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OECD Review of the Tertiary Education, Research and Innovation System in Portugal

Summary document

This note is a summary of the findings and main recommendations of the review. It is a draft document for consultation purpose only.

The document reflects the results of the Review at a pre-final stage and has not yet benefited from the comments of the Portuguese authorities.

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1. Introduction: objectives and approach for the Review

1.1. Background and objectives for the review

1.   The Government of Portugal has invited the OECD to undertake an independent review of the national tertiary education, research and innovation (TERI) system in Portugal. This review, which comes ten years after the <u>OECD review of tertiary education in Portugal</u>, finalised in 2007, aims to:

1. Provide a broad assessment of the functioning and performance of the Portuguese tertiary education, research and innovation system;
2. Identify opportunities for improving the performance of the system and formulate short and medium-term policy options for the Portuguese authorities and other stakeholders involved in tertiary education, research and innovation activities across the wider economy.

2.   The review has a deliberately broad scope, which recognises the complex inter-relationships between innovation in businesses and the public sector, high-level education in universities and polytechnics, research undertaken in and outside tertiary education and public research institutions, and networks of collaboration between the academic and non-academic sectors.

3.   The review has been undertaken jointly by the OECD Directorates for Science, Technology and Innovation (STI) and Education and Skills (EDU), working with specialist external experts. The work began in January 2017 with the development of a country background report by the Portuguese authorities. The Review team undertook four fact-finding missions to Portugal, involving discussions with more than 200 people between April and November 2017, and collected and reviewed additional factual material. In November 2017, the team held a series of discussion workshops with stakeholders across the country in order to validate and help to refine interim findings and recommendations. The final review findings will be published in spring 2018.

1.2. Context for the work: views about the future development of Portugal

4.   Portugal aims to develop a more innovative and productive economy, and to ensure that the benefits of these developments are widely distributed across society and the regions of Portugal. This vision is reflected in a range of national documents, including the *Programa do XXI Governo Constitucional - 2015-2019*. Key aspects of this vision are:

1. **Innovation as the basis for rising prosperity**. Portugal seeks to accelerate innovation in its commercial life to raise the productivity of its economy. Innovation should occur through the knowledge-based modernisation of traditional industries, permitting businesses to move up the global value chain and export more effectively; in the further development of newer industries with high growth potential (such as IT or renewable energies); and in public services and civic life, permitting increased effectiveness in governance and greater capacity to address contemporary problems, such as environmental challenges and sustainability. Innovation is to be nurtured by raising the skills of Portugal's population, and by widening internationalisation – by making Portugal more

attractive to knowledge-intensive foreign direct investment, highly-skilled immigrants and the Portuguese diaspora.

2. **Inclusiveness and equity**. Portugal seeks to ensure that the benefits of increased innovation and productivity are experienced by all sections of society and all regions of the country, metropolitan and rural.

5.   Portugal's ability to achieve this vision is dependent on many different factors. Among these are cultural, regulatory and fiscal environments that promote and reward creativity and investment in the development and application of new knowledge and skills. Equally important are innovative, productive, internationally oriented businesses, tertiary education institutions and research units, which operate and are connected through effective networks and supported by sound governance and funding mechanisms and structures.

6.   It is this second element – which encapsulates the tertiary education, research and innovation 'system' - that has been the primary focus of this OECD Review. The key objective of the Review has been to assess the extent to which Portugal's tertiary education, research and innovation system is well configured to help Portugal achieve the vision of inclusive innovation, and to identify which policy options might help it achieve its goals.

7.   The review has focused on the structure and operation of tertiary education, research centres and innovation-related bodies that form a core part of the tertiary education, research and innovation system, as well as direct public support for research and innovation in the business sector and public services. It has not examined in depth the broader legal, regulatory and fiscal environment – such as immigration or intellectual property rights policies - that also impacts on the capacity of firms and public services to invest and innovate to promote economic and societal development.

1.3. What does an effective TERI system look like?

8.   Different national economic and social contexts mean that what works in tertiary education, research and innovation in one country may not work in another. There is no single recipe for success that can be applied internationally. However, in order to provide a meaningful assessment of the performance of the Portuguese TERI system – a view of what is working well and what less well – and to formulate appropriate recommendations, some criteria against which to judge performance are required. The OECD Review team has therefore drawn on knowledge of effective TERI systems worldwide and the many insights gained through the research and fieldwork in Portugal to develop a set of broad features that would characterise an effective TERI system in the Portuguese context. These core characteristics, which have been used to frame the assessment in the final analysis, can be summarised as follows:

1. *Opportunities and incentives for engagement and cooperation across the system.* In successful systems, a *wide and appropriate range of people* with relevant knowledge and interests are involved in formulating and agreeing objectives, implementing activities and adjusting strategy and implementation to changing circumstances. Successful systems are characterised by strong cooperation across institutional and organisational boundaries, at all level (strategy and policy making, funding, performing activities). This includes effective coordination and cooperation between different parts and levels of government (horizontally between different ministries and agencies, and vertically between national and

regional authorities), and between public authorities, higher education and research institutions, businesses and civil society.

2. *Clarity of objectives and steadiness of rules and policy.* Successful research, innovation and higher education systems are guided by a clear and shared vision of overall objectives and characterised by a stability and predictability – by steadiness – in the main strategic, regulatory and financial frameworks in which organisations and individuals operate. This enhances the level of trust between the different actors of the system and permits them to set and act upon medium to long-term plans – for hiring, investing, cooperating -- with confidence. Operational entities within the system – such as research units or tertiary education institutions – also establish broad strategies to provide additional clarity about their specific missions and goals and help frame the work of their staff.

3. *Internationalisation.* Successful systems are open and attractive to the world. This means not only that there is strong cooperation between players in the national system and partners in other countries, but that the system is able to both attract talented researchers, teachers, innovators and entrepreneurs from abroad and ensure the international mobility of their domestic counterparts. Internationalisation is seen as a particularly important characteristic in Portugal, given the country's comparatively small size, tradition of openness and (increasing) dependency on international trade.

4. *Adequate and stable resources, joined up to incentives for good performance and accountability for results.* Organisations and individuals in successful systems have access to adequate and predictable financial, human and knowledge resources to allow them to undertake their activities effectively; where and when public intervention is justified, they are supported and incentivised to achieve good performance against agreed goals; and held accountable for the results they achieve.

5. *Flexibility, adaptiveness, and differentiation.* Within the stable and predictable frameworks highlighted above, successful education and research systems allow organisations and individuals act with flexibility, differentiating their institutional profiles, teaching, research and innovation-related activities to respond to the needs of their target populations, community, region, or global knowledge partners. Adequate flexibility and differentiation are particularly important for achieving objectives related to social and territorial cohesion, as teaching, research and innovation need to be adapted to the needs of particular individuals and particular places. The legal, regulatory, and funding frameworks within which organisations and businesses operate permit them to work with agility and are responsive when individuals and organisations need to adapt their activities to changing circumstances.

9.   The review has examined the strengths and weaknesses of Portugal's tertiary education, research and innovation system in light of these core characteristics. For analytical purposes, the Review examined the system from the perspective of six inter-related aspects or parts:

1. *Strategy. structures and funding at the level of the 'system'*: overall strategy that has been agreed at system-level, the structures in place that allow strategy to be agreed, implemented and amended over time and the availability and allocation of public resources for investment to support achievement of the overall strategy.

2. *Missions, profiles and use of resources in tertiary education and research institutions*: the missions and strategies of tertiary education and research

institutions and the ability of institutions and staff to design and implement activities effectively that respond to the needs of the population groups and regions they work with and contribute to institutional and national goals.

3. *Core tertiary education activities*: the quality, relevance and inclusiveness of undergraduate and Master's level education. Effective undergraduate and Master's level education is crucial for supplying the large body of skilled people needed by modern economies.

4. *Doctoral training*: the quality and relevance of training for PhD candidates and the ability of doctoral graduates to access quality jobs where they exploit their skills. The availability of trained researchers and specialists may be seen as a factor in further developing national research capacity and stimulating innovation.

5. *Academic careers*: the extent to which the conditions and the organisation of employment in tertiary education and public research institutions contribute to the effective deployment of skilled people and allow staff to pursue fulfilling and productive careers.

6. *High-skill employment and innovation in the wider economy*: activities designed to support the development of innovation and the kinds of high-skill employment that supports innovation in the wider economy in Portugal, in the business sector and public services.

10.   The five core characteristics of successful tertiary education, research and innovation systems vary in importance for these six aspects of the system. Some characteristics are more critical for one aspect than for another. The table below summarises how the characteristics of successful systems relate to the six aspects of the system. The six aspects of the system are examined in the remaining sections of this document.

