Innovation.
Policy observatories	Universities: ISCTE (some are managed by Associated laboratories); Minho university Associated laboratories: six observatories managed by the Instituto de Ciências Sociais (ICS) [University of Lisbon]; six observatories managed by the Centro de Estudos Sociais (CES) [University of Coimbra]. Collaborative laboratories: CoLABOR and ProChild data. Other examples: Observatory of Energy (Observatório da Energia), managed by ADENE, the Agency for the Energy, and Portuguese Observatory of Health Systems (Observatório Português dos Sistemas de Saúde – OPSS).
Contracted advisors	The document 'Visão estratégica para o plano de recuperação económica de Portugal 2020-2030', produced by António Costa Silva, as a chief exemple.
Consulting firms	Increasing role played by national and international consultancy firms

Source: Own elaboration, based on the text of section 4.

4.2 Research organisations

According to the Science Law, there are three types of R&D organisations: R&D units, ALs and PLs. This subsection will briefly address the roles played by the two first, while PLs will be specifically dealt with in 4.3 below.

R&D units are defined as encompassing human resources, equipments and technical infrastructures focused on R&D, training and S&T diffusion. Such units are usually no profit, and their size is very variable; many of them are anchored in Universities and part of their funding

comes from public sources. The provision of scientific advice is often not included in the mission of R&D units. However, if asked to do so, these units are usually eager to supply such an advice. In some cases, namely when there are no personal linkages, scientific advice is requested by policy-makers through a university, and this may channel the demand to a R&D unit under its remit. In other instances, the specificity of an R&D unit's research scope and knowledge makes it a key advisor in some policy-making fields. For instance, the knowledge accumulated by the Mountain Research Centre (*Centro de Investigação de Montanha – CIMO*) in the area of mountain ecosystems and biodiversity makes its advice often requested for the design of regional policies, integrated policy approaches to inland and landlocked areas, and on the exploration of endogenous potential.

Together with a multitude of relatively small R&D units there are large private research organisations, such as the Champalimaud Foundation or the Instituto Gulbenkian de Ciência (IGC). While the latter is devoted "to transforming society through science", science for policy is not a vector of their missions. However, at individual level, researchers may provide scientific advice for policy-making. Another large R&D organisation headquartered in Portugal is INL, the International Iberian Nanotechnology Laboratory. It was created in 2005 by the Portuguese and Spanish governments, and its scientific activities started in 2010. INL "intends to use science as the link to dilute cultural frontiers and stereotypes towards the difference, contributing to a more inclusive society" (INL, 2021). It is often consulted by the Portuguese government regarding policy-making related to applications of its core research field, namely nanotechnology.

ALs correspond to the main research organisations in Portugal. They basically stem from an evolutionary process of growth of the highest performing R&D units, often involving cooperative alliances to reach scale. The AL status is granted based on an international evaluation, and may last for a period of ten years, renewable after evaluation. After the last evaluation round, in late 2020/early 2021, the number of ALs increased from 26 to 40. According to the Law of Science, ALs are formally consulted by the government about the definition of programmes and instruments of scientific and technological policy; this is usually undertaken through the Associated Laboratories Council (*Conselho dos Laboratórios Associados – CLA*). Individual LAs may also be asked to provide scientific advice in other areas besides science policy. Later in this report, more specific information based on our survey will be provided regarding LAs' involvement in science for policy activities.

An interesting example of the contribution from LAs' concerns the initiative taken by *iMM, the Instituto de Medicina Molecular João Lobo Antunes*, to develop a COVID-19 test kit and to apply it in nursing homes for elderly people throughout the country (Mota, 2021). The move came from iMM, that got financing from a large Portuguese group, and presented the project to the Minister for Labour, Solidarity and Social Security (that supervises nursing homes), with support from the Minister for Science, Technology and Higher Education (Firmino, 2020). The kit was developed adapting a protocol of the US Center for Disease Control and Prevention, in an extremely short time span, being available before the end of March 2020. Other ALs, namely i3S, the Institute for

Research & Innovation in Health, have also provided advice to fight the pandemic, especially through actions taken by individual researchers.

4.3 Public laboratories

PLs have a long history in Portugal, the oldest being created in the 19th century. According to Henriques (2006), they were the backbone of Portugal's research system in the 1970s. Originally, they were envisaged as key bodies to provide scientific advice for policy-making by the Ministries to which they were affiliated. In 1999 there were 13 PLs (Henriques, 2006), but their number and relevance has shrunk along this century, to seven only: Hydrographic Institute (*Instituto Hidrográfico - IH*); Institute for Agrarian and Veterinary Research (*Instituto Nacional de Investigação Agrária e Veterinária, I.P. - INIAV*); National Institute of Legal Medicine and Forensic Sciences (*Instituto Nacional de Medicina Legal e Ciências Forenses, I.P. - INMLCF*); National Health Institute Doutor Ricardo Jorge (*Instituto Nacional de Saúde Doutor Ricardo Jorge - INSA*); Portuguese Institute for Sea and Atmosphere (*Instituto Português do Mar e da Atmosfera, I.P. - IPMA*); National Laboratory for Energy and Geology (*Laboratório Nacional de Energia e Geologia, I.P. - LNEG*); and National Laboratory for Civil Engineering (*Laboratório Nacional de Engenharia Civil, I.P. -LNEC*).

According to the Law of Science, PLs are geared to pursue the goals of Portugal's scientific and technological policy, through *inter alia* the carrying out of R&D activities as well as the support to the productive fabric, standard setting and regulation. PLs are formally consulted by the government to design the programmes and tools related to scientific and technological policy.

In spite of the historical waning of their relevance, PLs still play an important role in terms of scientific advice for policy making. For instance, INSA has been at the forefront of the response to COVID-19 pandemic. The epidemiological studies by INSA have been very important for monitoring and adjusting public policy towards COVID-19. Similarly, INSA has cooperated with the Directorate General for Health, the body that has coordinated Portugal's response to COVID-19, to develop systematic reports regarding the indicators on the evolution of the pandemic.

It is also worth mentioning the scientific advice activities carried out by IPMA in the field of climate change and coastal erosion. According to the IPMA website, "[f]ocusing its research efforts on projects that accrue to direct applications for use in operating activities, pursuing continuous improvement in the information made available to its users whether for commercial use or public service and in particular directed to the safeguard of people and property" (IPMA, 2021). In a recent press interview, Miguel Miranda, the president of IPMA, stated that "civil protection should envisage that situation [phenomena such as *Leslie*, an hurricane that hit a coastal area in mainland Portugal in 2018] in a way similar to that used for forest fires or earthquakes", by launching simulations, training and contingency plans (Firmino, 2021).

4.4 Permanent and *ad-hoc* advisory committees

While permanent advisory committees have a long-term scope, *ad-hoc* committees are usually convened to respond specific crises. Usually, such committees include scientists and academics, besides practitioners.

An interesting example of a permanent advisory committee is the Technical Commission for Vaccination (*Comissão Técnica de Vacinação – CTV*). This is an independent commission, launched in 1997, under the remit of the Directorate-General for Health, that provides recommendations regarding vaccination policy. CTV includes experts from different disciplines (paediatric medicine, public health, epidemiology, infectiology, biology, nursing, gynecology/obstetrics…). As time went by, CTV's disciplinary scope has been expanded, in tandem with the expansion of the vaccination plan itself, and the increasing complexity of the issues related to vaccines and vaccination. The quality of the work carried out by CTV has been widely recognised and corresponds, in the words of one of our interviewees (Expert Health #3), to a case of "adaptative success".

A relevant policy-related controversy happened in 2018, when the Parliament, without a previous hearing of either the CTV or the Directorate-General for Health, decided to include three additional vaccines (rotavirus, meningitis B and human papilloma virus [HPV] for boys) in the National Vaccination Plan. This was an unprecedented event and generated a vivid public debate, since the Parliament took a political decision without any technical or scientific backing. Two parties abstained or voted against with such an argument (Henriques, 2018). The political parties favourable to the decision have been criticised for an alledged populist drift, ignoring scientific advice, and for being sensitive to multinational firms' pressures (Henriques, 2018). The issue was about to lead to the resignation of several members of the CTV. As a constitutionalist put it, "MPs are not supposed to be super-scientists mastering all the fields of knowledge, and for that reason the legislative procedure provides that, according to the themes at stake, those institutions that, due to their interests or the knowledge about the theme, should be heard by the Parliament" (Botelho, 2018). With hindsight, this case offers two important conclusions: first, the low level of concern shown by many MPs with the scientific backing of their proposals; and, second, the insufficient formalisation of Parliamentary procedures to ensure that legislative initiatives have appropriate scientific support.

As mentioned above, *ad-hoc* advisory committees are usually convened (1) to respond crises or (2) to develop specific tasks, such as a white paper or a specific policy proposal. The wild fires that have devastated some areas in the Center of Portugal in July and October 2017, with significant consequences on what concerns both lives and property, led the Parliament to set up two ad-hoc independent committees[22], one for each event, to identify the reasons behind the fires and to make recommendations on how to proceed to avoid and respond similar incidents. As an example, the *ad-hoc* committee to analyse the October fires was chaired by a university professor

[22] The composition of both ad-hoc committees was almost the same, with just one change regarding the members nominated by the parliament.

and included also several academics, including foreign ones (Universities of Santiago de Compostela, Spain and Massachusetts Institute of Technology, USA), and experts nominated by the President of the Parliament, after hearing the various parliamentary groups. This *ad-hoc* committee was disbanded after producing its report in March 2018 (Comissão Técnica Independente, 2018)[23].

The setting up in 2018, by initiative from the Minister for Health, of an *ad-hoc* committee to carry out a technical analysis and a strategic reflection about the present and the future of Portugal's National Health System (*Sistema Nacional de Saúde - SNS*) provides an example of the second time of committees mentioned above. This committee was chaired by Constantino Sakellarides, a retired university professor and former Director General for Health, and included 12 renowned members, mostly academics from different disciplines. More specifically, the mandate assigned to this *ad-hoc* committee was to write a White paper on the present and the future of Portugal's SNS, ensuring wide public participation. Unfortunately, for reasons related to the difficult dialogue between politicians and scientists, the initiative was aborted. This case highlights how difficult is for politicians to 'import' knowledge from outside their inner circles.

4.5 Consultative and scientific councils

In Portugal there is a relatively wide number of consultative and scientific councils with a bearing on policy-making, addressing multiple domains. The creation of such councils may stem from four main reasons: (1) constitutional imperative; (2) initiative from the Government or from a specific ministry; (3) initiative from a public organisation; and (4) statutory mandate. The councils mentioned under (3) are established by the body concerned, to provide inter alia scientific support to the carrying out of its activities. In contrast, those under (4) are mandated by the statutes of the organisation (as is the case of the Consultative Council of the Bank of Portugal) or by legal regulations (for instance, according to article 23.1b) of the Law of Science [Decree-Law 63/2019] every R&D organisation should have a scientific council). Very often, the councils established under (1) and (2) are not just science-orientated, and include a wide number of stakeholders entitled to express their views on the subjects concerned.

That is the case of the Economic and Social Council (Conselho Económico e Social- CES), whose existence is stipulated by the Constitution itself. Its duties include social concertation and consultation regarding economic and social policies. It is intended to foster the participation of economic and social players in decision-making procedures at a macro-level. CES includes representatives for different areas: the government, social partners, and the organised civil society (including autonomous regions and local governments, as well as a NGO supporting women's rights and gender equality). The decisions are exclusively consultative and have to be approved by the plenary. The CES also comprises the Standing Committee for Social

[23] The Government followed a different approach, and commissioned a report on the subject to an R&D unit, the Center for Studies on Forest Fires (Centro de Estudos sobre Incêndios Florestais) of the University of Coimbra, led by Professor Domingos Xavier Viegas, one of the most renowned Portuguese experts in the field (Centro de Estudos sobre Incêndios Florestais, 2017).

Concertation (CPCS), where the two trade unions (CGTP and UGT) are represented as well as four employers' associations (CAP [agriculture], CIP [manufacturing industry], CTP [tourism], and CCP [commerce and services]) for tripartite concertation purposes. In this case, the decisions taken do not require approval from the plenary.

Relevant examples of consultative councils, including a significant share of membership by academics and scientists and tasked to provide science for policy, include the following: the National Council for Public Health (*Conselho Nacional de Saúde Publica - CNSP*) the National Council for Environment and Sustainable Development (*Conselho Nacional do Ambiente e do Desenvolvimento Sustentável – CNADS*), the Council for Productivity (*Conselho para a Produtividade*), and the National Council for Science, Technology and Innovation (CNCTI). These are briefly presented below.

The CNSP was created in 2009 (Law 81/2009, of 28th August). It is a consultative body to the government regarding public health risk management, including the prevention and control of transmissible diseases, especially regarding the analysis and evaluation of acute situations, namely large-scale epidemic outbreaks and pandemics. According to the Law 81/2009 (article 4), this Council is responsible for "substantiating the proposal for the declaration of a state of emergency, due to public calamity". The chair is the Minister for Health, who may delegate that function to the Director General for Health. It includes two specialised committees: the Epidemiological Surveillance Coordinating Committee, and the Emergency Coordinating Committee. Its membership was changed in January 2020 by decision of the Minister for Health. Members are representatives of the public, private and social sectors, including the academic and scientific areas, with many members being, due to the Council's functions, directly linked to public health bodies. Surprisingly, the CNSP had a very limited participation in the process of fighting COVID-19 pandemic. Its two specialised committees were never implemented. As a consequence, the Council had to operate without appropriate and timely technical support. The decision to renew CNSP's membership was made with an eye on the expectations regarding the risks of a pandemic outbreak. Having this in mind, the CNSP met on the 4th February and on the 11th March 2020. At this meeting, a recommendation was issued that, with data available at the date, conditions were not met to indicate a generalised closure of schools; instead, such closure should be analysed on a case-by-case basis, according to the local epidemiological situation, to be determined by the Directorate-General for Health (Observatório Português dos Sistemas de Saúde, 2021). This recommendation was not followed by the Government, that decided a general school closure. Be as it may, the CNSP held no further meetings when the pandemic was raging, its next meeting being held on the 23rd October 2020. This led an expert on health issues to argue that the "CNSP does not work"; this may be partly due to fact that the "structure provided for in the law is too heavy and to some extent dysfunctional" (quoted in Polónio and Vasconcelos, 2021)

The National Council for Environment and Sustainable Development (CNADS) was created in 1997, in the vein of the Special Session of the United Nations General Assembly (Rio+5), held on June 1997, commemorating the five years of the United Nations Conference on Environment and

Development (UNCED), known as the Rio Conference. CNADS is member of the European Environment and Sustainable Development Advisory Councils Network (EEAC). CNADS is an independent body that aims at advising on issues related to the environment and sustainable development to government officials, public entities and NGOs. It is also intended to be a forum for the design and implementation of environmental and sustainable development policies. While chaired by a renowned academic, and including scientists, the membership of CNADS is wide, involving multiple stakeholders, from business associations and trade unions to the government (some of them academics) and regional governments of Madeira and Azores. CNADS advice may be requested by the government or may be issued by decision of the council itself. It has followed a transparent line of behaviour, its advice being communicated to the minister in charge of environment and sustainable development, to the President of the Republic and to the President of the Parliament, being also available at its site. In 2020, CNADS published a synthesis of its advisory documents produced between 2017 and 2020 (CNADS, 2020).

The influence of international developments mentioned above in relation to CNADS was also felt in the case of the Council for Productivity (Conselho para a Produtividade). In fact, the roots of the establishment of this Council lie on a 2016 recommendation issued by the Council of the European Union for the euro area Member States to identify or create national productivity councils to assess developments and policies on productivity and competitiveness. The Council was established in 2018 by a joint decision by the Minister for Finance and the Minister for the Economy. Coordination of the structure changes annually, beginning with the Ministry of Finance and then moving to the Ministry of Economy, and the functioning of the Board will be reviewed and evaluated after two years. It is in charge of monitoring public policies in the field of productivity, developing *ex-ante* and *ex-post* analyses of the effects of public policies with an impact on productivity in Portugal. The Council should also promote initiatives for debate among the civil society, integrating different stakeholders, to foster a broader public discussion on the subject and to strengthen the importance of increasing productivity. An important feature, from a science for policy perspective, is the existence of a Consultative Board, comprised of renowned academics from different organisations, in Portugal and abroad. However, the information provided at the website is outdated, suggesting either an insufficient level of transparency and/or a decline in its activities, probably as a consequence of the pandemic.

The CNCTI was already mentioned in 4.1 above. In its most recent form, it includes the President, representatives of FCT (the science board), ANI (the innovation agency) and IAPMEI (the agency for competitiveness and innovation) and up to 20 “personalities of recognised merit, acting as representatives of R&D organisations, technological interface centres, higher education organisations, academic clinical centres, of S&T networks and consortia, the business field and the international scientific community” (Decree-Law 63/2019, article 31.3). Its mandate includes the provision of scientific advice for policy-making, not just with regard to S&T matters, but for “all sectoral areas” (article 31.2b), as well as to promote cross-cutting and inter-ministerial cooperation in S&T policies (article 31.3c). The nomination of CNCTI’s president and membership took place on February, and its first meeting was held on March 1st, 2021. No information was

made publicly available about the issues discussed at this meeting. As argued in 4.1 above, it is still too early to anticipate how the pattern of CNCTI's activities will look like.

4.6 Expert panels, working groups and task-forces

As shown in Table 1, expert panels correspond to standing groups of experts assigned to provide advice on an individual basis, while working groups and task-forces refer to temporary teams in charge of a specific mission, involving a significant scientific content. Two examples of use of expert panels and working groups are provided below: the expert meetings to provide scientific advice on COVID-19 and the development of the Thematic Agendas for Research and Innovation.

Probably, the best example of the provision of scientific advice by expert panels in Portugal is provided by the meetings held at INFARMED, the National Authority for Medicament and Health Products, to assess the developments of the COVID-19 pandemic in Portugal. Initially labelled as "technical commissions" and later as "expert meetings", they were attended by the Minister for Health and often by the President of the Republic and the Prime Minister. The first set of experts invited was selected by the Director-General for Health, but the approach was open, and along the process more experts, namely academics, were asked or volunteered to join the meetings and present their findings. Drawing on the evidence available at the internet, diffused by newspapers and TV programmes and collected from interviews, the structure of the meetings usually featured an introduction by a member of the government, most often the Minister for Health, followed by presentations by experts. No formal conclusions have been drawn from the meetings.

This approach did not enable neither the development of a consensus nor the formulation of a consistent scientific advice. In contrast, it provided more leeway for the government to take policy decisions on the basis of these hearings but having also other aspects into consideration. Several academics have criticised the approach, arguing namely that it would have been desirable "the scientists in the field of health […], meeting in a council with a spokesperson to represent science without compromise with politics" (Carlos Fiolhais, quoted in Serafim, 2021). Likewise, the position taken by the Observatório Português dos Sistemas de Saúde (2021: 62-63) is more nuanced, insofar as it highlights the merits of the approach followed, namely the alignment of the positions of the political agents, on the basis of scientific advice, while warning that "the illusion that the individual hearing of experts, without the benefit of a qualified scientific synthesis […] was an effective and suitable way to provide scientific advice for policy-making". Obviously, it is important to consider, for the credit of politicians, the role played by the pressure of time in taking policy decisions, especially in the context of a pandemic.

The development, in the context of FCT, of the Thematic Agendas for Research and Innovation provides an interesting example of the use of working groups of experts to reflect about scientific developments and to provide scientific advice for policy-making. Launched by FCT in 2017, this project was intended to mobilise experts from R&D institutions and companies to identify challenges and opportunities in the Portuguese scientific and technological system, particularly

in the medium- and long-term; the Agendas were also expected to contribute to the development of research and innovation activities, with a view to respond future problems or needs to be felt by different sectors of society. Most envisaged agendas were completed (11 out of 15 foreseen Agendas), and the process was participated, but in general the commitment from academics was higher than for business people. The completed Agendas addressed themes going from social inclusion and citizenship, culture and cultural heritage and health, clinical and translational research through industry and manufacturing and labour, automation and job qualification to circular economy, ocean, and space and earth observation. Through this process the participation of the scientific community and stakeholders was stimulated, while public consultations and workshops were held around the themes at stake. Every Agenda included a chapter on the implications for public policy. These chapters were in some cases the result of the interaction between relevant public organisations in the field, experts, and the FCT team, as in the case of climatic change. The recommendations and issues stemming from the Agendas have implications for multiple fields beyond the S&T one: societal, public health, employment, economy, and the environment.

4.7 Policy observatories

In Portugal there are multiple policy observatories, mostly managed by academic organisations in the field of Social Sciences, with a view to monitor the development of public policies. Therefore, several observatories will be mentioned below, namely those associated to bodies with a more consistent scientific record. PORDATA[24] is also worth being mentioned, for its relevant initiative to establish, develop and make available to the public a wide set of statistical information to depict the evolution of Portugal and the Portuguese society, in the European context, in multiple areas. PORDATA provides a very important source of statistical evidence for policy-making.

We will start with a reference to the observatories managed by ALs. Under the remit of the Instituto de Ciências Sociais (ICS), an AL at the University of Lisbon, there are six observatories: OFAP, on family and family policy; OPJ, focused on youth; IE, on ageing; OQD, on the quality of democracy: and OBSERVA, on environment, territory and society. For instance, the three former observatories have provided information and scientific advice to the Ministry for Labour, Social Security and Solidarity. The *Centro de Estudos Sociais* (CES), another AL at the University of Coimbra, also encompasses six observatories: CRISALT, the Observatory on Crises and Alternatives, created in cooperation with the International Labour Organisation (ILO), to follow up crises and their implications; OPJ, on justice; PEOPLES', focused on citizens' participation in shaping public policies; OSIRIS, on social risks; POLICREDOS, on religious issues; and OP.EDU, on education policies. Out of these, in our view, the most relevant from a policy-making perspective are those regarding justice and citizens' participation.

[24] PORDATA, the Database of Contemporary Portugal, was organised and developed by the Francisco Manuel dos Santos Foundation, a private foundation created in 2009 by Alexandre Soares dos Santos (the founder of one of biggest retail groups in Portugal) and his family, to honour their ancestor Francisco Manuel dos Santos, to whose memory they dedicated the Foundation.

In the context of ISCTE, another University, there are seven observatories dealing with the following subjects: social differences, in cooperation with R&D units at the Universities of Porto and Azores; emigration; working conditions (associated to EurWORK - European Observatory of Working Life); European employment; cultural activities (managed by CIES, a sociology R&D unit now integrated in the Socio-Digital Laboratory for Public Policy [*Laboratório Sócio-Digital para Políticas Públicas*], a recently established AL); youth employment; and family and family policy, in cooperation with the similar observatory under ICS. At the University of Minho there is an observatory dealing with science, communication and culture (POLObs), combining the capabilities of three R&D units specialised in such themes.

A reference is also due to the activities carried out by two Collaborative Laboratories: CoLABOR and ProChild. The first has followed the impact of the pandemic on labour and has published several research papers on the theme, providing significant attention to the implications for public policy. Aiming at developing a national strategy against child poverty and social exclusion, the second is building an observatory (ProChildDATA) that intends to contribute towards public policies in the field.

Under the public remit, a reference is due to the Observatory of Energy (*Observatório da Energia*), a digital platform managed by ADENE, the Agency for the Energy. This observatory includes thematic information on public policies in the area of energy since 1974 (https://www.observatoriodaenergia.pt/pt/o-observatorio).

Regarding health policy, there is a relevant observatory, active for over 20 years: the Portuguese Observatory of Health Systems (*Observatório Português dos Sistemas de Saúde* – OPSS). It intends to provide an accurate and independent analysis about the evolution of Portugal's health system and its main determinants. One of its outputs has been used in sections 4.5 and 4.6, namely with regard to the vicissitudes of the National Council for Public Health (Observatório Português dos Sistemas de Saúde, 2021).

A final reference is due to the existence of a Portuguese network for research on public policies (*Rede Portuguesa de Investigação em Políticas Públicas*), created by the Public Policy Monitoring Unit (*Unidade de Monitorização de Políticas Públicas – UMPP*) at the University of Évora. It is intended to promote reflection, debate and production of knowledge about public policies in Portugal. Its membership includes a wide number of academics but also a few consultants, many of them specialised in territorial planning issues. However, the website does not provide information about the network's activities.

4.8 Contracted advisors

The use of academics as consultants to provide scientific advice, when needed, to specific PA bodies has traditionally been a key feature of science for policy in Portugal. In the 1970s and 1980s, when there was a significant body of knowledge in several organisations within the PA, there was a dialogue between consultants and higher PA staff regarding the design of public policy. From late 1980s onwards, with the increasing focus of many PA bodies on the

management of the structural funds coming from Brussels, in-house strategic capabilities and knowledge were seriously undermined, and PA's policy-making prowess declined. This made the recourse to individual consultants even more important. Concurrently, a host of policy-making activities migrated upwards, towards Minister's (and Vice-Minister's) offices, further undermining PA's policy-making capabilities. As a result, the contracting of advisors has also moved upwards. These features, combined with the decline in PA in-house capabilities, also led to an increase in the weight of partisan-based trust *vis-à-vis* expert professional-based trust.

Connected to this, the increasing formalisation requirements from the European Commission, concerning both the design and the evaluation of policy programmes, led an increasing recourse to organisations (firms, universities or R&D units) as sources of advice, instead of individual academics. As a result, some academics created their own firms, namely in the areas of industrial policy, regional studies and territorial planning, thereby adapting to this trend. However, such formalisation has also paved the way towards an increasing participation by international consultancy firms in the process, as detailed in 4.9. Taken together, these developments mirror the partisanship and externalisation drives mentioned by Craft and Howlett (2013).

Interestingly, the Prime Minister invited a contracted advisor (Mr António Costa Silva) to write a report that might play a beacon role to the process of preparation of Portugal's Recovery and Resilience Plan (RRP). Mr António Costa Silva is an experienced engineer and manager, being since 2003 the President of the Executive Board of Partex Oil and Gas, a company owned until 2019 by the Calouste Gulbenkian Foundation. He is also professor at the *Instituto Superior Técnico* (University of Lisbon), with an aggregation on planning and integrated management of energy resources. The text of Portugal's RRP justifies the decision to get the contribution from Mr Costa Silva as follows: "The need to revisit the outlined strategy [Portugal 2030] led the government to invite a personality of recognised merit, with extensive international business experience, Professor António Costa Silva, to prepare a document with the 'Strategic vision for the recovery plan economic activity of Portugal 2020-2030'" (República Portuguesa/XXII Governo, 2021: 237). It is somewhat surprising that, at a time when the reliance on consultants has increased, the government has resorted to an individual, combining international scientific and managerial experiences, to formulate a strategic vision for the future of Portugal underlying the design of programme endowed with a huge financial envelope.