Table 1.1. Characteristics of effective tertiary education, research and innovation systems

Characteristics of the system : Aspect of the system:	Does the system offer sufficient opportunities and incentives for engagement and cooperation?	Are there clear objectives and stable and predictable rules and policy frameworks at relevant levels of the system?	Is the system internationally open and attractive?	Is there a sufficient and predictable flow of resources and appropriate incentives for good performance and accountability?	Does the system allow enough differentiation, adaptiveness and flexibility?
1. Strategy, structures and funding at the level of the 'system'	Strategy and allocation of strategic resources at national level take into account the views and input of - and are broadly accepted by - a full range of relevant actors in the TERI system. There is adequate horizontal and vertical coordination between different policy-making, regulatory and funding bodies.	A strategy is established to guide the direction and objectives of the different actors in the TERI system, with a medium to long-term time horizon. The strategy identifies clear priorities and indicative allocation of resources to achieve objectives, permitting individuals and institutions to act with confidence and efficiency in planning their own activities (including hiring staff etc.).	Strategy and strategic allocation of resources take full account of the global context and opportunities for international cooperation. Promoting international openness and attractiveness is as a core priority.	Adequate financial resources are made available for strategic investment to support achievement of overall goals and priorities in system-level strategy. Analytical and support resources are in place to develop accurate and effective strategy and targeting of resources.	Strategy and resource allocation arrangements are neither over-prescriptive, nor set in stone. Actors at different levels of the system (funding agencies, TEIs) have flexibility and autonomy to take risks, be creative and adapt their activities to their specific needs and evolving circumstances, while keeping in line with the broad national strategic orientations; strategy and resource allocation are periodically reviewed to ensure continued relevance
2. Missions, profiles and use of resources in tertiary education and research institutions	A full range of relevant actors are involved in developing and agreeing missions, profiles and prioritisation of resource use for tertiary education and research institutions. In setting profiles, institutional leadership takes into account views of policy-makers, funders, staff, students and partners in the wider economy.	Tertiary education and research institutions have clear and missions and profiles that guide their activities and are tailored to the needs of the specific populations and regions they work in and serve. Relevant legislative, regulatory and funding instruments at system level support clarity of missions and effective development and achievement of strategies	Institutional profiles and internal allocation and use of resources support international openness and attractiveness (e.g. attracting international staff and students).	Institutions of different types receive adequate resources to allow them to fulfil their missions, are rewarded for good performance in a transparent way and are held accountable for their use of public resources. Institutions have adequate management capacity and professional staff to achieve goals.	Strategies and funding arrangements at institutional level leave staff adequate autonomy and flexibility to pursue activities in creative and innovative ways. Institutional profiles are periodically reviewed to ensure continued relevance.
3. Undergraduate and Master's level education	Businesses and public services collaborate with TEIs in the design and delivery of programmes. Programmes are focused on student learning outcomes and involve adequate student-teacher interaction.	The course offering and the qualifications they deliver are transparent and easily understood by students and employers.	TEIs have international faculty, international cooperation and exchange in teaching (including credit mobility for students) and international students (in-coming degree mobile).	Adequate funding is provided for teaching activities; adequate training and incentives for good teaching are in place. There are adequate incentives and resources for student support (pastoral and financial)	An adequate range of course types and flexible modes of delivery are in place to serve students from different background and population groups. The course offering is regularly reviewed to ensure it remains relevant to student learning needs

Characteristics of the system : Aspect of the system:	Does the system offer sufficient opportunities and incentives for engagement and cooperation?	Are there clear objectives and stable and predictable rules and policy frameworks at relevant levels of the system?	Is the system internationally open and attractive?	Is there a sufficient and predictable flow of resources and appropriate incentives for good performance and accountability?	Does the system allow enough differentiation, adaptiveness and flexibility?
4. Doctoral training	Businesses and public services collaborate with HEIs and funding bodies in delivering and funding PhD training and in determining priorities for PhD funding.	There are clear priorities against which PhD funding is allocated and the mechanisms for allocation of funding are clear and predictable for candidates, institutions and employers.	There are a significant numbers of international doctoral candidates in the system, alongside international faculty (supervisors) and cooperation agreements.	The level funding awards and support for doctoral programmes is adequate, the overall volume of funding is predictable and meets national needs and adequate incentive are in place to ensure relevance and good performance.	Funding mechanisms and doctoral training approaches reflect the need for a full range of PhD types, including practice-based research. The funding system and doctoral training provision are able to adapt to changing and specific skills needs.
5. Academic careers	Academic staff are closely involved in the development and achievement of the objectives of their institutions and research centres. They are encouraged and supported to develop innovative work that contributes to institutional and system-level objectives.	Regulations (national and institutional) and planning governing staffing are clear, relevant to the needs of the system and predictable for hiring managers, staff and potential recruits. Career structures, promotion rules and recruitment policies create clear pathways for career progression.	Significant numbers of international academic staff work in the national system, alongside nationals with international experience. International exchanges (e.g. sabbaticals) are promoted and commonplace.	Remuneration levels are adequate to ensure academic careers are attractive for talented individuals, including from abroad and the overall level of funding ensures adequate staffing levels. Remuneration and promotion is based on performance, ensuring staff are both incentivised and accountable for good performance.	Institutions and research centres are able to manage their human resources policy in a differentiated and flexible way, to respond to specific needs and changing circumstances.
6. High-skill employment and innovation in the wider economy	Opportunities and incentives are in place for cooperation and exchanges between 'academic' institutions and staff and individuals and organisations in the private economy and public services.	Strategy and dedicated funding instruments to support high-skill employment and innovation in the private economy and public services are clear, with changes organised to ensure transparency and predictability.	Strategy and policy and funding instruments to support innovation support the goals of international openness and attractiveness, including through attracting Foreign Direct Investment (FDI) and international staff.	Public and private resources allocated to innovation-related activities and support institutions are adequate to needs. Public funding mechanisms for innovation are designed to incentivise effective private investment in research and innovation activities and provide sufficient accountability for use of public funds.	Public policy and funding instruments to promote innovation are designed to accommodate the needs of different types of business / organisation / institution and respond quickly and effectively to changing circumstances.

2. Structures, strategy and funding at the level of the system

2.1. Introduction

11. The ability of individuals, teams and institutions engaged in innovation, research and education activities to succeed in their roles – by developing valuable innovations, undertaking pioneering research and providing high quality education - is influenced by the policy, regulatory and funding environment in which they operate. Evidence from the OECD and beyond highlights the importance of four factors in particular for creating a good policy, regulatory and funding environment for tertiary education, research and innovation:

1. Effective *governance arrangements and practices* to ensure decisions are taken with adequate coordination between different parts and levels of government. This is particularly crucial to avoid contradictions and unnecessary duplication between the different, but closely related, tertiary education, research and innovation policy fields. Moreover, these policies should be linked to other policy domains that interact with knowledge generation and exploitation, such as employment, environment or transport. Coordination between different parts of government can link previously separate initiatives and thus increase the efficiency and impact of actions taken. The inclusion of research-related and innovation priorities in EU regional policy - with guidelines agreed at EU level and implementation of Structural Funds programmes at regional level - has created additional need for vertical coordination between regional, national and European level, even in countries, like Portugal, that lack strong regional government.

2. Ongoing *dialogue and engagement* between policy makers with decisional responsibility (government and parliament) and stakeholders in tertiary education, research and innovation. Effective policies are developed in close collaboration with those whom they affect, drawing on insights from those on the ground and paying due attention to their concerns. If done well, inclusive policy-making and strategy-setting can help build a greater sense of shared ownership of ideas and priorities.

3. A *clear mid to long-term strategy* to guide tertiary education, research setting out a collective vision for the development of the tertiary education, public research and innovation system. National strategies fulfil two main objectives. First, they allow public authorities, in dialogue with relevant stakeholders, to develop a *shared understanding* and agree on priorities to respond to the imperatives for raising competitiveness and addressing societal challenges. This is particularly the case in smaller countries, such as Portugal, which cannot afford to invest in all fields of science or industry. Second, they provide tertiary education and public research institutions and their innovation collaborators with clarity and predictability about national priorities and resource commitments in the mid- to long term, the lines of policy that will support them, and the scope of action – and

      responsibility – that performing institutions will share. Without a shared national strategy, decision-making in higher education and research policy risks remaining ad hoc and focused on the short term.

   4. A *stable and efficient framework for allocating resources* to tertiary education, research and innovation actors based on the collectively established national priorities and monitoring of their execution and effects. This depends, in part, on achieving agreement on the priorities, volumes and timeframes for public investment in innovation, research and tertiary education at the highest levels of the system (at the centre of government between ministries and relevant advisory bodies). It also depends on effective linkages between this top level of government and the operational decisions in funding agencies. These agencies must be provided with clear and stable multi-annual strategic guidance and objectives, and with sufficient autonomy in their decisions as to how to meet the objectives they have been set.