4.9 Consulting firms

As mentioned above, the role of consulting firms in providing advice for policy-making has increased along this century. In many cases such advice should not be considered *prima facie* as scientific advice: it is mainly policy-making advice, sometimes including most of the design of policy measures, while including also information regarding the scientific foundation for the decisions proposed. In some calls, consulting firms compete against R&D units or universities, while in others they cooperate with them in consortia.

On the basis of our experience, four types of consulting firms may be identified: Portuguese firms; international business consultants; law offices; and very specialised consultants, just focused on a specific field (energy, health, education, environment or territorial development, for instance).

Leaving the latter aside, we will briefly comment on the remaining three types. The relevance of law offices has increased in the last decade. The rationale for this was two-fold: the scarce in-house capabilities of many PA bodies; and the experience of law firms in designing legal frameworks envisaged as key to ensure policy change. This happened, for instance, in the case of the enacting of new labour laws in the 19th Constitutional Government.

Many Portuguese consultancy firms emerged as a result of the convergence of the formalisation process mentioned in the previous sub-section and the expansion of the market as a result of European commitments (for instance, the increasing demand for *ex-ante*, interim and *ex-post* evaluations of policy programmes). A part of such firms was created by academics or experts that had previously provided scientific advice to the PA in specific fields as industrial policy, regional studies and territorial planning, as mentioned above. This move has been to some extent based on the capital of trust existing between the managers of public bodies and the academics concerned. Such firms provide advice at different levels: national, regional and even municipal.

International consultants have experienced a sustained increase in their market share; this happened both by endogenous growth but also by acquisitions as was the case of the takeover of Augusto Mateus & Associados, a firm set up by Augusto Mateus, an academic and former Minister for the Economy, by Ernst & Young. One example of the reliance on international consultants' policy-making advice was the initiative Industry 4.0 (Indústria 4.0), in which Deloitte played a key role. The main advantages of international consultants are the capacity to deliver on time and the mobilisation of international knowledge; however, this may turn into a weakness, since in several instances they have shown an insufficient capacity to adjust their advice to Portugal's specific characteristics and challenges.

5. A closer look at specific policy domains: main findings

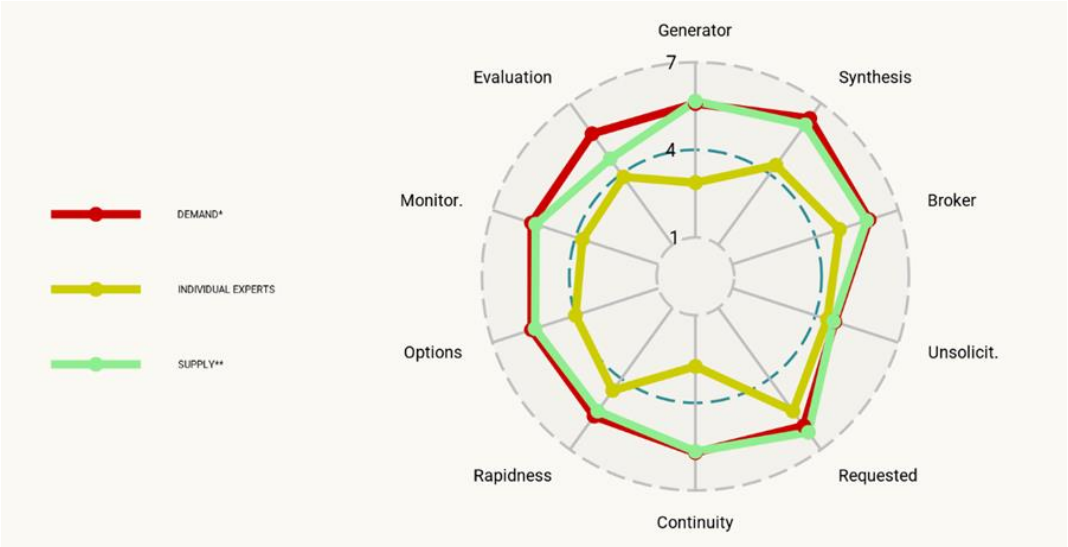
This section reports on the results and main findings of the Science for Policy in Portugal survey. The survey was carried out following the procedure outlined in 3.2. The section is structured in two parts. First, a characterisation of the main features of scientific advice is provided, drawing on information from the three groups of respondents: demand bodies, supply organisations, and experts. Second, an exercise of mapping the linkages between the demand for and the supply of scientific advice in Portugal is developed. To remind, the survey was focused on five policy domains: Defense, Economy, Employment, Environment, and Health.

5.1 Characteristics of scientific advice

The survey included questions regarding the features of advisory functions shown on Table 2, in line with the Danish report (Pedersen and Hvidtfeldt, 2021). Questions raised to each respondent were also intended to enable a better portrayal of the specific relationships reported by both the demand and the supply sides. Experts were also asked to address the issue, with a view to confirm the main features of scientific advice in their domain of specialisation.

The results are shown in Figures 1 and 2. Figure 1 gives a general perspective, broken down by respondent type. The similarity of the patterns stemming from the assessment by demand and supply is striking. In fact, the average Likert scales are very close, the only relevant difference concerning the scores for evaluation advice (scores around 6 and 5, for demand and supply, respectively). Another finding is the high average scores assigned to most types of advice, generally between 5 and 6; this may suggest a very favourable assessment and the coexistence of multiple dimensions of advice in most specific relationships. However, caution is needed since a more in-depth analysis of the contents of the relationships suggests that many of them are not dense enough to encompass high levels for most types of advice.

Figure 1: Characterisation of advisory functions by respondent type



Source: Science for Policy in Portugal survey

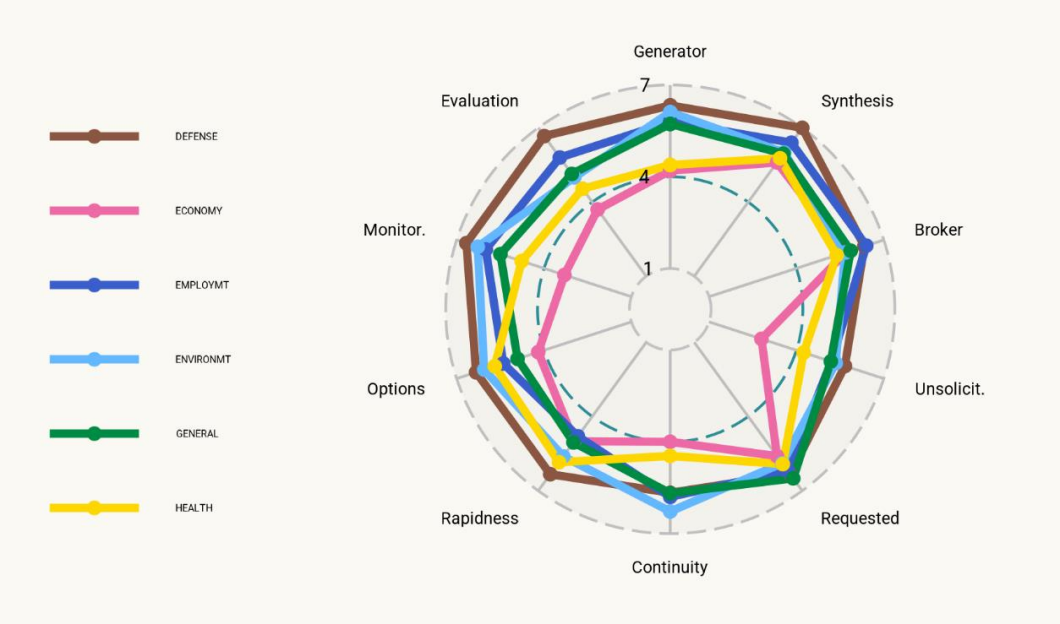
The pattern reported by experts confirms the above cautionary note. It is clearly distinct from the former, assigning lower scores to all the dimension of scientific advice, with the exception of requested input and rapidness. Generator and Continuity of advice have the lowest scores. They may be interpreted as reflecting experts experience of more occasional relationships. Experts are also more critical about the scope of advice, scoring the synthesis and brokerage functions higher than the generator function. Such results are consistent with the evidence collected in the interviews, highlighting the brokerage role. They are also consistent with the finding of a relative downgrading of advisory activities among the scientific community, discussed in section 6. The experts' assessment may be related also to the international scope inbuilt in expert's assessments. In our view, this assessment conveys a more nuanced and realistic perspective of the science advice patterns in Portugal.

Figure 2 depicts the same information, broken down by policy domain. It is important to remark that for some fields, especially Defense, the number of observations is very low; this may have biased the results in this domain, since it is the one to portray the highest average scores for most types of advice. In contrast, Economy has the lowest average scores, with the exceptions of the knowledge brokerage role (score close to 6). In this domain, the bottom scores, below 4, were found for unsolicited advice and evaluation; the first shows that in this field, as in Health, it is relatively less common scientific advisers to take the initiative, this coming usually from demand; the latter seems a bit surprising having in mind that Economy is a field in which evaluation of results is a key concern, drawing on Alfred Marshall's view of money as the measuring rod of utility. Health also exhibits below average scores. A look at this domain indicates further interesting characteristics: the relevance of identifying options and rapidness, suggesting the scientific advice is often provided in crisis situations; and the relatively meagre score (slightly above 4) assigned to knowledge generation, in contrast to brokerage and synthesis functions. This may be interpreted as suggesting that international knowledge sharing is likely to play an important role. The patterns for Employment and Environment are not significantly different. They show relatively high scores overall, often around 6. The main divergences concern rapidness, which exhibits a higher score for Environment, and evaluation, in which the opposite happens. The former finding suggests a stronger recourse to scientific advice in crisis situations or to assess the environmental impact of specific policy decision alternatives; the second is a bit surprising, since one might expect a significant concern with evaluation, especially ex-ante, on what regards environmental issues.

These findings are very relevant, insofar as they provide a pioneering perspective on the features of scientific advice in distinct policy fields in Portugal. The results should, however, be read with caution, since the sample is limited and the views of demand and supply organisations are not fully confirmed by the experts' assessment. More statistical evidence on this regard is therefore needed to provide a sounder picture.

We now turn to another key issue: the graphical mapping of the relationships between the demand and the supply for scientific advice in Portugal.

Figure 2: Characterisation of advisory functions by policy domain



Source: Science for Policy in Portugal survey

5.2 Mapping the linkages between demand and supply

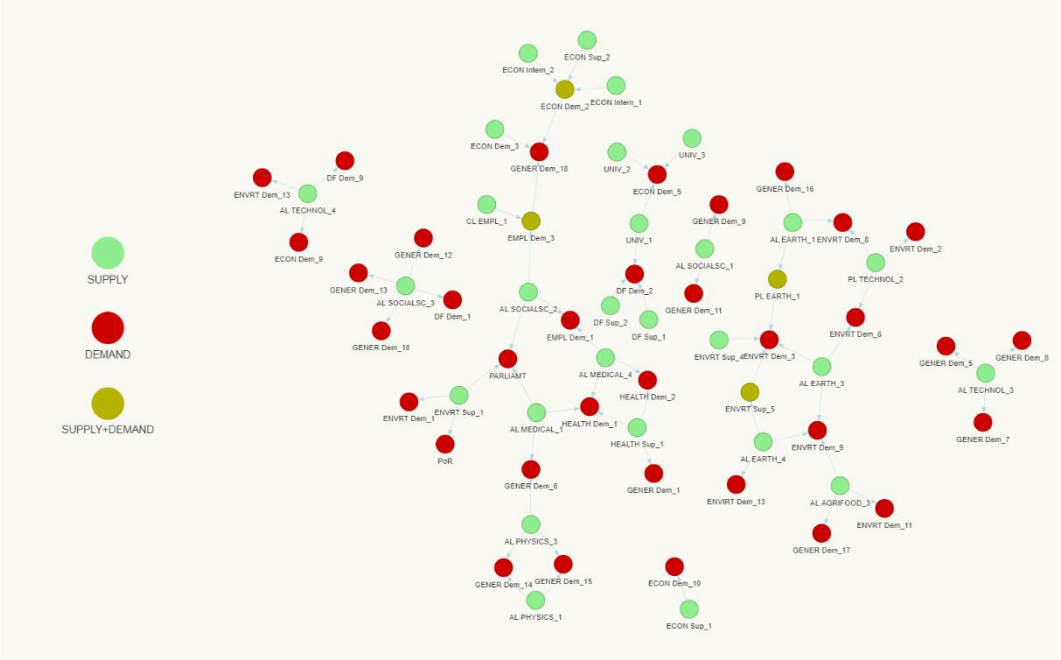
Drawing the graph of linkages between scientific advice demand and supply has been one of the main motivations to launch the Science for Policy survey. By asking the main bodies involved in the process to indicate the three main sources or destinations of advice, it became possible to get a wider and deeper perspective of the phenomenon in the selected policy domains. The results are depicted on Figures 3 and 4. They portray exactly the same graph of relationships. The only difference between them is that Figure 3 provides global information, irrespectively of the policy field, while Figure 4 highlights the policy domains. In both cases, the names of the organisations involved are disguised for confidentiality reasons[25]. They were replaced by codes enabling a general characterisation of the organisations concerned. For instance, ENVRT Dem_10 corresponds to a Directorate General of the Ministry for Maritime Affairs and ECON Dem_8 corresponds to the Parliamentary Standing Committee on Economics, Innovation, Public Works and Housing, while AL MEDICAL_3 denotes an AL carrying out R&D in health sciences, PL HEALTH_1 corresponds to a Public Laboratory under the remit of the Ministry for Health, and ENVRT Sup_2 is the code of a consultative council in the Ministry for Environment and Climate Action's purview.