12.   Although they cannot work in isolation, policy makers play the primary responsibility for creating the policy environment outlined above. Against this backdrop, the Review considers three key questions in this section:

   1. To what extent is there a *clear and coherent strategy* to guide the further development of tertiary education, publicly funded research and innovation actors in Portugal while leaving sufficient autonomy for these actors to define their respective plans, experiment and learn?
   2. Are the *governance arrangements and processes* in place in Portugal sufficient to allow effective co-ordination and steering of higher education, public research and innovation policy?
   3. Are *adequate resources* made available for public investment in the tertiary education, research and innovation systems over a *predictable timeframe* and are *resource allocation procedures* in place that ensure available resources are used with accountability, efficiency and in line with national priorities?

2.2. Diagnosis: Key points

2.2.1. Priorities and strategy

13.   Unlike many other OECD countries[1], there is no single clear, overarching and shared national strategy in place to provide a vision and guide the tertiary education, research and innovation system and its contribution to Portugal's development. Rather, many documents co-exist, focused on different institutional processes (national, EU Stability Programme or EU Cohesion Policy) with different policy scopes (economic development, research, innovation, health etc.) and time horizons (aligned to the annual budgetary cycle, the mandate of the government or the seven year cycle of Structural Funds).

14.   While these documents share the objectives of supporting the further development of a knowledge-based Portuguese economy, they do not provide a unified, stable and transparent framework of priorities and funding within which Ministries and public agencies perform their work. As a consequence, institutions engaged in research, teaching and innovation-related activities in the country – universities, polytechnics, research units, intermediary organisations and business firms – receive conflicting priorities and signals, and cannot confidently take decisions about mid to long-term

investments in their educational programmes, research priorities, or collaborations in support of product or process innovations.

15. The Government's overarching work programme[2] provides little strategic direction for tertiary education, science and innovation policy. Recent versions of the *Grandes Opções do Plano*, for example, have contained a variety of 'one-off' policy measures in the fields of tertiary education, science and innovation, focusing on the supply of research and skills and, increasingly, support to innovation, but with few connections between these policy strands and virtually no thematic or sectoral priorities.

16. Responsibility for tertiary education, science and innovation in Portugal is shared between different government ministries, primarily the MCTES and the Ministry of Economy. These government departments have developed a succession of initiatives in these fields in recent years. MCTES, for example, developed the "Commitment to knowledge and science" Agenda, adopted by the Council of Ministers in 2016. On the innovation side, the Ministry of Economy had already adopted the "Industrial development strategy for growth and employment 2014-2020" (EFICE). MCTES has recently added a medium- and long-term vision for the Portuguese TERI system structured along 14 thematic research agendas. Although this "National Plan for Science and Technology" marks a change in comparison to the thematically neutral research policy traditionally in place in Portugal, it is uncertain whether and how it will be used to guide research funding allocation. A new knowledge strategy for Portugal linked to additional funding from the European Investment Bank (EIB) for targeted investment projects has been proposed by MCTES[3]. Notwithstanding the merits of each initiative, the plan in which they are based – still informal at this stage – falls short of the overarching strategy needed to provide a vision and stable inter-ministerial framework to guide the future development of the TERI system.

17. Additional strategy documents relating to research and innovation have been developed to meet the requirements of European Structural and Investment Funds. The national "Research and Innovation Strategy for Smart Specialisation", adopted in November 2014, was based on significant analytical work to identify strengths and challenges of the Portuguese economy and research and an innovation systems at regional and national levels, and wide stakeholder consultations led by the Foundation for Science and Technology (FCT). The strategy sets out a broad vision for developing key sectors of the economy in the different Portuguese regions and at national level, drawing on the contributions of tertiary education and research. However, this strategy is too narrowly connected to the Structural Funds to provide a comprehensive vision for the development of tertiary education, research and innovation. Moreover, it is not clear how policy initiatives in the field of research and innovation funded under the Operational Programme COMPETE 2020 have, in practice, been aligned with the goals of the Smart Specialisation Strategy.

18. The lack of an overarching strategy has been compounded by the 'bottom-up' approach adopted by Government agencies responsible for implementing government tertiary education, science and innovation policy, including the FCT and the National Innovation Agency (ANI). The former is responsible for a large proportion of the government research funding provided to tertiary institutions – accounting for about one-half of all research income they receive. FCT funds are allocated directly to research units, through a multi-year 'block-funding', based on national research assessments. FCT is also responsible for competitive public funding of PhD and post-

doctoral positions, funds R&D projects for principal investigators and has committed significant amount of funding allocated to international cooperation activities. It has generally allocated institutional funding to research units and based the award of grant and fellowship funding on academic merit, without reference to the strategic fit of the activities funded. Despite some formal linkages to the Smart Specialisation Strategy, this funding allocation occurs without a clear link to national development goals, nor explicit and transparent prioritisation of research areas. The severe budget cuts experienced by the agency since 2011 has made its reliance on excellence criteria in competitive calls even stronger.

19. Researchers and organisations submitting proposals for funding do not develop proposals within a clear *ex-ante* prioritisation of research domains and disciplines and those who have been awarded funding are, likewise, not taking decisions about the future development of their work within a framework of national priorities. Moreover, the lack of explicit criteria for the allocation of resources among thematic areas would not allow the government to support the transformation of the system in line with national development goals. It has been widely documented in the literature that the process of selection based on excellence naturally favors the strongest actors and areas, to the detriment of the emerging ones.

20. The analytical and intelligence base for strategy setting in higher education and science, technology and innovation policy in Portugal is also comparatively weak. Pressure on public spending has limited the capacity to develop additional analytical capacity in the MCTES or its dependent agencies. Furthermore, there are few evaluations of previous or existing policy initiatives. Virtually all evaluations are conducted to comply with Structural Funds requirements and are often procedural, centred on implementation issues rather than results and impacts, and lack a strategic dimension that could help guide future policy actions.

21. International experience shows that successful national strategies for tertiary education, research, and innovation are not the result of a top-down approach that imposes priorities on researchers, rectors, and firms. Rather, sustainable plans take into account the views of different stakeholders. Portugal has made recent progress on this regard. Although it is too early to assess whether this marks a breakthrough in comparison to past practices, the participatory approach adopted to develop the 2014 Smart Specialisation Strategy marked a shift in policy making style. The recently announced Laboratory for Public Participation launched by MCTES in collaboration with *Ciência Viva* could also be instrumental in allowing the participation of stakeholders in tertiary education, research and innovation policy.

2.2.2. *Governance arrangements and stakeholder engagement*

22. Portugal has a concentrated composition of policy portfolio and a clear division of responsibilities between the different policy making and funding organisations (despite some shared responsibilities as in many countries in the area of knowledge transfer and innovation). Tertiary education and research have been under the responsibility of a single government department in Portugal since 2002, albeit with frequent reorganisations as government portfolios changed. The current Minister of Science, Technology and Higher Education (MCTES) has responsibility for higher education, public funding of research and researchers based in higher education institutions and public non-profit organisations linked to them, and science-based innovation activities involving TEIs and public research units. Primary responsibility for business innovation

policy lies with the Minister of the Economy, with European Structural and Investment Funds (ESIF) financing the bulk of innovation support initiatives. Structural Funds also bestow important prerogatives to the Ministry of Planning and Infrastructure, which is in charge of their management in various areas (regional development, sea and fisheries, agriculture, social issues).

23.   There is a lack of horizontal co-ordination between government departments and policies dealing with higher education, research and innovation and between these departments and those responsible for broader economic, social and regional development policies. Portugal has a long and stable tradition of clear separation and differentiation of the policy boundaries between science and higher education on the one hand (and at times also between these two domains), and the support to the demand of knowledge in firms and entrepreneurship on the other hand. This situation leads to a duplication of efforts, inconsistent measures and distinct funding streams, notably for research and higher education.

24.   While FCT is under the unique supervision of MCTES, the national innovation agency (ANI) received instructions from and reports to both MCTES and the Ministry of Economy. This agency could provide, in theory, a channel for co-ordination between research and innovation policies, as can be found in several countries where co-ordination occurs primarily at the level of agencies, in relation to decisions on funding and policy instruments. However, the lack of co-operation culture in the two ministries and of formalisation of the vertical relationships between the ministries and the agencies does not allow this channel to work effectively.

25.   There have been attempts in the past to set up bodies to help co-ordinate the activities of these Ministries, most recently through the creation of the National Council for Science and Technology (CNCT), and the National Council for Entrepreneurship and Innovation (CNEI). The CNCT and CNEI, established in advance of the latest generation of European Structural and Investment Funds and chaired by the Prime Minister, had in their mandate the objective of supporting inter-ministerial coordination in science, technology and innovation policies. However, both bodies have effectively ceased to function, with no meetings held in recent years.

26.   The European Structural Funds spending in Portugal dedicated to tertiary education, research and innovation means that the dedicated high-level coordination bodies, the Agency for Development and Cohesion and the Managing Authorities for the different national and regional Operational Programmes are also important actors in the strategic governance and implementation of policies in these fields. This dedicated governance structure has evolved overtime and significantly improved its inter-ministerial coordination capacity, in particular since the adoption of NSRF (2007-2013), when research and innovation activities have for the first time been dealt with together within the same programme. However, the primary preoccupation of those in charge of implementing the Structural Funds in Portugal – as elsewhere in the EU – is the effective disbursement of European funds in line with the priorities agreed between Portugal and the European Commission in 2014. The EU and national procedures associated to the management of Structural Funds create a heavy administrative burden and limit the strategic flexibility and policy leeway. The importance of Structural Funds also creates an additional challenge of vertical co-ordination between the European, national and regional levels.

2.2.3. Resourcing tertiary education, research and innovation

27.   Gross expenditure on research and development from all public and private sources, or GERD, has fallen. The financial crisis of 2008 put a halt to the strong and unprecedented increase of public and private R&D investment during the period 2000-2009. Gross expenditures in R&D (GERD) had reached 1.58% of GDP in 2009 -- above the R&D intensity of Spain, Ireland and Greece -- and then fell to 1.27% of GDP in 2016. This share of GDP is well below the different 2020 R&D GDP targets of 2.0 to 2.7% set in national plans and the 'European convergence' goals 3% of GDP by 2030.

28.   Moreover, public funding for tertiary education, research, and innovation has fluctuated from one year to another (see Table 4.x). The Foundation for Science and Technology (FCT), the principal research funding agency in Portugal, has been greatly affected as it still functions with significant funds from the State Budget. These fluctuations in national funding for TERI are partly mitigated by European funding, most especially for agencies tasked with the support for innovation in business firms (ANI, IAPMEI, AICEP), However, the integration of different funding streams, with different types of rules and diverse conditions for eligibility and reporting into single funding instruments, has created important operational and management complexity for researchers and innovation actors. Portugal 2020, with a clear regionalization of the funding activities related to STI, has increased the management complexity of the R&D funding programs and the administrative burden for the applicants.

29.   FCT faces challenges in carrying out its mission that originate from above, in its relationship to MCTES; from below, in its relationship to researcher communities; and horizontally, in its relationship to innovation funding delivered by other agencies.

30.   A clear functional separation between the policy making and policy implementation levels, complemented by effective linkages between these levels are an essential condition of a well-functioning system. This allows for exchanges of objective-based, multi-year, strategic guidance and reporting information. In Portugal, the head of FCT is also the Director General for Research, and the absence of a formal process for the ministry to convey strategic orientations and targets to its research agency undermine this necessary condition for an effective and transparent 'principal-agent' relationship, and makes it difficult for the FCT to ground its actions in enduring national priorities. This structural feature has been compounded by the budget austerity measures taken following the crisis, including the removal of the policy analysis and planning unit within MCTES and the merger of other entities into FCT. The limited autonomy of FCT vis-à-vis the ministry, as well as the lack of stability and predictability of FCT research funding methodologies and policy measures – such as the number of doctoral researchers funded and the locus of funding decisions -- were perceived by stakeholders with whom we met as short-term interventions that were harmful to the well-being of the nation's research-performing organisations, most especially for those that lack revenue diversification, since it is difficult to formulate plans and act strategically in an environment with high levels of uncertainty.

31.   From below, FCT independence vis-à-vis the scientific communities is also challenged. Funding priorities are set from the bottom – in response to proposals originating from the scientific communities that it supports. FCT independence vis-à-vis the scientific communities -- represented in its Scientific Councils -- is limited by its internal governance arrangements, which are marked by disciplinary fragmentation and a low level of strategic management capacity at the centre. While the involvement of researcher stakeholders is an essential attribute of good governance, current

arrangements pose a risk of "capture" by incumbent researchers and disciplines. Alignment with the national objectives would require broadening the set of actors represented in the FCT advisory bodies and strengthening its strategic management capacities.

32.   Review Team visitors were told that FCT funding practices and policies have been poorly aligned to the timelines and outputs of clinical and applied research. Clinical researchers, in medicine for example, report that they have not had a clinical orientation adequately recognised within its scientific panels and in its funding policies. Proposals have recently been put forward to ensure that clinical research is given sufficient consideration, by means of a new agency dedicated to the promotion of (hospital-based) clinical research. While the support to clinical and translational research and innovation is a positive step (along with the recently set up Clinical academic centers), the limited scale and scope of operation of this new agency could lead to additional fragmentation of the funding and priority-setting process. In addition, the efficiency of such a small agency is questionable given the unavoidable fixed costs its creation and management would involve. Other options building on a reformed FCT could be envisaged.

33.   The horizontal challenge that FCT faces is how best to coordinate its work with that of the national innovation agency (ANI) – thereby ensuring that researchers and innovation actors have clarity about who supports which projects, and how to work effectively with both.

2.3. Main recommendations:

1. **Adopt an overarching National Strategy for Knowledge and Innovation covering and providing clear guidance to tertiary education, research and innovation funding and steering organisations**

On the basis of an appropriate bottom-up consultation and engagement process (see next recommendation), a dedicated high-level task force should oversee preparation of a formalised National Strategy for Knowledge and Innovation for Portugal. This document should include:

- A vision of how the Government wishes to see the Portuguese economy develop through innovation in the next decade, including identification of sectors with greatest growth and innovation potential.
- An assessment the broad skills and education attainment profiles, research capabilities and collaboration with firms and non-profit organisations that will be needed to support the development trajectory the government wishes to see.
- An account of the regional and social dimensions of education, research, innovation, and on the prospects for the benefits of increased productivity and innovation to be shared.
- An assessment of the capacity of Portugal's tertiary education, research and innovation actors to support the nation's innovation policy goals.
- Identification of the overall funding levels that the nation's tertiary education, research, and innovation actors are likely to need to achieve. The initial timeframe for the actions could be four years, with a broad multi-annual budget allocation attached.

- Specification of procedures for monitoring progress against the goals for the strategy and for periodic revision of both global objectives and specific actions (after the initial four-year timeframe).

The national Knowledge and Innovation Strategy should provide a clear framework to guide the internal strategies of implementing bodies and funding agencies under the MCTES and Ministry of Economy (such as the FCT and ANI), while leaving these bodies adequate room to devise the best policy tools and precise prioritisation of actions to achieve the overall goals. The Ministry of Planning and Infrastructures should also be involved to establish effective linkages with (EU) Cohesion Policy.

The main orientations included in the Knowledge and Innovation Strategy should be the basis for the development of the content of the next generation of Operational Programmes for EU Structural Funding for the period 2021-2028 in the 'competitiveness' and 'human capital' areas.

2. **Establish a high-level task force at inter-ministerial level to take political responsibility for development of the shared national knowledge strategy, taking into account stakeholder input**

The OECD Review team recommends that a high-level task force be established at ministerial level, bringing together, as a minimum, the Ministers for Science, Technology and Higher Education and Economy, to take responsibility for the development of the new national Knowledge and Innovation Strategy. Direct involvement of the Minister of Finance (responsible for budgetary decisions) and Minister of Education (dealing with wider skills issues) would clearly be beneficial.

The high-level task force should be established for a fixed time period with the initial task of developing and adopting the Strategy. It could meet formally every few months. It should be supported by a well-qualified secretariat of policy and analytical staff drawn from respective ministries. While such inter-ministerial initiatives may not have a well-established tradition in Portugal,[4] they have proved effective in other OECD countries and in EU governance structures, as a way to integrate actions in closely inter-related policy fields.

While primarily created to lead the development of the Strategy, the task force could be a first step toward a permanent inter-ministerial coordination council which would provide orientations of the higher education, research and innovation policies in a horizontal setting.

For any national knowledge and innovation strategy to be effective, it needs to be informed by the expertise and perspectives of those working directly in knowledge-intensive sectors, research and education and take into account the views of a wider range of relevant stakeholders. During its missions to Portugal, the OECD Review Team was impressed by the appetite for greater engagement in policy formation from the business, research and higher education communities and the many constructive suggestions put forward during the numerous discussion events held around the country.

To tap into the knowledge and expertise in the country – and to ensure a future knowledge strategy has wide support – the high-level ministerial task force should organise a wide-ranging consultation and engagement exercise, going beyond the sectoral consultations so far undertaken on elements of current strategy. Existing sectoral advisory groups, including the Coordinating Council for Higher Education can play a key role in convening stakeholders and providing input to this process. To structure the process in

the most efficient and effective ways possible, the secretariat supporting the task force should prepare a consultation document – equivalent to a green paper – outlining initial proposals and options for the priorities and action lines for a national knowledge strategy, to which stakeholders can react. This can draw and build on work undertaken for the 'Knowledge Strategy for Portugal' – currently proposed, but not published - and the associated 'Strategic Investment Plan 2017-2021'. The consultation exercise itself should be concentrated in time and could involve a combination of interactive discussion events (similar to those organised for the OECD review) and written submissions. The process of preparing the consultation document, undertaking the consultation and collating input is likely to take at least 12 months. Good practice on organising such consultation and engagement exercises is available.