The first finding emerging from the analysis of the graph is the existence of four bodies, depicted in olive green (PL EARTH_1, ECON Dem_2, EMPL Dem_3 and ENVRT Sup_5), that play a platform role, behaving simultaneously as demand and supply organisations. This is not

[25] In fact, to elicit a higher response rate, respondents were ensured that the information provided was confidential, and would not be published.

uncommon in Portugal's PA structure, in which some bodies act as brokers between S&T sources and higher-level decision-makers. The activity of the public laboratories (PLs) also follows this logic, since they are supposed to provide S&T advice to other organisations under the remit of the respective ministries. Following this logic, PL EARTH_1 is a key scientific adviser to policy making on climate change issues; however, it needs to rely on more specialised scientific knowledge to carry out its mission, thereby relying on an Associate Laboratory focused on geosciences. Another case (ENVRT Sup_5) concerns a Directorate General in the Ministry of Maritime Affairs, which provides scientific advice to other bodies inside that Ministry. From our own experience and interaction with policy makers, we know the existence of more similar cases within PA. Indeed, as one of the experts who responded the survey pointed out in an interview with us, one should recognise the existence of several layers in PA's approach to science for policy: policy-makers draw on the advice of other PA bodies assumed to be endowed with scientific knowledge and these, in turn, resort on the advice of PLs in the Ministry's remit and, if this is not sufficient, Public laboratories may demand support from more specialised research organisations, either in the country or abroad[26].

Figure 3: Graph of science for policy relationships: general perspective



Source: Science for Policy in Portugal survey

A key finding is the relatively low density of clustering observed in the graph. Although the methodological approach followed (focus on specific domains) may have influenced the results, the figure depicts a significant fragmentation of the ecosystem(s), and weak levels of cross-

[26] It is interesting to remark that this chain of knowledge sourcing has some similarities to the chain-link model of innovation, developed by Kline and Rosenberg (1986). See also Simões (1995) and Caraça, Lundvall and Mendonça (2009).

fertilisation and coordination[27]. The maximum number of linkages exhibited by any organisation is 4, and this happens in just two cases (ECON Dem_2 and ENVRT Dem_3). The most common situation is a body to be the hub for three linkages[28]. The observation above has to be tempered by the fact that a limited number of organisations responded the survey. A higher response rate would have probably increased the density of linkages. Nevertheless, the large number of hubs with just three linkages suggests that further clustering is scarce. This leads to a more general conclusion: there is not a single, encompassing ecosystem of science for policy in Portugal. On the contrary, what Figure 3 depicts is the existence of multiple clusters with low density. It may be argued that the present situation rather corresponds to a situation in which multiple ecosystems, often clustered around one or a few ministries, coexist. In our view, this is probably due to the convergence of three factors: the relative youth of Portugal's S&T system in historical terms; the low levels of inter-ministerial cooperation; and the absence of coordinated organisational approaches to the science-policy nexus, not to speak about the inexistence of a CSA network model[29].

The third finding is not surprising, having in mind the nature and the history of the science for policy setting in Portugal: the relative diversity and specialisation of scientific advice supplying bodies. This clearly emerges in the concentration of ALs researching on marine sciences as suppliers to the Ministry for Marine Affairs or the focus of ALs researching on social sciences on supporting the Ministry for Employment, Solidarity and Social Security. This is also a consequence of the relative low involvement by fundamental sciences ALs, such as Physics, in providing science for policy advice.

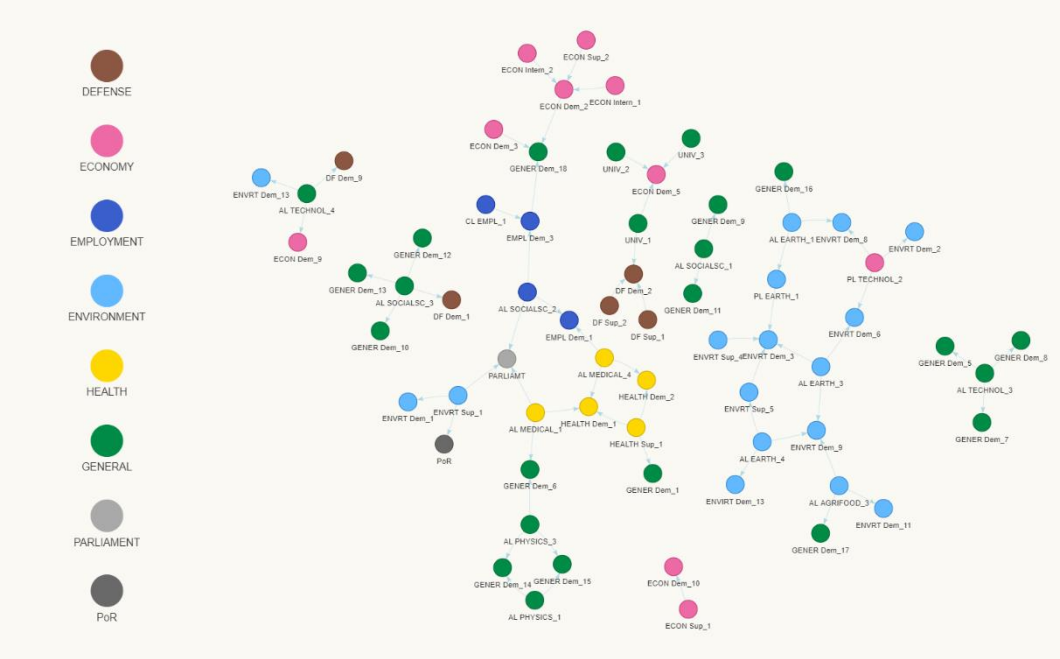
Although not very visible in the graph, a reference is also due to the reliance on international advice. This happens especially, though not exclusively, in the case of Economy, where linkages with both the European Union and OECD are envisaged as a source of scientific advice. Also in domains such as Energy and Environment (and to an increasing extent in Health) the influence of European programmes and strategies is getting more relevant. This entail more recourse to S&T knowledge and thereby the reliance on experts able to cooperate in the formulation of such policies[30]. In Defense, international collaboration in the context of NATO, the North Atlantic Treaty Organisation, was also reported simultaneously as an influencing factor and a spring of advice (personal information in survey process). In general, such advice seems to have mainly a synthesising and brokerage nature, as international organisations act as synthesisers and cross-pollinators of knowledge among member countries.

As mentioned above, Figure 4 provides the same basic graph, but highlighting the policy domains. The Parliament and the Presidency of the Republic are presented as separate domains, to enable

[27] I thank Lorenzo Melchor for this observation.
[28] Remember that surveyed organisations were requested to indicate with which bodies linkages related to scientific advice had been established.
[29] It is worth to remark that focusing the survey on a limited set of policy domains may have also played a role on this regard. However, this does not conceal the finding of a low density of linkages.
[30] I thank José Bonfim for this observation.

a better perspective of their positions in the graph. The Parliament is a significant recipient of scientific advice, coming from medical, environmental and social sciences[31]. This is not surprising, having in mind the Parliament's legislative role and also the existence of open consultation processes through the participation by scientific experts in sessions of Parliamentary standing committees.[32] The relatively large number of green nodes, corresponding to the remaining general group, is chiefly a consequence of the inclusion of the Prime Minister's office in the survey, aimed at getting its views on scientific advice, and from recipients mentioned by ALs. The latter is the main reason for scattered positions of bodies belonging to this group.

Figure 4: Graph of science for policy relationships: perspective of policy domains



Source: Science for Policy in Portugal survey

The frequency of bodies assigned to each policy domain is very much influenced by the relative numbers of respondents to the survey. This explains, for instance, the large number of organisations in the Environment cluster and the rather low recorded for Health (please note that no reply was got from PA bodies in this field). The hosts of Economy and Employment are also scanty. The Environment cluster shows the most intense linkages, although these seem to be structured Ministry wise; in other words, the linkages between the clusters led by the two ministries in the Environment domain (Ministry for the Environment and Climate Action, and Ministry for Maritime Affairs) are limited.

The above observations confirm the need to have a wider coverage of the demand organisations for most domains, especially Defense, Health, Economy and Employment. This would provide a

[31] It was not possible to confirm this finding from the Parliament's end. In fact, we have sent the survey to the presidents of the four Standing Committees dealing with the selected domains but, in spite of a reminder, we got no reaction from them, besides the automatic acknowledgement of the receipt.
[32] I thank Lorenzo Melchor for the support on this regard.

much better picture of the pattern of relationships between demand and supply for scientific advice. Unfortunately, it was not possible within the time constraints to work out this report. We do hope that the baton will be carried out forward, to get a more accurate depiction of the ecosystem(s) of science for policy in Portugal.

6. Assessment of science for policy in Portugal: challenges and opportunities

This section aims to provide our assessment of the contribution of scientific advice to policy-making in Portugal and to identify the main challenges and opportunities. In the process, we mainly draw on the evidence collected from the science for policy survey (section 5) and the ensuing interviews with experts, but also on the general analysis of the organisational mechanisms for the provision of scientific advice in Portugal (section 4). Our findings will be compared to the literature reported on section 2. The present section is structured in three parts: the first provides an analysis of the issues identified in the practice of scientific advice in Portugal; the second summarises the main challenges; and the third presents the opportunities available to respond such challenges.

6.1. Science for policy in Portugal: an assessment

This section is intended to assess the practice of science for policy in Portugal. There exists a relatively wide set of organisational forms to provide scientific advice for policy making. However, the performance track record of such organisations is uneven: there are several cases of good practice in terms of advice and transparency, as the CNV or CNADS, while in others it is poor, as it happened with the CNSP during the pandemics or the aborted White paper on the present and the future of Portugal's SNS. From the desk research, the survey and the interviews with experts, the perception of a lack of coordination and consistent procedures strongly emerges. There is not a set of common rules guiding the provision of scientific advice for policy-making. The consequence is a heterogeneity of approaches, very much influenced by *ad-hoc* decisions and by the members of the government's personal traits and connections. The mapping of the demand-supply interactions has shown a low density of relationships[33]. Therefore, the evidence collected clearly indicates that there is not an ecosystem of science for policy in Portugal, but rather several clusters of relationships. These may be envisaged as small ecosystems (or embryos of ecosystems) rather than as a general, structured ecosystem.

The approach followed to manage the pandemic has raised a discussion in the media about the role and structure of science for policy in Portugal (Pereira, 2021; Fiolhais, 2021; Ribeiro, 2021; Serafim, 2021). As we have already addressed the issue in sections 2.1 and 4.6, there is no need to come back to it. Rather, it is preferable to go deeper into the characteristics and tensions pervading the dialogue between science and policy-making in Portugal, based on the evidence amassed in our research.

The main finding from the survey is the lack of an inter-linked ecosystem of science for policy in Portugal. There is not a single science for policy ecosystem in Portugal, with specific coordination mechanisms. As mentioned above, Figure 3 depicts a very thin set of interactions among the demand and the supply for scientific advice. In contrast, what came out was the existence of some

[33] As mentioned above, this is in part due to the method followed and to the low response rate, but these do not inhibit the findings reached.

clusters of relationships, around specific themes, mostly driven by individual linkages, and common interests, concerns and linkages. Although they should be carefully interpreted due to the survey's low response rate, these findings are consistent with a more general assessment about governance in Portugal, that underlined the need to develop oversight mechanisms (Jalali, Bruneau and Colino, 2020).

To develop a better understanding of the picture of scientific advice in Portugal, the information collected from the experts' survey and the interviews are more critical, nuanced and qualitatively richer to understand such characteristics and tensions than those provided by the replies from the demand and supply.

Which are the reasons behind the request for scientific advice?

Building upon the response of an expert (Expert Health #4), our research suggests that the existence of five main rationales behind the demand for scientific advice. The first corresponds to the existence of "a genuine doubt about the best option to solve a problem", leading to seek advice. This problem is usually a short-term one, stemming from normal policy-making activity or from a crisis, in line with SAPEA (2019). The contribution of science is sought to elucidate the problem with a view to take an appropriate decision. The second is geared to get a confirmation to decisions already taken or shaped. While in some cases the decision may be reversed on the basis of the scientific evidence provided, the most common is just seeking "validation, the interest in scientific advice waning if such validation is not provided" (Expert Health #4). This perception led some experts to complain about the lack of information on the consequences of the advice provided. In fact, oftentimes such advice is not put in practice, but it rather remains 'on the drawer'. It is important to underline, however, that this is not a problem in itself. A policy-maker may, and eventually should, stimulate diversity in scientific advice to open the range of available options. As it was underlined by SAPEA (2019: 34), "in contemporary pluralist societies, diversity of risk perspectives within and between social groups is generally fostered by divergent value preferences, variations in interests". This leads to another issue: the lack of information and transparency about the decision taken[34]. The third concerns the forward-looking decision-making, with regard to medium- to longer-term issues. While politicians tend to be much more attuned to the short- to medium-term, in line with the electoral calendar, there are cases in which longer-term objectives may be pursued, as it happens with climate change. The president of IPMA alerted towards the need to better address such issues in Portugal (Firmino, 2021). The fourth reason to seek scientific advice is related to a crisis, to explain why an event happened and the actions taken to counter it. The various reports and working committees commissioned or convened to analyse the 2017 fires in the Center of Portugal, mentioned in 4.4, are an example of this. Finally, there are the situations in which scientific advice is mandatory. This happens namely in the cases of EU-funded programmes, for which *ex-ante*, interim and *ex-post* evaluations should be carried out: "advice comes in the context of policy evaluations imposed by

[34] And it should be acknowledged that sometimes scientists do not seem to be aware about the existence of diverse legitimate options, assuming that theirs is the only scientifically-grounded approach.

regulations (national or European), and not by policy-makers' perception or conviction about the need of scientific knowledge to ground decisions" (Expert Economy #1). Another expert went further, and argued that many politicians "disdain evaluation" (Expert General #2). Evaluations should, in contrast, be envisaged as golden opportunities to learn, and to get evidence to fine-tune and improve policy-making. In spite of the improvements observed, the culture of evaluation is not yet fully embedded in policy-making practice in Portugal.

A relevant set of science for policy issues in Portugal has to do with the lack of formalisation. Informality is intimately related to the relevance of personal relationships that was pointed out by some experts as an important factor in shaping the practice of science for policy in Portugal: quoting an interviewee, the take up of scientific advice is contingent upon "the awareness of the [member of the government] and his/her close collaborators to scientific knowledge" (Expert Health #1). In Portugal there is not a general code of conduct on scientific advice, addressing issues as confidentiality of information, conflicts of interest and feed-back. This seems to be especially felt in the case of consultative bodies[35]. The main exception to this appears to happen under the Ministry for Health, that has specific regulations on that regard (Decree-Law 14/2014, of January 22nd). Furthermore, personal and political trust are very important considerations for the decision. In many cases, the strength and closure of the policy-making core, namely at ministerial level, constrains the characteristics of external scientific advice. These findings are not surprising. They express the fact that shared interests between policy-makers and the expert are a foundation for trust, as Mair et al. (2019) have underlined. However, the existence of a clear and general set of guidelines for scientific advice would enable to curb the potential deleterious effects of 'club friendships'.

Another issue reported by some experts was the perception of insufficient *ex-ante* and *ex-post* transparency in the process of contracting scientific advice. E*x-ante* transparency refers to the process of seeking advice, in which the reasons for a specific choice must be made clear. *Ex-post* transparency has to do with the availability of information on the use (or lack thereof) of scientific advice for policy decisions. "There are no clear criteria to select the experts participating" in external advisory groups (Expert Health #5). This may be also envisaged as an expression of insufficient formalisation. This sometimes leads to a perception of opacity, even though the reasons behind it may lay more on organisational weaknesses than on a deliberate attempt to control or conceal information. Our findings are not, at the end of the day, very different from those of Mara Almeida in 2015: "the lack of public trust is likely to be a result of the lack of transparency of decision-making processes and their underpinning information" (Almeida, 2015a: 234). This observation may be related to an important point raised by Godinho and Caraça (2008): science for policy is not just a dual relationship between science and policy-making, but also a triangular interaction between politics, science and society.

[35] The author of this report has served in several consultative committees, but has never been asked to sign a confidentiality requirement of a declaration of absence of conflict of interests. In contrast, these are usually required when entering into consultancy contracts regarding EU-financed programmes.

Our analysis shows that, while acknowledging the relevance of scientific knowledge, the policy-making community in Portugal is not aware enough about the advantages of an increased reliance on scientific advice. Previous research on the place of scientific issues in the Parliament (see 2.2) or the Parliamentary decision to expand the vaccination programme without hearing the CNV (reported in 4.4) show that the Parliament is not sensitive enough to scientific advice and lacks formal procedures that might ensure its availability. In a similar vein, there is not a tradition of existence of a scientific adviser to the President of the Republic; such existence was the exception rather than the rule. Though being the main recipient of scientific advice, the evidence provided also indicates that the government's recourse to advice also suffers from shortcomings at different levels. These findings, together with the relatively low reliance on scientific advisory councils in many areas, including in S&T itself, suggest that much has to be done to strengthen the role played by scientific advice in policy-making in Portugal.

The awareness of the need of science for policy is not widespread, in spite of the significant developments of Portugal's scientific system along the last 25 years and the general recognition by politicians of the increasing quality of scientific research. This problem is more the result of a weak scientific culture, partly stemming from the late development of the S&T system, than of a negative reaction to science and scientists. It may be suggested, in line with the arguments of some of our interviewees, that, irrespectively of the colour, the political power does not live well with scientific advice and with concerted positions from the scientific community, since these may be envisaged as reducing the leeway to take policy decisions.

This leads to another important theme: the tensions existing in the dialogue between science and policy-makers. As mentioned in 2.1, one should bear in mind that we are dealing with two distinct epistemic communities, with different cognitive approaches, languages and objectives. This generates tensions as Wilsdon, Allen and Paulavets (2014) or Mair et al. (2019) have acknowledged. In our perspective, grounded on the evidence collected and on the interaction with the experts, especially Expert General #2, there are five inherent tensions in the practice of scientific advice.

The first concerns the difficult balance between scientific freedom and political affinities. For some scientists, political decision is envisaged as a relatively 'dirty' field that might hinder scientific freedom. Science is often envisaged as value-free, aiming at reaching the 'truth'. However, this does not correspond to the reality. Scientists are also value-laden as Mair et al. (2019) or Oreskes (2021) have underlined. To solve the tension, it is essential both scientists and policy makers to acknowledge their values and to make them clear to the public. The second friction has to do with the independence of advice and ensuring that it is listened by policy-makers, as Wilsdon, Allen & Paulavets (2014) have noticed. This should not be envisaged just as a matter of personal trust, as it is common in Portugal, but also as an issue that requires formalisation and transparency, two characteristics in short supply in Portugal's science for policy landscape. The third issue is related to the individual versus multidisciplinary approaches. In Portugal, they coexist through the reliance on distinct organisational forms to provide scientific advice. Individual advisers should

recognise that often their knowledge alone is not enough to appropriately address the complexity and the multi-faceted nature of policy issues. The fourth tension is between scientific advice and academic careers, as some experts have pointed out. One of them argued that “it is key to consider the dimension of public-policy extension at the same level as teaching, research and university management” (Expert General #2). This is an obvious call for a revision of the statute of the university career to provide more balanced stimulus for diversified forms of scientific activity. Finally, there is a different perception of time. Time for policy-makers is usually more pressing than for scientists. Policy makers often need to decide ‘here-and-now’, while scientists may assign more importance to optimisation or accuracy than to time constraints.

In spite of such tensions, our survey highlights several cases of fruitful cooperation in science for policy. One interesting example is the case of an important public agency providing incentives in the field of investment (ECON Dem_5) making use of data science inputs from a university to significantly improve the quality of the analysis of investment projects. Another example, taken from the supply side (AL EARTH_4), concerns the tripartite collaboration for the co-management of octopus fishing, involving work with fishermen communities; this led to a green book on octopus fishing, highlighting the most urgent measures to implement and their acceptability by fishermen communities. Further positive cases of dialogue concern the already mentioned committee on general vaccination (CTV) and the advisory council on environment and sustainable development (CNADS).

It may also be argued that the launching of the CNCTI may play a positive role on this regard, having in mind that it is intended to provide scientific advice for policy-making in all sectoral areas. This may be envisaged as a positive development. However, it is still too early to anticipate how this function will be carried out in practice, not to speak about how the ministries not participating in the Council will react to such ‘external’ scientific advice. While some voices have pointed out the advantages of setting up of a CSA to the Government as it happens in the UK, such a job does not guarantee an appropriate consideration of science for policy, and may lead to reduce diversity. In contrast, what is relevant is to develop initiatives to increase the awareness of politicians, in all sovereignty bodies, about the relevance and the positive implications of scientific advice. This should not be envisaged as a bothering factor or as a counter-power, but rather as a relevant tool to improve policy-making. Anyway, having in mind the insufficient awareness about science for policy among Portuguese political class, there will be a lot of ‘evangelisation’ to be carried out to improve the take up of science for policy in Portugal.

The increasing influence of international instances in the provision and in the demand for scientific advice is another important finding. Especially in the domain of Economy, a significant part of advice comes from international organisations, namely from the European Commission and the OECD. The creation of the Council for Productivity, mentioned as one of the main sources of advice in the Economy field, was the result of a European decision to promote the setting up of specific bodies, at the Member State level, to deal with productivity matters. This also happens in other areas, such as climate change or energy policy. European influence also regards the

compulsory adoption of specific policy approaches, as was the case of Smart Specialisation strategies in the preparation of the operational programmes of the 2014-2020 programming period. A vector with an important bearing on science for policy is the process of ex-ante, interim and ex-post evaluations of EU financed operational programmes. While initially these were often envisaged by Portuguese policy-makers as bureaucratic and burdensome procedures, the mood has changed and their usefulness as opportunities for policy learning and improvement has increasingly been recognised.

On what concerns the supply of scientific advice, it seems that its quality is uneven. It emerged from the analysis that the way how university staff is evaluated, putting a strong emphasis on publication on international peer-reviewed journals, dissuades them from assigning time to science for policy. This is often envisaged as lackluster activity that the university *élite* will not bother to carry out. Furthermore, there is a need that scientific advisers make an honest attempt to understand policy-makers' logics and key concerns. This is essential for a fruitful dialogue.

We conclude this assessment by coming back to a critical issue hindering the proper work of science for policy in Portugal: the low level of formalisation of procedures regarding scientific advice in Portugal. Informality is, for better or for worse, an ingrained trait of the Portuguese culture. Informality undermines governance, impairs the establishment of clear rules of behaviour and reduces transparency; not surprisingly, this was pointed out by many of surveyed experts as a serious weakness of the present state of science for policy in Portugal. As one interviewee put it, "an increased institutionalisation, with a formalisation of advice procedures […] would be very positive" (Expert Economy #2) for policy-makers to have access to knowledge that might enable them to better anticipate or identify scenarios regarding future policy approaches. This idea reminds the role of scientific advisers as "honest brokers of policy alternatives" (Pielke Jr., 2015).

Drawing on Innerarity (2021), it may be argued that science for policy is an essential ingredient of a complex democracy. The existence of formalised rules regarding the provision of scientific advice in Portugal might significantly contribute to withstand the challenges raised by volatility, uncertainty, complexity and ambiguity. In fact, the setting up of clear procedures and roles might significantly contribute to increase the quality, take up and effectiveness of science for policy, while increasing transparency, participation and commitment from the different stakeholders.

6.2 Main Challenges

The main challenges stem from the assessment of the situation carried out in the previous section. Six key challenges were identified from our research:

1. <u>Insufficient awareness about the advantages provided by scientific advice</u>: Political powers in Portugal do not seem to be fully aware of the relevance of scientific advice. There is a wide recognition of the merits of science and a pride about the development, capabilities and achievements of Portugal's scientific community. However, this is not translated in a clear awareness of the potential contribution of scientific advice for policy making. This is common to all sovereignty bodies and political parties. While in many cases there is a genuine desire to

understand which might be the best option to respond a policy problem, in others advice is mainly sought to provide confirmatory support for decisions that were broadly shaped *ex-ante*. Policy decisions are often taken *en petit comité* (Godinho & Simões, 2015) As mentioned above, there is a need to make policy-makers more cognisant about the potential for smart use of scientific advice.

2. Difficulty of dialogue between science and policy-making: This is not surprising since they correspond to distinct epistemic communities, whose values, cultures and time frames are not necessarily aligned, as suggested by Mair et al. (2019). Politics is the art of the possible while science, especially pure science, aims at optimisation. Therefore, some scientists envisage policy-making as a field pervaded by multiple, sometimes not fully legitimised, interests. In contrast, politicians often criticise scientists for being distanced from the harsh realities of life. The different concepts of time have also emerged as a factor of division: as fighting the pandemics has shown, time was a critical factor for politicians, sometimes preventing them from waiting for further information that the scientific community perceived as essential[36]. Dialogue is paramount. But it requires trust and a capacity to recognise and understand the differences and to be able 'to put oneself on the other's shoes'. The suggestion presented by the European Commission's Group of Chief Scientific Advisers (2019) to cooperate in the definition of the key questions to be addressed is pervaded with difficulties, for various reasons pointed out along this report. But it is a good starting point to enable a more productive dialogue, beneficial for science, policy-making and the society as a whole.

3. Relevance of personal trust: Portugal is a small country in which at higher rankings 'everybody-knows-everybody' but in which there are groups, often defined by political *cum* personal affinities and trust. While trust is an essential ingredient in science for policy (Wilsdon, Allen and Paulavets, 2014), the key place assigned to personal *vis-à-vis* professional trust may become a problem. Sometimes, the replacement of a Minister or Vice-Minister leads to a wide change in scientific advice connections and orientations. The strong focus on personal trust may also have two further negative effects: the curtailing of both diversity and multi-disciplinarity.