3. **Strengthen analysis, foresigth and management capacity in government**

The development and monitoring of the kind of strategy proposed must be informed by accurate information on what is happening on the ground in terms of innovation, research activity and education, and, to the extent possible, relevant perspectives on future developments in the international economy, technological sectors etc. (foresight). The Portuguese administration has significant data collection, monitoring and analytical capacity in comparison to many similar countries. However, this capacity has been weakened during the financial crisis and is dispersed across government departments and agencies, while data collected is not systematically exploited.

The OECD Review recommends the creation of shared data and analysis unit, drawing on and regrouping resources from different agencies, with the task of effective monitoring of implementation of the national knowledge strategy. This unit should be charged with reporting to ministers (high-level task force if this continues beyond initial preparation of the strategy) with a detailed report every two years. These reports should inform the process of periodic revision of the national knowledge and Innovation strategy, every four years, for example. The monitoring of public expenditure related to the strategy would be facilitated by the creation of a specific budget category in national accounting protocols, consolidating spending on Higher Education, R&D and Innovation.

4. **Use the Portugal Knowledge and Innovation Strategy to set a predictable funding environment for the nation's higher education, research, and innovation system.**

The analysis and advice of task force – based upon wide engagement across relevant Ministries within government and careful wide public consultation – should provide government, with the endorsement of Parliament, with an opportunity to establish a high-level, multi-year commitment of public funding in support of higher education and research. With this funding framework agreed, MCTES can deliver multi-year research funding through FCT and educational funding through its institutional subsidies in ways that predictable, aligned to national priorities, and at a level adequate to achieve needed reforms identified in the review.

While the Knowledge and Innovation Strategy would have a long-term time horizon, the funding framework linked to it would be for a shorter duration, such as four or five years. In Norway or Spain, for example, a national strategy contains a long term perspective for and a mid-term rolling plan with financial commitments. The strategy is revised every four years for instance, adapting the long term orientations as needed, and agreeing upon a new funding framework for the four years to come.

5. **Reform the FCT, increasing its capacity to effectively balance national research priorities and the priorities of the nation's scientific research communities.**

The institutional arrangements between FCT and MCTES should allow the ministry to provide clear guidance and associated resources to the agency on a multi-annual basis and monitor the performance of the agency in implementing these orientations. Such arrangements could take the form, for instance, of multi-annual letters of assignment or performance contracts negotiated between FCT and MCTES, setting out clear objectives and planned resources in line with the national knowledge strategy.

The independence of FCT in the fulfilment of these objectives should be strengthened by institutional reforms such as the dissociation of the roles of Director General for Research Planning and President of FCT. More radical reforms could also be considered, including a change of the current 'Public Institute' status of FCT, which provides only limited administrative and financial autonomy, into a public Foundation status. The latter option would also increase its operational flexibility and reduce the level of bureaucratization that has significantly increased in proportion with the share of EU Structural Funds in its budget.

The capacity of FCT to put in place the necessary measures to fulfil the objectives assigned to it should be also strengthened by changes of its internal organisational structure to ensure increased autonomy vis-à-vis the the scientific communities it funds. A key condition of this autonomy is a clear separation between the "scientific evaluation" bodies and the "decision making" bodies that assign the indicative allocations of resources per areas, instruments. Potential options include notably the creation of an FCT "General Advisory Council", with a broader scope and stronger role than the current *Conselho Consultivo,* and changes to strengthen the FCT "Governing Board" (*Conselho Directivo*) with the appointment of additional members.

Wider autonomy vis-à-vis funded scientific communities should be complemented by a review of its scientific panel structure, to ensure that the FCT is capable of responding effectively to new knowledge needs, and to new research community that are applied, clinical, or transdisciplinary.

3. Missions, profiles and resource use in TEIs and research institutions

3.1. Introduction

34.   Universities, polytechnics and publicly supported research centres form the backbone of the national and regional tertiary education, research and innovation systems in Portugal. In a country where spending on research and innovation-related activities in the private economy remains comparatively limited, these institutions play an especially important role, not only in equipping people with high-level skills and performing fundamental research, but also in creating, sharing and exploiting knowledge of direct benefit to the wider economy and society around them.

35.   The work of staff and students in tertiary education and research institutions – and the quality and impact of this work – both influence and are conditioned by the institutional environment in which it takes place. In sectors like tertiary education and research, which are highly regulated and dependent on public funding, institutional environments and way institutions function are strongly influenced by *external* legal, regulatory and financial conditions that ultimately emanate from government policy, as well as *internal* factors lying within the control of institutional leadership.

36.   Three of the most fundamental *external* conditions affecting how individual institutions define their purpose and implement their activities are:

1.   The *role or missions* assigned to different types of tertiary education institutions and research unit by relevant legislation and public policy. This sets the basic parameters of what institutions can and are expected to do, and underpins more detailed specifications of goals, profiles and responsibilities within individual institutions. In some OECD countries, the missions of tertiary education and, if relevant, public research institutions are defined rather loosely. In others, particularly those – like Portugal – with a binary distinction between universities and polytechnics, the distinct roles of different institution types tend to be prescribed in more detail.
2.   The degree of *autonomy or discretion* that government, regulatory authorities and relevant rules leave institutions and staff in the design and implementation of their activities (in learning and teaching, research or engagement with the wider world, for example). Across the OECD, in recent decades, governments have tended to grant public tertiary education institutions increased operational and financial autonomy, including in matters such as institutional strategy, infrastructure and staffing. In parallel, the development of external quality assurance systems in teaching and research has, in many cases, created new forms of external control and accountability.
3.   The *level and type of funding* available to institutions to pay staff, provide buildings and equipment, and implement their activities. In Portugal, as in most OECD countries, tertiary education and research institutions are highly dependent on public funds, meaning that the level of government resources available and the mechanisms through which these resources are distributed in the system have a significant impact on institutional activities and behaviour. Fees paid by students, although nominally a form of private funding, are strongly influenced by government policy and regulation, in Portugal, as elsewhere in the OECD.

37.   Within the framework of these external conditions, the operating environment in individual tertiary education and research institutions also depends on a range of *internal* factors, specific to the institution in question. Crucial among these are the specific profile and development strategy adopted and pursued by the institution, and the quality of institutional leadership and management capacity.

38.   For a variety of reasons, governments in many OECD countries have taken steps to encourage tertiary education and research institutions to focus on and profile themselves in areas of activity where they are strong – or have clear potential to be strong – and to differentiate themselves from other institutions in the system. Common objectives include ensuring adequate diversity in the types of education provided (see section 4), allowing institutions to respond effectively to the needs of their localities and regions, avoiding unnecessary duplication in teaching and research to increase efficient use of resources (particularly in comparatively small systems), or encouraging concentration of activities to create internationally competitive centres of excellence. In an increasing number of tertiary education systems, the definition of a clear institutional profile is a core element in performance or development agreements negotiated between individual institutions and public authorities, and which are often linked to the allocation of public funding.

39.   In light of these considerations, this section of the Review examines two main questions:

1. Do the *legal, regulatory and financial frameworks* in which they operate create conditions (notably, clarity of missions, adequate institutional autonomy, adequate resourcing and incentives for good performance and accountability) that allow tertiary education institutions and research units in Portugal to define differentiated profiles and work effectively to achieve their goals? Do these frameworks provide institutions with incentives to *engage with external partners at regional, national or international level*, in ways that are aligned to their mission and profile?
2. To what extent do tertiary education institutions and research units have *defined profiles and development strategies in practice and to what extent do they have the leadership and management capacity* to implement these strategies?

3.2. Diagnosis: Key points

3.2.1. Institutional autonomy is expanding, but remains insufficient to permit HEIs to act as flexible and agile innovation partners

40.   The 2007 *Legal regime for higher education institutions* (RJIES) defines the missions and the scope of autonomy available to tertiary education institutions in Portugal. Within the binary system of TEIs, polytechnics are distinguished in the legal framework by their focus on professionally oriented studies and 'targeted research' (*investigação orientada*) and the fact they are only entitled to award bachelor and Master's degrees, but not doctorates (which can only be awarded by universities). The legal framework recognises the inter-dependency of education, research and innovation in the wider economy, as well as the broader cultural role of tertiary education, assigning the same basic roles to all tertiary education institutions, within the limits of the 'vocation of each sub-system'.