4. Academic engagement in policy-making: The insufficient relevance assigned to extension and scientific advice activities in the evaluation of academics leads many researchers to abstain from such activities, concentrating in higher career-rewarding tasks. This is a challenge insofar it leaves many high-skilled researchers out of science for policy, when otherwise they might provide relevant contributions to evidence-informed policy-making.

5. Insufficient transparency: This feature is not always deliberate; in many cases it stems from a lack of organisational capabilities and/or of human resources. But, of course, it may also be a way to avoid scrutiny and to have more leeway for taking decisions. This issue has been relatively often mentioned by the experts as a hindrance of science for policy in Portugal. The problem may

[36] The report by the Portuguese Observatory of Health Systems (Observatório Português dos Sistemas de Saúde, 2021) also shows how decisions taken by scientific bodies may be significantly influenced by existing information (or by the lack of it).

be expressed in different ways: information regarding the selection of advisers; information about potential options; information about the rationale for decision-making; and information for societal participation and scrutiny. Insufficient transparency is a challenge that deserves more attention and the adoption of appropriate measures. Part of these are, in our opinion, related to the response to the next challenge.

6. Insufficient formalisation: Being a small country with a very informal culture, Portugal suffers in general from a lack of formalisation. This is particularly clear in the science for policy field. There are no general regulations regarding relevant themes such as the criteria and conditions for searching advice, conflicts of interest or confidentiality. The challenge is, however, wider, since it requires an institutional approach towards science for policy. As remarked by one of our interlocutors, "it is not a matter of individual [efforts; change requires] organisations that might embody another vision" (Expert General #3). Having said this, the formalisation approach has to provide appropriate regulation of procedures and inter-actions while avoiding bureaucratisation and keeping flexibility to enable a proper working of the science for policy system.

Besides these challenges, there are two questions to design an appropriate governance framework to address science for policy in a VUCA context:

• *How to establish a multi-layered and diversified but consistent governance?* The formalisation challenge points out, in fact, towards the need for promoting organisational change to respond volatility, uncertainty, complexity and ambiguity. The challenge is to make scientific advice a key vector in the context of an improved multi-layered governance system encompassing distinct sovereignty bodies and a diversified set of demand and supply organisations, involving the participation of multiple stakeholders, while ensuring appropriate forms of coordination. Drawing on Innerarity (2021) and considering the governance weaknesses highlighted by both Simões, Godinho and Sánchez-Martinez (2018) and Jalali, Bruneau and Colino (2020), there is a need for improving overall governance procedures, while promoting the tools to enhance the quality and effectiveness of scientific advice.

• *How to respond societal challenges stemming from fast change in multiple fields?* This is a key challenge that requires a turn in the prevailing approaches to science for policy. It is not a matter of relying on science to respond a crisis, as it happened with the pandemics. It is more than preparing for climate change, a challenge that Portuguese public authorities are endeavouring to respond. It is mainly a matter of anticipating change, requiring a more forward-looking approach, in which the contribution from science in identifying options and in designing possible scenarios is key. Examples of this, some of them already hitting us, are robotisation, artificial intelligence, platform companies, employment opportunities, systemic risks, ageing diseases, the socio-digital divide and new feeding sources. They have multiple and sometimes contradictory implications, the understanding of which requires the recourse to scientific advice.

6.3 Main Opportunities

To respond the changes identified there are opportunities that need to be explored. Such opportunities have a lot to do with learning and institutional innovation. Financially-endowed programmes may work as enablers, but the key issues regard the creation of conditions for achieving better systems of governance.

The development of this research together with the reflection about governance in VUCA contexts, suggest the existence of five important opportunity windows that might be explored to achieve the changes required:

1. The widespread recognition of the important role of science: This statement seems contradictory to the reference to the insufficient awareness of the political community about the relevance of science for policy. This is not the case, however. We have underlined that both the Portuguese society and the political players recognise the role of science and are proud of the Portuguese scientific community living either in Portugal or abroad. In other words, the relevance of those groups denying the role of science is low. Furthermore, most political parties converge in praising science. There is, therefore, room for establishing a social consensus about the need for creating conditions for a better governance of science for policy in Portugal.

2. The pandemic has highlighted the role of scientific advice: Although the media have been 'invaded' by several analysts lacking the appropriate skills to comment about the pandemic developments, public opinion has learned to rely on the qualified opinions of public health specialists, epidemiologists or virologists to keep abreast of the situation and to forecast the future. They have conquered media attention, and this may pave the way for an increased attention to science advice. Together with the former point, this is another opportunity for creating a coalition for change towards an improved role of science for policy.

3. The existence of facilitators: In Portugal it is relatively common the assignment of government responsibilities to academics. There are also cases, though relatively less common, of academics that have served for some time as high-level PA officials. This is, of course, due to the size of the country as well as to the limited pool of highly-skilled people. The circulation through different jobs is likely to enable such individuals to play the role of facilitators or 'bridges' between the executive and the academy, contributing to reduce the frictions existing in the dialogue between them as well as to potentially increase the take up of scientific advice by government members.

4. The Recovery and Resilience Plan provides an opportunity to improve the skills of PA's human resources, including its rejuvenation. A serious hindrance to science for policy is the relatively low level of skills and the ageing of PA. The funding from RRP may contribute to enhance such skills through different ways, from the recruitment of younger and more qualified staff to the training of existing staff, making this more able to establish a fruitful dialogue with the providers of scientific advice. This opportunity window should be accompanied by an effort to

ensure a consistent policy of selection of high-level PA officers chiefly based on capabilities instead of political affiliation.

5. <u>The (difficult) recognition of the need for improved governance</u>: The last one and a half years have been dominated by the pandemic. This has strengthened the focus on the short-term. When the pandemic is tamed, an increased recognition of the weakness of governance in Portugal, highlighted by Jalali, Bruneau and Colino (2020) is likely to emerge. This may lead to more open, multi-layered and participatory approaches creating new opportunities for institutionalising science for policy interactions and enhancing coordination. Though not specifically addressed to scientific advice, the recent book by Daniel Innerarity (2021) is likely to provide a template for new governance experiments aimed at responding an increasing complex and uncertain setting.

7. Conclusions

This report was aimed at investigating the landscape of science for policy in Portugal. It is based on the acknowledgement of the conditions of volatility, uncertainty, complexity and ambiguity that pervade the contemporary world. It also comes in the vein of literature that underlines the relevance of evidence-informed policy, while recognising the existence of diverse stakeholder perspectives to address complex phenomena or issues.

More specifically, the purpose was three-fold: to identify distinct organisational forms for provision of scientific advice; to map the network of relationships between the demand and the supply for scientific advice; and to assess the profile of science for policy in Portugal. To respond these objectives, a three-pronged methodological approach was followed, encompassing: desk research; a survey on a limited set of policy domains, and addressed to the demand and the supply of scientific advice as well as to experts; and a set of interviews with selected experts.

The desk research enabled to identify a multiplicity of organisational settings of science for policy, going from R&D units, ALs and PLs to the reliance on individual experts and consultants, through different types of advisory commissions and councils. In most cases it was possible to identify success cases and failed experiences. However, the awareness of sovereignty bodies about the advantages of scientific advice was found to be relatively weak, especially for the President of the Republic (a dedicated job of science adviser was assigned for ten years only) and for the Parliament.

The analysis of the survey was undertaken with caution, since due to time and budget constraints the reply rate was low, especially in the case of demand. In spite of this, the survey has shown that the assessment of the pattern of scientific advice was much better for the demand and supply than for the experts. These were clearly more critical about its quality, characteristics and relevance.

A relevant consequence of the project was the possibility of depicting a graph of demand-supply relationships for the various domains selected (Defence, Economy, Employment, Environment, and Health). This led to conclude that there is not a single science for policy ecosystem in Portugal. The analysis undertaken suggests, in contrast, the existence of diverse clusters of relationships. Further, in Portugal there is not a common approach to the management of scientific advice. What emerges from the research undertaken is a multi-faceted reality, in which the demand for advice is to a significant extent informal and influenced by personal characteristics, trust and the perceived compliance with political options. There is clearly a dearth of formalisation of science for policy affairs.

In Portugal there is a somewhat paradoxical situation with regard to scientific advice. On the one hand, there is a widespread acknowledgement by the political community of the quality and dynamics of the Portuguese scientific community, both at home and abroad. On the other, the awareness about the merits and advantages of scientific advice is relatively limited. With regard

to the demand for scientific advice, there is a coexistence of situations in which scientific advice is sought to identify possible options and their implications and relative advantages, to respond a crisis and to search for a confirmatory position to validate decisions already taken or envisaged.

The research led to other interesting findings besides those mentioned above. First, international relationships, especially in the context of the EU, play an increasing role in shaping the pattern of science for policy. Second, the provision of scientific advice is not highly regarded by the academic community, not least because its weight for career evaluation is low. Third, and mostly important, there is an insufficient formalisation of scientific advice procedures. This undermines the provision of science for policy, and negatively affects the perception of transparency.

The main challenges faced are the following: (1) Insufficient awareness about the advantages provided by scientific advice; (2) the difficulty of dialogue between science and policy-making; (3) the important role played by personal trust in the decision to source scientific advice; (4) the limited academic engagement in policy-making, (5) the insufficient transparency in the provision of information regarding the process of scientific advice; and (6) the low level of formalisation of such process, including the lack of consistent rules regarding for instance independence, conflicts of interest and confidentiality. Two additional issues concern, How to establish a multi-layered and diversified but consistent governance? and How to respond societal challenges stemming from fast change in multiple fields?

In contrast, there are opportunities to be explored with a view to set a sounder system of science for policy in Portugal. These have to do with the following themes: the widespread recognition of the relevance of scientific knowledge, increased as a result of the pandemic; the existence of facilitators that might play a bridging role and enhance the dialogue between science and policy-making; the possibilities stemming from the RRP, namely in terms of the upgrading and rejuvenation of PA capabilities, and the growing, albeit difficult, recognition of the need to improve the quality of governance in Portugal.

The present report is just a first inroad on the study of science for policy in Portugal. Due to time and budget constraints, it just corresponds to an attempt to scratch the surface of a complex and multi-faceted reality. We do hope that this contribution might pave the way for further initiatives to address a very important issue to foster evidence-informed policy-making in Portugal. Both research and collective action are needed…

References

Almeida, Mara (2015 a). 'Explorative Country Study: Portugal', in Leonhard Hennen and Linda Nierling,eds, *Exploring the TA Landscape: Country Studies*. Report of the PACITA Collaborative project on mobilisation and mutual learning actions in European Parliamentary Technology Assessment, pp. 221-254.

Almeida, Mara (2015 b). 'Parliamentary TA in Portugal – A Comparative Analysis of Two Models'. *Technikfolgenabschätzung – Theorie und Praxis* 24(3): 102-108.

Bauman, Zygmunt (2000). *Liquid Modernity*. Cambridge: Polity Press.

Bennett, Nathan and G. James Lemoine (2014). 'What VUCA really means for you'. *Harvard Business Review*, January–February, 27.

Bijker, Wiebe E., Roland Bal and Ruud Hendriks (2009). *The Paradox of Scientific Authority: The role of science advice in democracies*. Cambridge, Mass./London: MIT Press.

Boavida, Nuno, António B. Moniz and Manuel Laranja (2014). Towards an assessment of the Portuguese E-mobility case: The Mobi-E., in *Technology Assessment and Policy Areas of Great Transitions*, Proceedings of the PACITA 2013 Conference, Prague: Technology Centre ASCR, pp. 263-270.

Botelho, Leonete (2018), 'Parlamento tem legitimidade para aprovar vacinas, mas arriscou "má decisão política", *Público*, 30th November 2018, available at https://www.publico.pt/2018/11/30/sociedade/noticia/parlamento-legitimidade-arriscou-ma-decisao-politica-1852950, retrieved on October 19th, 2021.

Böhle, K. and António B. Moniz (2015). 'No Countries for Old Technology Assessment?', *Technology Assessment – Theory and Practice* 24(1): 29–44.

Buckley, Peter J. (2020). 'The role of International Business theory in an uncertain world', in Rob van Tulder, Alain Verbeke, Barbara Jankowska and Peter J Buckley, eds*., International business in a VUCA world: the changing role of states and firms*. Bingley, UK: Emerald Publishing Limited, pp. 23-29.

CNADS (2020). *Coletânea de Pareceres e Reflexões 2017-2020*. Lisboa: Conselho Nacional do Ambiente e do Desenvolvimento Sustentável.

Cairney, Paul (2016a). *The Politics of Evidence Based Policy Making*. London: Palgrave Springer

Cairney, Paul (2016b). 'The politics of evidence-based policymaking'. *The Guardian*, March 10, available at https://www.theguardian.com/science/political-science/2016/mar/10/the-politics-of-evidence-based-policymaking, retrieved on July 28th, 2021.

Cairney, Paul (2020). 'The myth of 'evidence-based policymaking' in a decentred state'. Public Policy and Administration, Special Issue. https://doi.org/10.1177/0952076720905016, retrieved on August 1st, 2021.

Caraça, João M. G., Bengt-Åke Lundvall and Sandro Mendonça (2009). 'The changing role of science in the innovation process: From Queen to Cinderella?', *Technological Forecasting & Social Change*, 76: 861–867.

Carvalho, Anabela, Luísa Schmidt, Filipe Duarte Santos and Ana Delicado (2013). 'Climate change research and policy in Portugal'. *WIREs Clim Change.* DOI: 10.1002/wcc.258.

Centro de Estudos sobre Incêndios Florestais (2017), *O complexo de incêndios de Pedrógão Grande e concelhos limítrofes, iniciado a 17 de junho de 2017*. Coimbra: Universidade de Coimbra.

Clegg, L. Jeremy, Hinrich Voss and Liang Chen (2020). 'Can VUCA help us generate new theory within International Business?', in Rob van Tulder, Alain Verbeke, Barbara Jankowska and Peter J Buckley, eds., *International business in a VUCA world: the changing role of states and firms*. Bingley, UK: Emerald Publishing Limited, pp. 55-66.

Comissão Técnica Independente (2018) [Guerreiro J., Fonseca C., Salgueiro A., Fernandes P., Lopez Iglésias E., de Neufville R., Mateus F., Castellnou Ribau M., Sande Silva J., Moura J. M., Castro Rego F.

and Caldeira D. N., eds.]. *Avaliação dos incêndios ocorridos entre 14 e 16 de outubro de 2017 em Portugal Continental. Relatório Final*. Lisbon: Assembleia da República. 274 pp.

Craft, Jonathan and Michael Howlett (2013). 'The dual dynamics of policy advisory systems: The impact of externalization and politicization on policy advice'. *Policy and Society*, 32(3): 187-197. https://doi.org/10.1016/j.polsoc.2013.07.001

Doubleday, Robert and James Wilsdon (2012). 'Beyond the great and the good'. *Nature*, Vol. 485: 301-2. Available at https://www.nature.com/articles/485301a.pdf, retrieved on September 26th, 2020.

Eldredge, Niles and Stephen Jay Gould (1972). 'Punctuated equilibrium: An alternative to phyletic gradualism', in Thomas Schopf, ed., *Models in Paleobiology*. San Francisco: Freeman, Cooper and Co.: 82-115.

Fernandes, João M. and Pedro Afonso (2021), *Engineering education in a context of VUCA*. 4th International Conference of the Portuguese Society for Engineering Education (CISPEE 2021), Lisbon, Feb.

Fernandes-Jesus, Maria, Anabela Carvalho, Lúcia Fernandes and Sofia Bento (2017). 'Community engagement in the Transition movement: views and practices in Portuguese initiatives'. *Local Environment*. DOI: 10.1080/13549839.2017.1379477.

Fiolhais, Carlos (2021). 'Portugal nos cuidados intensivos', *Público*, February 4th 2021, available at https://www.publico.pt/2021/02/04/opiniao/opiniao/portugal-cuidados-intensivos-1949125, retrieved on September 27th, 2021.

Firmino, Teresa (2020). 'Cientistas portugueses já asseguraram 20 mil testes de diagnóstico à covid-19', *Público*, April 25th , available at https://www.publico.pt/2020/04/25/ciencia/noticia/cientistas-ja-asseguraram-20-mil-testes-diagnostico-covid19-1913834, retrieved on April 25th, 2020.

Firmino, Teresa (2021). 'Miguel Miranda: "Já estamos a mexer com o clima ao mesmo nível que mexe a astronomia"'. *Público*, September 4th, available at https://www.publico.pt/2021/09/04/ciencia/entrevista/miguel-miranda-ja-mexer-clima-nivel-mexe-astronomia-1975892, retrieved on September 4th, 2021.

Gluckman, Peter D. (2016a), 'Scientific advice to governments: An emerging dimension of Science diplomacy', *Science & Diplomacy*, 5(2), available at https://www.sciencediplomacy.org/article/2016/science-advice-governments, retrieved on August 22nd, 2021.

Gluckman, Peter (2016b), 'The science-policy interface'. *Science*, 353 (6303): 969. doi: 10.1126/science.aai8837. Available at https://www.science.org/doi/full/10.1126/science.aai8837, retrieved on September 26th, 2021.

Gluckman, Peter (2017). *Enhancing evidence-informed policy making - A report by the Prime Minister's Chief Science Advisor*. Auckland: Office of the Prime Minister's Chief Science Advisor.

Gluckman, Peter and James Wilsdon (2016), 'From paradox to principles: where next for scientific advice to governments?', *Palgrave Communications*, 2:16077.

Gluckman, Peter, Ann Bardsley and Matthias Kaiser (2021). 'Brokerage at the science–policy interface: from conceptual framework to practical guidance'. *Humanities and Social Sciences Communications*, volume 8, available at https://www.nature.com/articles/s41599-021-00756-3, retrieved on September 28th, 2021.

Godinho, Manuel Mira and João Caraça (2008). *Scientific advice and policy making, a relationship slowly coming of age*. Report of the Seminar on scientific advice to policy making. Unpublished document.

Godinho, Manuel Mira and Vítor Corado Simões (2005), *I&D, Inovação e Empreendedorismo*. Report commissioned by the CSF Observatory. Lisbon: ISEG.

Godinho, Manuel Mira and Vítor Corado Simões (2012). *ERAWATCH country reports 2011: Portugal*, JRC Working Papers JRC77832, Seville: Joint Research Centre.

Godinho, Manuel Mira and Vítor Corado Simões (2014). *ERAWATCH Country Fiche*. COUNTRY | Portugal; http://erawatch.jrc.ec.europa.eu/erawatch/opencms/system/modules/com.everis.erawatch.template/pages/exportTypesToHtml.jsp?contentid=8720bca9-7d1c-11df-b939-53862385bcfa&country=Portugal&option=PDF.

Godinho, Manuel Mira and Vítor Corado Simões (2015). *RIO Country Report Portugal 2014*. Brussels: JRC/European Commission. EUR 27313 EN. DOI:10.2791/584

Godinho, Manuel Mira, Vítor Corado Simões and Jana Zifciakova (2016), *RIO Country Report 2015: Portugal*. Brussels: JRC/European Commission. EUR 27873 EN. DOI:10.2791/493673

Godinho, Manuel Mira (2021). Personal communication, October 11th.

Gonçalves, Fernando and João Caraça (1987). Towards Technology Assessment in Portugal, in S.C. de Hoo, R. Smits and R. Petrella, eds., *Technological Assessment – An Opportunity for Europe*. The Hague, pp. 1-9.

Gonçalves, Maria Eduarda (1995), *Ciência e Política em Portugal: O caso da 'doença das vacas loucas'*, Working paper #59, Coimbra: CES.

Gonçalves, Maria Eduarda, ed. (2000), *Cultura Científica e Participação Pública*. Oeiras: Celta Editora.

Gonçalves, Maria Eduarda, ed. (2003), *Os Portugueses e a Ciência*. Lisboa: Publicações Dom Quixote and Observatório das Ciências e das Tecnologias.

Gonçalves, Maria Eduarda, ed. (2007), *Os Portugueses e os Novos Riscos*. Lisboa: Imprensa de Ciências Sociais.

Gonçalves, Maria Eduarda and Ana Delicado (2009). The politics of risk in contemporary Portugal: tensions in the consolidation of science–policy relations'. *Science and Public Policy*, 36(3): 229–239.

Group of Chief Scientific Advisers (2019). *Scientific Advice to European Policy in a Complex World*. Brussels: European Commission (Scientific Opinion No.7, Sep. 2019).

Henriques, Luísa (2006). *The dynamics of a national system of innovation and the role of the non-profit space: Portugal as a Research Laboratory*, Paris/Lisboa: École nationale Superieure de Mines de Paris and Instituto Superior de Economia e Gestão (University of Lisbon). Unpublished Doctoral Dissertation.

Henriques, Joana Gorjão (2018). 'Polémica das vacinas: deputados dizem que nunca sentiram pressão das farmacêuticas'. *Público*, November 29th, available at https://www.publico.pt/2018/11/29/sociedade/noticia/polemica-vacinas-deputados-sentiram-pressao-farmaceuticas-1852898, accessed on October 29th, 2021.

Higgitt, Rebekah and James Wilsdon (2013), 'The benefits of hindsight: how history can contribute to science policy', in Robert Doubleday and James Wilsdon, eds., *Future Directions for Scientific Advice in Whitehall*, Alliance for Useful Evidence, pp.79-85.

INGSA – International Network for Government Science Advice. (2017). *Principles and guidelines for social science advice to policy*. Berlin: INGSA, MCC Berlin, and Stiftung Mercator.

INL- International Iberian Nanotechnology Laboratory (2021), 'Welcome to the Mission-NERD', available at https://www.scaleexperiences.inl.int/mission-nerd, accessed on 18th October, 2021.

Innerarity, Daniel (2021), *Uma Teoria da Democracia Complexa*. Lisboa: Ideias de Ler/Porto Editora.

IPMA (2021), *O IPMA*, available at https://www.ipma.pt/en/oipma/, accessed on October 19th, 2021.

Jalali, Carlos, Thomas C. Bruneau and César Colino (2020). *Portugal Report – Sustainable Governance Indicators 2020*. Bertelsmann Stiftung.

Jasanoff, Sheila (1990). *The Fifth Branch: Science Advisers as Policymakers*. Cambridge, Mass: Harvard University Press.

Jasanoff, Sheila (1998). 'Coming of Age in Science and Technology Studies'. *Communication Studies*, 20 (1): 91-98.

Jasanoff, Sheila (2013). 'The science of science advice', in Robert Doubleday and James Wilsdon, eds., *Future Directions for Scientific Advice in Whitehall*, Alliance for Useful Evidence: 62-68.

Johnson, Steven (2010), *Where Good Ideas Come From: The Natural History of Innovation*, Penguin.

Kahneman, Daniel, Andrew M. Rosenfeld, Linnea Ghandi and Tom Blaser (2016). 'Noise: How to Overcome the High, Hidden Cost of Inconsistent Decision Making'. *Harvard Business Review*, October.

Kahneman, Daniel Olivier Sibony and Cass R. Sunstein (2021). *Noise: A Flaw in Human Judgment*, Harper Collins, UK.

Kline, Stephen J. and Nathan Rosenberg (1986). 'An overview of innovation.', in R. Landau and N. Rosenberg (eds.), *The Positive Sum Strategy: Harnessing Technology for Economic Growth*. Washington, D.C.: National Academy Press, pp. 275–305.

Ladi, Stella, Dimitra Panagiotatou and Angelos Angelou (2021). *The Greek Ecosystem of Science for Policy*. Brussels: JRC.

Mair, David, Laura Smillie, G. La Placa, F. Schwendinger, M. Raykovska, Z. Pasztor, and R. van Bavel (2019). *Understanding our political nature: How to put knowledge and reason at the heart of political decision-making*, EUR 29783 EN, Publications Office of the European Union, Luxembourg. DOI:10.2760/374191, JRC117161

Mamede, Ricardo Paes and Pedro Adão e Silva, eds. (2019). *O Estado da Nação e as Políticas Públicas 2019: Menos Reformas Melhores Reformas*. Lisboa: IPPS-ISCTE.

Mamede, Ricardo Paes and Pedro Adão e Silva, eds. (2020). *O Estado da Nação e as Políticas Públicas 2020: Valorizar as Políticas Públicas*. Lisboa: IPPS-ISCTE.

Mamede, Ricardo Paes and Pedro Adão e Silva, eds. (2021). *O Estado da Nação e as Políticas Públicas 2021: Governar em estado de emergência*. Lisboa: IPPS-ISCTE.

Millar Carla C. J. M., Olaf Groth and John F. Mahon (2018), 'Management Innovation in a VUCA World: Challenges and Recommendations'. Call for papers, *California Management Journal* , https://doi.org/10.1177/0008125618805111.

Mokyr, Joel (2009). *The Enlightened Economy: An Economic History of Britain 1700-1850*. London: Yale University Press (Vol. III in the Penguin Economic History of Britain).

Mokyr, Joel (2016). *A Culture of Growth: Origins of the Modern Economy*. Princeton, NJ: Princeton University Press.

Moniz, António B. (2006). Scenario-building methods as a tool for policy analysis, in B. Rihoux, & H. Grimm, eds., *Innovative Comparative Methods for Policy Analysis: Beyond the Quantitative-Qualitative Divide*. Springer US, pp. 185-209. https://doi.org/10.1007/0-387-28829-5_9.

Moniz, António B. (2009), 'Recent Experiences and Emerging Cooperation Schemes on TA and Education: An insight into cases in Portugal and Germany'. *Technikfolgenabschatzung - Theorie Und Praxis.* 18(3): 17-24.

Moniz, António B., Gabriel Velloso and Maria João Maia (2015). *GrEAT Portuguese network of technology assessment*. Poster session presented at 2nd European TA Conference. The Next Horizon of Technology Assessment.

Moore, Alfred and Michael K. Mackenzie (2020), 'Policy making during crisis: how diversity and disagreement can help manage the politics of expert advice', *BMJ*, 371. DOI: https://doi.org/10.1136/bmj.m4039, BMJ 2020;371:m4039.

Mota, Maria Manuel Mota (2021). Personal Communication. 21st September.

Nico, José Bravo (2009). *Comissão permanente de Educação e Ciência: Relatório sobre Ciência*. Parliamentary report.

OECD (2015). *Scientific Advice for Policy Making: The role and responsibility of expert bodies and individual scientists*. OECD Science Technology and Industry Policy Papers No. 21. Paris: OECD.