41.   In practice, in educational provision, despite the binary divide, there is a tendency for all institution types to attempt to provide a wide range of disciplines in their

educational offering, rather than specialise. This is, in part, driven by pressure to maximise enrolment and the fee-income that comes with each enrolled student, although the total number of study places each institution can offer on each programme is limited by a comprehensive system of *numerus clausus* (see below). There are signs of universities encroaching on the natural territory of polytechnics. A number of research universities are offering programmes (such as tourism management) that, in light of their professional orientation, could be expected to be provided exclusively in the polytechnic sector. At the same time, as in many OECD countries, there are pressures in the polytechnic (applied science) sector to increase focus on research and to obtain the right to award doctoral degrees. While universities tend to defend their exclusive right to award PhDs, representatives of polytechnics tend to see PhD-awarding powers as a necessary step to allow them to fulfil fully their roles in applied research. Pressure from polytechnics in this respect has increased since the introduction of the requirement for academic staff in polytechnics to hold PhDs.

42.   Public TEIs in Portugal enjoy a moderately high degree of flexibility in organising their internal management and structures in comparison to those in some other European countries[5]. However, the level of institutional autonomy in many other key areas remains limited in Portuguese universities and polytechnics, particularly in public institutions that have not transitioned to foundation status (see below). In particular, national legislation governing public sector employment (see Section 6.), public procurement and financial management are burdensome, and limit the ability of institutions to plan and manage their operations efficiently and effectively.

43.   In 2007, the RJIES (article 129) introduced the possibility for tertiary education institutions to become public foundations under private law. The objective was to give TEIs greater operational autonomy in financial management – including procurement, asset and property management, borrowing, the carrying forward of unspent funds -- and staffing. In the latter case, foundation institutions were to be permitted to hire by allowing them to use of the greater flexibility afforded by the employment, accounting and procurement legislation applicable to the private sector in Portugal.

44.   Although article 129:2 of the RJIES requires that institutions seeking foundation status obtain the support for the proposal by an absolute majority of the General Council, and present to the government, through MCTES: (a) a report on the implications of this institutional transformation on the organization, management, financing and autonomy of the institution; (b) a document describing the advantages of adopting this model for the pursuit of the institution's objectives. However, an informal requirement was later added to the process of review and approval in government: institutions seeking foundation status must demonstrate in a consolidated institutional audit that its own revenues exceed 50% of total revenues. To date, only five (out of 15) public research universities and university institutes[6] have adopted foundation status.

45.   The implementation of foundational status was overtaken by 2009 financial crisis and a sequence of legislative changes suspended or sharply constrained the financial autonomy contemplated by the 2007 legislation. Foundation universities "were integrated … into the state budget perimeter", and made "subject to the rule of budgetary balance and compliance with the principle of treasury unit on the same terms as other higher education institutions." By 2012 the financial management flexibilities that had been anticipated – except for the management of real property – were curtailed (CCHE, 2017, unpublished).

46. A recent review by the Coordinating Council for Higher Education (CCES) concluded that even those TEIs that have adopted foundation status have so far made limited use of the flexibility it offers. Extensive legal ambiguity persists concerning key aspects of foundation status that impair its wider adoption and effective use. Legal uncertainty exists concerning both human resources and financial resources, and it has led universities to use, according one university trustee, "perhaps fifteen percent of the potential of foundation status."

47. Core institutional funding for public TEIs in Portugal in support of education and other core operations – which account for about one-half of the income of public tertiary institutions -- is delivered through one funding mechanism: basic funding allocated on an historical basis. In January, 2006 a complex formula-based institutional funding model was proposed by MCTES and the Finance Ministry, in which institutional subsidies were to be based principally based on enrolments by field of study, though the model was supplemented by other non-enrolment parameters, such as a graduation efficiency rate (*Portaria* no. 231/2006). The model has not been updated since its introduction. Instead, institutional subsidies have been made upon that original funding base, with annual incremental modifications that are not formula-based.

48. The lack of a clear funding formula, like those used in many other OECD countries, makes the funding system opaque and means there is only a weak relationship between effort and performance (the volume of activity and outputs) and money received by individual institutions. These shortcomings are recognised by government and stakeholders in Portugal. However, the current, historical system provides stability across the system and, significantly, financial security to institutions with falling enrolment (notably in rural areas) that would be adversely affected by an activity and output-based system. Without at least some additional resources flowing into the system, the introduction of a formula funding model would lead to a zero-sum game, benefitting some institutions, but potentially destabilising weaker institutions through significant budget cuts.

49. Research funding for tertiary institutions is allocated through multi-year block funding allocated by the Portuguese Science Foundation (FCT) directly to research groups based within higher education institutions and associated laboratories, rather than to tertiary institutions themselves. Approximately one-half of Portuguese higher education faculty participate in such groups, or "R&D units." These funds comprise 21% of total research income received by HEIs, and are supplemented by project-based research funding awarded by the FCT (30%); research funding from EU and international sources (39%); and industry funding (10%). The fact that TEIs themselves do not receive institutional funding for research limits their capacity to develop an integrated research strategy. However, the situation varies according to institutions since different models of integration of R&D units into universities and polytechnics exist.

3.2.2. Public spending is provided in a way that does not support sound or strategic management, or provide incentives for good performance and accountability.

50. It is widely recognised among leaders in Portuguese tertiary education that core public funding for education and operations that is delivered to tertiary institutions on an historical basis makes the funding of institutions opaque, and establishes a weak

relationship between the money received by individual institutions and their level of effort and performance.

51.   Further, the same leaders broadly acknowledge that annual funding – with frequent "captivations" to balance public accounts and lengthy periods within the year during which institutions are not permitted to commit public funds allocated to them – is harmful in the short-run to sound and efficient institutional management, and in the long-run, to the development of institutional strategy and close collaboration with commercial and community partners.

52.   In recognition of the shortcoming of historical funding, there have been repeated efforts to develop a budget framework that is pluri-annual and systematically linked to past performance (e.g. degrees awarded) and current activity (e.g. enrolment by study field). These proposals have foundered. Three basic obstacles hamper improvements to core institutional funding.

   a.   MCTES is not well-endowed with performance monitoring capabilities and funding expertise, and thus it is not fully equipped to manage a funding process that includes (past) performance components or forward-looking and profile-oriented performance agreements.
   b.   Portugal's fiscal crisis and subsequent public austerity have left it with little capacity to dedicate the *new* resources that would be needed for the reform of tertiary education funding. Changes to funding methodologies used by governments are typically implemented, in part, through the addition of new resources, not purely through the redistribution of resources among tertiary institutions according to a new set of rules, since this latter path creates clear 'losers' and precipitates more conflict than can be managed.
   c.   Pluri-annual budgets cannot be achieved by the efforts of education ministries alone. Rather, experience in OECD member countries shows that education ministries rely upon parliaments and finance ministries to establish predictability in the funding envelope with they, in turn, allocate to research and teaching.

53.   Although the overall funding level available for MCTES to distribute among public higher education institutions has been unstable, institutional autonomy in the management of public finances has been enhanced. An informal agreement adopted in 2016 between the Finance Ministry and public higher education institutions has provided authorisation for: (a) lump sum rather than line-item appropriations to institutions; (b) exclusion from "captivations" in return for an agreement that annual deficits incurred by any single institution would be offset by the shared contributions of all other institutions in their sector; (c) authorisation to carry forward surplus public funds from one fiscal year to the next; and (d) an agreement, in principle, of budget increases sufficient to reimburse institutions for cost increases they experience as a consequence of policies adopted by Parliament.

3.2.3. Institutional profiles, strategies, leadership and management capacity remain limited

54.   The framework conditions discussed above are among the key factors explaining why tertiary education institutions in Portugal generally lack their own clearly differentiated profiles (areas of focus, unique features etc.) and development strategies.

55.   In additional to the comparatively limited degree and tradition of institutional autonomy, the funding and wider regulatory systems provide few incentives for either

specialisation or improving performance over time. There are no ongoing funding streams provided by MCTES to public higher education institutions that encourage institutions to engage in profiling their institution. Institutional core funding in support of education and infrastructure is provided on an historical basis, without taking into account directly the specific missions and potentially differentiated needs and objectives of different institutions.

56.   The fragmentation of research activities across a multitude of research centres, discussed in Section 2. , has also have limited the capacity of individual TEIs to formulate coherent profiles and development strategies covering teaching, research and engagement with society. FCT block funding for research units has led to the progressive development of dense network of research units across different universities and, to a lesser extent, Polytechnics. While the size of this network has varied over time according to government priorities, the network is shaped by the bottom-up priorities of researchers, without obvious reference to either institutional or national priorities for knowledge development. The situation also creates asymmetry between the legal responsibility of TEIs for employment in research units and real influence they have over their research strategies.