Observatório Português dos Sistemas de Saúde (2021). *20 anos de Relatórios de Primavera - Percurso de Aprendizagens*. Lisboa: OPSS.

Oreskes, Naomi (2004), 'Science and public policy: What's proof to go with it?', *Environmental Science & Policy*, 7(5): 369-383.

Oreskes, Naomi (2018), 'The Scientific Consensus on Climate Change: How Do We Know We're Not Wrong?'. In: A. Lloyd E., Winsberg E. (eds), *Climate Modelling*. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-65058-6_2

Oreskes, Naomi (2021). *Porque confiar na Ciência?.* Lisboa: Gradiva.

Ostrom, Elinor (2014). 'A Polycentric Approach for Coping with Climate Change'. *Annals of Economics and Finance*, 15(1): 97-134.

Pavitt, Keith (1998), 'Technologies, Products and Organization in the Innovating Firm: What Adam Smith Tells Us and Joseph Schumpeter Doesn't'. *Industrial and Corporate Change*. 7(3): 433-52.

Pedersen, David B. and Rolf Hvidtfeldt (2021). *The Danish Eco-System of Science for Policy*. Uddannelses- ogForskningsministeriet | Danmarks Forsknings- og Innovationspolitiske Råd.

Pereira, Tiago Santos (2021). 'Uma lição para o pós-pandemia: um Conselheiro Científico Principal do Governo', *Público*, March 24, available at https://www.publico.pt/2021/03/24/ciencia/noticia/licao-pospandemia-conselheiro-cientifico-principal-governo-1955575, retrieved on 22nd July 2021.

Pereira, Tiago Santos, António Farinhas Rodrigues, António Manuel Carvalho and João Arriscado Nunes (2010) 'Parlamento e Conhecimento*Científico: Dupla delegação?', in José Manuel Leite Viegas, Susana Santos e Sérgio Faria, eds., *A Qualidade da Democracia em Debate*, Lisboa: Editora Mundos Sociais.

Pielke Jr., Roger (2015), 'Five modes of science engagement', in *Roger Pielke Jr.'s Blog*, available at http://rogerpielkejr.blogspot.com/2015/01/five-modes-of-science-engagement.html, accessed on August 16th, 2021.

Polónio, Rui and Catarina Maldonado Vasconcelos (2021). 'Conselho Nacional de Saúde Pública "não funciona", diz ex-Diretor Geral da Saúde: Constantino Sakellarides, antigo diretor geral da Saúde, considera que o Conselho Nacional de Saúde Pública "não funciona"'. *Diário de Notícias*, July 21st, available at https://www.tsf.pt/portugal/sociedade/conselho-nacional-de-saude-publica-nao-funciona-diz-coordenador-do-opss-13865288.html, retrieved on October 21st, 2021.

Reis, Bruno Cardoso (2019), *Pode Portugal ter uma estratégia?.* Lisboa: Fundação Francisco Manuel dos Santos.

República Portuguesa/XXII Governo (2021), *Recuperar Portugal Construindo o Futuro: PRR – Plano de Recuperação e Resiliência*. Lisboa: República Portuguesa.

Ribeiro, Nuno (2021), 'Especialistas criticam Governo por não ter criado conselho científico para a pandemia', *Público*, February 20th, 2021, available at https://www.publico.pt/2021/02/20/politica/noticia/especialistas-criticam-governo-nao-criado-conselho-cientifico-pandemia-1950409, retrieved on September 11th, 2021.

JD Rinaudo, M Montginoul, M Varanda, S Bento (2012). Rinaudo, Jean-Daniel, M. Montginoul, Marta Varanda and Sofia Bento (2012). Envisioning innovative groundwater regulation policies through scenario workshops in France and Portugal. *Irrigation and Drainage*, 61(S1): 65–74.

Rouvrais, Siegfried, Sophie Gaultier Le Bris and Matthew Stewart (2018). 'Engineering Students Ready for a VUCA World? A Design based Research on Decisionship'. *Proceedings of the 14th International CDIO Conference*, Kanazawa: KIT, pp. 872–881.

SAPEA - Science Advice for Policy by European Academies. (2019). *Making sense of science for policy under conditions of complexity and uncertainty*. Berlin: SAPEA. https://doi.org/10.26356/MASOS.

Schick, Axel, Peter R. Hobson & Pierre L. Ibisch (2017) Conservation and sustainable development in a VUCA world: the need for a systemic and ecosystem-based approach, *Ecosystem Health and Sustainability*, 3:4, DOI: 10.1002/ehs2.1267.

Serafim, Teresa Sofia (2021). 'Governo reaviva Conselho Nacional de Ciência'. *Público*, February 23rd, available at https://www.publico.pt/2021/02/23/ciencia/noticia/governo-reaviva-conselho-nacional-ciencia-1951802, retrieved on October 21st, 2021.

Silva, António Costa (2021). *Visão Estratégica para o Plano de Recuperação Económica de Portugal 2020-2030*. Lisbon, July 21st.

Simon, Herbert (1959). 'Theories of Decision-Making in Economics and Behavioral Science'. *The American Economic Review*, 49(3): 253-283.

Simões, Vítor Corado (1995). *Inovação e Gestão em PME*. Lisbon: Ministério da Indústria.

Simões, Vitor Corado, Manuel Mira Godinho and Miguel Sanchez-Martinez (2018). *RIO Country Report 2017: Portugal*, JRC Working Papers JRC111275, Brussels: Joint Research Centre.

Simon, Herbert A. (1959), 'Theories of decision-making in economics and behavioral science', *American Economic Review*, XLIX(3): 253-283.

Šucha, Vladimir and Marion Dewar (2020). 'Institutional Framework for the Science–Policy Interaction', in Vladimir Šucha and Marta Sienkiewicz, eds., *Science for Policy Handbook*, Oxford: Elsevier, pp. 21-32.

Šucha, Vladimir and Marta Sienkiewicz, eds. (2020). *Science for Policy Handbook*, Oxford: Elsevier.

Topp, Lene, David Mair, Laura Smillie and Paul Cairney (2018). 'Knowledge management for policy impact: the case of the European Commission's Joint Research Centre'. *Palgrave Communications*. DOI: 10.1057/s41599-018-0143-3

Waller, R., P. Lemoine, Evan G. Mense, C. Garretson, and M. Richardson (2019), *Global Higher Education in a VUCA World*: Concerns and Projections, DOI: 10.20849/JED.V3I2.613Corpus ID: 200085790.

Whiteman, Wayne E. (1998). *Training and educating army officers for the 21st century: Implications for the United States Military Academy*. Fort Belvoir, VA: Defense Technical Information Center.

Wilsdon, James, Kritiann Allen and Katsia Paulavets (2014). *Science Advice to Governments: Diverse systems, common challenges A briefing paper for the Auckland conference.* Auckland : International Network for Government Science Advice (INGSA).

List of Abbreviations

Abbreviation	Meaning
ADENE	Agency for the Energy (Agência para a Energia)
AL	Associated Laboratory (Laboratório Associado)
ANI	National Innovation Agency (Agência nacional de Inovação)
CAP	Portuguese Confederation for Agriculture (Confederação da Agricultura Portuguesa)
CCP	Portuguese Confederation for Commerce (Confederação do Comércio Português)
CES	Economic and Social Council (Conselho Económico e Social)
CES	Centre for Social Studies (Centro de Estudos Sociais)
CGTP	General Confederation of Portuguese Workers (Confederação Geral dos Trabalhadores Portugueses)
CICS	Interdisciplinary Center for Social Sciences (centro inter-disciplinar de Ciências Sociais)
CIMO	Mountain Research Centre (Centro de Investigação de Montanha)
CIP	Portuguese Confederation for Manufacturing Industry (Confederação da Indústria Portuguesa)
CLA	Associated Laboratories Council (Conselho dos Laboratórios Associados)
CNADS	National Council for the Environment and Sustainable Development (Conselho Nacional para o Ambiente e o Desenvolvimento Sustentável)
CNCTI	National Council for Science Technology and Innovation (Conselho nacional de Ciência Tecnologia e Inovação)
CNSP	National Council for Public Health (Conselho Nacional para a Saúde Pública)
CoLABOR	Collaborative Laboratory for Labour, Employment and Social Protection (Laboratório Colaborativo para o Trabalho, Emprego e Proteção Social)
CPCS	Standing Committee for Social Concertation (Comissão Permanente de Concertação Social)
CSA	Chief Scientific Adviser
CTP	Portuguese Confederation for Tourism (Confederação do Turismo Português)
CTV	Technical Commission for Vaccination (Comissão Técnica de Vacinação)
DGS	Directorate-General for Health (Direcção Geral da Saúde)
EEAC	European Environment and Sustainable Development Advisory Councils Network
EPTA	European Parliamentary Technology Assessment
EurWORK	European Observatory of Working Life
FCG	Calouste Gulbenkian Foundation (Fundação Calouste Gulbenkian)
FCT	Foundation for science and Technology (Fundação para a Ciência e a Tecnologia)
IAPMEI	Agency for Competitiveness and Innovation (Agência para a Competitividade e Inovação)
ICS	Social Sciences Institute (Instituto de Ciências Sociais)
IE	Institute for Ageing (Instituto do Envelhecimento)
IGC	Instituto Gulbenkian Ciência
IH	Hydrographic Institute (Instituto Hidrográfico)
ILO	International Labour Organisation
iMM	Instituto de Medicina Molecular João Lobo Antunes
INFARMED	National Authority for Medicament and Health Products (Autoridade Nacional do Medicamento e Produtos de Saúde I.P.)
INGSA	International Network for Government Science Advice
INIAV	Institute for Agrarian and Veterinary Research (Instituto Nacional de Investigação Agrária e Veterinária, I.P.)
INL	International Iberian Nanotechnology Laboratory
INMLCF	Institute of Legal Medicine and Forensic Sciences (Instituto Nacional de Medicina Legal e Ciências Forenses, I.P.

INSA	National Health Institute Doutor Ricardo Jorge (Instituto Nacional de Saúde Doutor Ricardo Jorge)
IPMA	Portuguese Institute for Sea and Atmosphere (Instituto Português do Mar e da Atmosfera, I.P.)
ISEG	Lisbon School of Economics & Management, University of Lisbon (Instituto Superior de Economia e Gestão, Universidade de Lisboa)
i3S	Institute for Research & Innovation in Health (Instituto de Investigação e Inovação em Saúde da Universidade do Porto)
JNICT	National Scientific and Technological Research Board (Junta Nacional de Investigação Científica e Tecnológica)
JRC	Joint Research Centre
KMP	Knowledge Management for Policy
LNEC	National Laboratory for Civil Engineering (Laboratório Nacional de Engenharia Civil, I.P.)
LNEG	National Laboratory for Energy and Geology (Laboratório Nacional de Energia e Geologia, I.P.)
MoPs	Members of the Parliament
NATO	North Atlantic Treaty Organisation
NGO	Non-Governmental Organisation
OAT	Observatory of Technology Assessment
OBSERVA	Observatory of Environment, Territory and Society (Observatório do Ambiente, Território e Sociedade)
OECD	Organisation for Economic Cooperation and Development
OFAP	Observatory of Families and Family Policy (Observatório das Famílias e da Política de Família)
OP.EDU	Observatory of Education and Training Policies (Observatório das Políticas de Educação e Formação)
OPJ	Standing Youth Observatory (Observatório Permanente da Juventude)
OPJ	Standing Observatory on Portuguese Justice (Observatório Permanente da Justiça Portuguesa)
OPSS	Portuguese Observatory of Health Systems (Observatório Português dos Sistemas de Saúde)
OQD	Observatory of Quality of Democracy (Observatório da Qualidade da Democracia)
OSIRIS	Observatory of Risk (Observatório do Risco)
PA	Public Administration (Administração Pública)
PACITA	European Parliamentary Technology Assessment
PEOPLES'	Observatory on Participation, Innovation and Local Powers (Observatório da Participação, da Inovação e dos Poderes Locais)
PlanAPP	Competence Center for Planning, Policy and Foresight for Public Administration (Centro de Competências de Planeamento, de Políticas e de Prospetiva da Administração Pública)
PL	Public Laboratory (Laboratório do Estado)
POLICREDOS	Observatory of Region in the Public Field (Observatório da Religião no Espaço Público)
POLObs	Observatory on Science, Communication and Culture Policies (Observatório de Políticas de Ciência, Comunicação e Cultura)
PoR	President of the Portuguese Republic (Presidente da República Portuguesa)
ProCHILD	CoLAB against Poverty and Social Exclusion (Laboratório Colaborativo ProChild)
RRP	Portugal's Recovery and Resilience Plan (Plano de Recuperação e Resiliência, Portugal)
R&D	Research and Development
SAPEA	Science Advice for Policy by European Academies
SARS	Severe acute respiratory syndrome
SNS	National Health System (Sistema Nacional de Saúde)
S&T	Science and technology
RIO	Research and Innovation Observatory

UGT	General Workers' Union (União Geral de Trabalhadores)
UK	United Kingdom
UMPP	Public Policy Monitoring Unit, University of Évora (Unidade de Monitorização de Políticas Públicas, Universidade de Évora)
UNCED	United Nations Conference on Environment and Development
USA	United States of America
VUCA	Volatility, Uncertainty, Complexity, Ambiguity