57.   The weakness of institutional profiling and development strategies has a number of consequences for the performance of the tertiary education, research and innovation system as a whole. Teaching, research and innovation activities in individual departments and institutions are, to a large extent, planned and implemented in isolation, without reference to the goals of the institution as a whole, to the activities of other institutions in the system and broader national development goals. While this situation may leave room for the professional creativity of individual staff members and teams (notwithstanding the broader constraints discussed), the lack of strategic steering can also lead to inefficient duplication, missed opportunities for collaboration and a weak alignment of activities on the ground with the needs of particular localities, population groups or the nation as a whole. The absence of clear profiles and strategies for each institution also makes the system as a whole less readable or transparent, particularly for students looking to choose an institution and institutions looking to differentiate themselves from – or partner with – peer institutions in other locations.

58.   Weak pressures for institutional profiling have led to the underdevelopment of consortia among higher education institutions for the joint development and delivery of academic programmes and alliances that permit institutions to coordinate their complementary profiles with one another. While the system is highly networked in research through a complex web of R&D centres spanning institutions, at the institutional level Portugal has a more weakly developed basis of division of labour and collaboration compared than other OECD tertiary systems.

59.   The OECD Review team was impressed by the quality and dynamism of the institutional leadership in the TEIs it visited. Nevertheless, two internal factors, in particular, emerge that may constrain the ability of institutions to develop and implement profiling and development strategies. The first relates to the ability of institutions to engage effectively with relevant external stakeholders. Institutional profiles and strategies should be informed by the views and needs of the different populations institutions serve, whether this is particular student groups, regional, national or international employers, research and innovation partners and so forth. While some institutions clearly have well-developed processes for consultation, engagement and cooperation, others have far less capacity and experience in this

respect. Second, non-academic professional positions (in financial management, facilities management, marketing etc.) in Portuguese tertiary education institutions tend to have a lower status and fewer resources attached to them than equivalent positions in tertiary education institutions in many other OECD countries. As qualified professional staff with adequate authority and resources are crucial to the development and implementation of effective institutional strategies, this comparative under-resourcing is problematic.

3.3. Main draft recommendations:

1. **Rebalance the missions of Portugal's higher education institutions to ensure that nation has a diversified network of institutions, the missions of which are well-aligned to national and regional needs. Specifically:**

Continue lines of policy from the past decade that have been effective in developing diverse capacities, including establishing a PhD requirement for polytechnic academic careers, supporting applied research through the Polytechnic Modernisation and Valorisation Programme, and awarding R&D centre designations to leading polytechnic research groups.

Develop a regulatory capacity in MCTES to review and approve new educational programmes at the bachelor level to ensure they are well-aligned to the mission of institutions in each sector, and to the institution's own strategic profile.

Modify, as necessary, the legal basis of accreditation and quality assurance processes administered by A3ES to ensure that its reviews adequately differentiate between theoretically-oriented university study programmes and practice-oriented professional education.

Revise the legal basis for polytechnics to **permit the carefully controlled award of doctoral degrees by polytechnics.** This should be permitted in (a) practice-oriented applied research fields where (b) institutions have a clearly demonstrated capacity to support high quality instruction, where (c) there is a strong regional economic rationale for the offer of doctoral awards, and (d) there is collaboration with existing centres of PhD training. The process of doctoral authorisation should operate at the level of school or faculty rather than the polytechnic as a whole. A programme approval process could require:

a. Approval by the polytechnic's President and General Council, in which the proposed doctoral programme is clearly linked to the institution's profile, and motivation for the proposed PhD demonstrating that the proposed doctoral programme will increase the institution's capacity to support regional needs and why the polytechnic is best placed to offer this training.
b. For PhD programmes based in polytechnic institutions, a partnership with other institutions in a joint doctoral programme (or individual research university) must be established permitting doctoral students to take advantage of peer learning, instruction, and research opportunities across institutions;
c. Review by A3ES; and,
d. Academic staff participating in doctoral instruction should participate in R&D centres recognised as very good, excellent, or exceptional by the FCT.

2. **Support the further development of autonomous higher education institutions, ensuring that all have the capacity to engage in close and flexible collaboration with firms and community partners**

Pursue full implementation of the foundational status for TEIs and take additional measures to increase flexibility in financial management and procurement for all tertiary institutions. These measures should include, in sequence:

   a. Immediately amended the State Budget Law to put the financial management provisions for public HEIs agreed by the Ministry of Finance on a statutory basis.
   b. Appropriately modify the Official Plan of Public Accounting for the Education Sector and the Public Contracts Code so their provisions do not apply to institutions with foundational status.
   c. Revisit the criteria that it uses when proposing institutions for foundation status. New tests for sound financial management should be adopted that permit all well-managed public higher education institutions to achieve foundation status

3. **Reform the system of institutional funding mechanisms to create greater transparency and more incentives for good performance; help institutions make fully effective use of autonomy through targeted schemes for strengthening the management and professional capacities of professional and administrative staff in institutions;**

Ensure a properly balanced institutional funding regime that (a) predictably funds the core activities of institutions, (b) rewards institutions for performance in a way that is recognised to be fair, and (c) provides incentives for the development of forward-looking institutional profile, Portuguese authorities should aim for the development of a funding methodology that allocates approximately 80%-15%-5% of institution resources across these three funding pillars (activity; outputs; and future profile).

Funding to support core activities (80%) and performance (15%) would be delivered based upon agreed models that contain methodologies common to institutions within a sector. Funding to support institutional profiling (5%) should be based upon a multi-year performance agreement between the tertiary institution and the Ministry of Science, Technology, and Higher Education.

Institutional profiles would necessarily vary, focusing in some cases principally on research and innovation, while in other cases on professional education and regional engagement. Profiles focused on research could be used, for example, to allow HEIs to better integrate R&D units into the institution's research strategy.

Strengthen the CCHE, along the lines of the OECD's recommendations of 2007, so that it can function effectively in bringing sector priorities to national debates and priority-setting for science, technology and higher education, and provide a stable framework of national priorities against which higher education institutions can expected to develop institutional strategies. This strengthening should include the addition of a budget for research and analysis, and a professional staff adequate to its expanded mission.

4. Tertiary education provision, access and support mechanisms

4.1. Introduction

60.   An adequate supply of individuals qualified at tertiary level is widely recognised as a key factor in enabling economies to shift towards higher levels of knowledge intensity and allowing industries to move up the global value chain. Internationally, increases in tertiary graduate rates have typically gone hand in hand with improved adoption and absorption of technological and process innovations, advances in productivity and the wealth creation associated with this. These developments are driven not only by the advanced subject knowledge students acquire through tertiary education, but also the wider transversal skills sets they are able to develop through pursuing their education to a higher level.

61.   Notwithstanding years of growth in tertiary education participation in Portugal, tertiary education attainment rates remain below the OECD average, and below EU and national targets. In this context, the Portuguese system needs to widen access to tertiary education further, while also ensuring as many students as possible successfully complete their studies.

62.   Effective tertiary education systems, with high levels of participation and completion, support and encourage diversity and flexibility in the provision of study programmes. Greater institutional and programmatic differentiation ensures that institutional profiles and activities respond to the varied needs and interests of their student population, and society at large, and support the development of a broad range of skilled individuals.

63.   In light of these considerations, this section of the review examines three important issues:

1. Is the educational provision in Portugal's tertiary education system adapted to the different needs of a broad range of student types, and society at large?
2. Are admission procedures allowing access to tertiary education adapted to the needs, interests and learning experiences of different student populations, providing suitable pathways into tertiary education?
3. Are there adequate financial and pastoral supports in place to help students complete their studies and to encourage young adults to return to education?

4.2. Diagnosis: Key points

4.2.1. Differentiation and flexibility in modes of provision and pedagogical approaches

64.   Starting from a position of particularly low educational attainment rates, Portugal has succeeded in greatly expanding participation in both upper secondary and tertiary education in the last decade. In 2015, about 67% of 25-34 year-olds had attained at least upper secondary education in Portugal, a significant increase from 43% of 35-44 year-olds and 24% of 55-to-64 year-olds. Overall, however, Portugal still lags behind other OECD countries in terms of educational attainment, with a third of young adults not

having completed upper secondary education - a share that is significantly above the OECD average of 16%.

65. Portugal's tertiary education provision is based on a well-established binary system, with polytechnics providing professionally oriented study programmes alongside universities offering more traditional academic programmes. This structure ensures a degree of diversity in education provision, despite some blurring of the binary divide in recent years (see previous section).

66. The introduction, in 2014, of the *Cursos Técnicos Superiores Profissionais* (CTeSP) added a new type of short-cycle tertiary educational programme to the range of course offerings in Portugal. The introduction of CTeSP has clarified and strengthened the nature of short-cycle programmes by including a greater orientation on deepening knowledge and skills, more workplace exposure, and stronger links to the labour market needs. Additionally, the creation of new study options may prove to be particularly attractive to groups who have hitherto not pursued tertiary education and may help address skills gaps in the economy. Nevertheless, additional monitoring and evaluation of CTeSP programmes and the labour market outcomes of CTeSP graduates will be required to understand fully the ongoing relevance and impact of these programmes.

67. Despite the apparent diversity created by the binary system, tertiary education programmes, including across polytechnics, often remain theoretical in focus, with limited co-operation with the outside world and a lack of attention to developing key competences students needed for the modern economy. Programmes typically have rigid structures and are oriented to specific professions, providing students with limited flexibility in combining courses. Additionally, traditional teacher-centred methods with a large number of lecture-based contact hours still prevail.

68. Furthermore, modes of provision are not aligned to the needs and interests of a more diverse student population. The provision of flexible, part-time, evening and distance learning options is very limited. Portugal has among the lowest proportions of bachelor degree students undertaking part-time study in the OECD. Opportunities to study either on an accelerated or an extended basis are not widespread. And, as in many other countries, there is little provision of short courses tailored to adult learners (i.e. outside the short-cycle, Bachelor, Master structure). Ensuring greater flexibility in programme provision modes, structures and curriculum is key to encouraging young adults to return to education and upgrade their skills.

69. In interviews with the OECD Review team, TEI staff highlighted that the current quality assurance system may be deterring the introduction of more flexible, student-focused and competency-based programmes. A3ES has successfully established and implemented a respected external quality assurance system for higher education in Portugal, covering bachelor and master's programmes provided in universities and polytechnics which provides a guarantee of basic standards and appears to have influenced the quality culture in Portuguese TEIs. As noted in the previous section, the system is currently moving towards a lighter touch model of quality assurance. This could be an opportunity to shift from a rather prescriptive approach to one that encourages greater diversification and innovation in the development of new types of programme, instruction methods, and delivery modes.

4.2.2. Misalignment in access routes to tertiary education

70.   The centralised admission process to tertiary education (known as the *Regime Geral de Acesso*, RGA) provides students with a transparent mechanism for admission and the government with a strong and direct steering mechanism to influence the tertiary sector. However, the RGA is solely aligned to the curriculum of generalist upper secondary education (i.e. the traditional higher education cohort), neglecting that of secondary professional education. A total of 18 subjects may be examined in the *Provas de Ingresso*, their content exclusively based on the curriculum of the academic track. Secondary professional students are required to take an examination in subjects which are not part of the curriculum they have followed, putting them on an unequal footing to enter tertiary education. Because secondary professional students now comprise approximately half of upper secondary students this imposes a key bottleneck to the expansion of access to tertiary education.

71.   As a result of the gap between the secondary professional curriculum and the entry examination regime, while 88% of students from the academic track who took the examination enter higher education this is only true for 16% of those from vocational tracks - 10% enrol in a CTeSP and 6% to a Bachelor programme. Given the over-representation of students from lower socio-economic backgrounds in secondary VET in Portugal, this phenomenon perpetuates and reinforces inequalities. Students in vocational tracks in other OECD countries are much more likely to transition to tertiary education - around 50% in the Netherlands (MBO 4), 59% in France, 75% in Korea.

72.   Key stakeholders in interviews with the OECD Review team also suggested that low transition rates to tertiary education across students from vocational tracks may also relate to the poor quality of VET programmes in Portugal, an issue that falls outside the scope of this Review.

4.2.3. Support mechanisms for students

73.   Portugal offers limited mechanisms to support students and, in particular, young adults to enter – or return to – higher education and successfully complete degrees. The main form of support is means-tested grants, dependent on family income. Around 20% of students in tertiary education current receive a grant, although in many cases this may be a level that only covers tuition fees. In addition to covering only a very small proportion of students' living costs, the support system's design strongly discourages students seeking revenue from other sources as the threshold to be eligible for a grant is very low – at EUR 7 000 per household member. To date, there has been no systematic assessment of the impact of the student support system in place, in particular on students' decision to pursue a tertiary education degree and on completion rates.

74.   A specific student financial support policy, +*Superior*, was established to provide additional, top-up grants to students moving to study at institutions in designated regions of the interior of Portugal. It was designed to award aid after enrolment decisions have been taken, and thus not influence study location decisions. The scheme experienced a number of difficulties in its first period of implementation, which considerably widened eligibility for the grant and undermined its effectiveness as a tool to promote mobility to less popular institutions. The design of the system has been revised for the academic year 2017-2018 (after the start of the academic year) to limit eligibility to those in receipt of a mainstream student grant (*bolsa de estudo de ação social*) and attending an institution covered by +*Superior* in a NUTS III area different

from that where they are normally resident. The effectiveness of this revised instrument has yet to be demonstrated.

75.   Adults who have completed secondary education but not undertaken tertiary studies have been identified as a priority population for raising educational attainment. These adults are typically at work, and may have family responsibilities. Many do not undertake tertiary students because they judge the benefits of continued study to be minimal. Others may expect study to be beneficial, but they may be reluctant to bear the out-of-pocket or opportunity costs (e.g. lost wages) of tertiary study. The design of student support systems (means-tested study assistance) is not well-adapted to those needs. Portugal's *Programa Retomar* targeted at young adults showed weak take up due to strict criteria and inadequate levels of financial support. Portugal is currently reorienting the programme towards ICT fields and reassessing the participation criteria.

76.   Moreover, Portuguese higher education students have limited access to academic support and guidance services. This is particularly alarming, given that stakeholders highlighted to the OECD Review Team during on-site visits and interviews their concern regarding the level of preparedness of students entering higher education, in particular of those graduating from professional tracks. Effective higher education systems set out the foundation for student success by providing them with adequate and targeted financial and academic support as well as guidance services and monitoring their progression along the system. This is particularly important for systems that are widening access and bringing in students with different needs and experiences and potentially weaker academic performance levels.

77.   Portugal has taken steps in recent years to develop an integrated student-level education data system that collects and disseminates data on the tertiary sector, including indicators on enrolment, completion and labour market outcomes. Completion of this work is needed to ensure that students have information about the risks and benefits of tertiary education when making choices about what and where to study. Additionally, information on students' performance and progression can be used by the upper secondary education system to review and recalibrate its curriculum and practices to strengthen the alignment and improve the quality of education.

4.3. Recommendations

1.   **Further improve the diversity of the educational offer**

Remove obstacles in quality assurance and funding systems that limit the capacity of higher education institutions to offer part-time, distance and blended short cycle, bachelor and master's programmes, and ensure that provision is adapted to a full range of students, including adult learners. Provisions in the Assessment Law of 2007 that underpin the A3ES programme quality assurance decisions and unnecessarily limit flexible programme design should be reviewed and eliminated. Likewise, if other legal provisions, such as the Law on Degrees and Diplomas, have an unsuitably restrictive impact on programme design, those should be revised as well. Through performance contracts, encourage strategic co-operation between institutions and social partners to identify, develop and deliver short / modularised training courses responding to specific upskilling needs.

2. **Provide targeted support to encourage pedagogical training and reward good teaching performance.**

Portugal should encourage and support pedagogical training for academic staff, targeting both new and established staff members and reflecting the diversity of requirements across student groups and institutions. Although some countries (such as the UK) have developed national academies focused on pedagogical development, others (including the Netherlands) have provided public funding to pedagogical capacity building initiatives organised by individual or groups of TEIs. Such an initiative could initially be supported in Portugal through pilot projects in selected TEIs. Additionally, the Portuguese Government should explore ways to encourage institutions to include teaching performance as a key element in transparent, institution-wide systems of evaluation and promotion (see Section 6. .

It is also crucial that Portugal includes improvement of learning and teaching as a core objective in its national strategy for tertiary education and in institutional agreements to raise the profile of the issues at stake and incentivise action at institutional level. Key objectives should be increasing uptake of effective pedagogical approaches for skills development (problem-based learning, flipped classroom, use of technology etc.) and greater cooperation with employers and outside actors.

3. **Reform the entrance examination system to ensure it is adapted to students from generalist streams and upper secondary VET.**

To widen access to tertiary education, the entrance examination system for tertiary education should be aligned to the needs and profiles of students from both secondary professional *and* academic programmes. A skills-focused entrance examination that reflects key aspects of the secondary professional curriculum could ensure that the knowledge and skills of students from vocational streams are properly recognised. In the short-run, the *Provas de Ingresso* examination could include additional modules that are aligned to the curriculum of the vocational stream. Vocational modules must be developed through cooperation between tertiary education and upper secondary educators. This will be essential to ensure take-up of the reform by students and tertiary education institutions, and the proper alignment of examinations both to secondary curriculum and higher education programmes. In the long run, Portugal should, however, consider a broad reform of its access system, developing tailored access routes that are aligned to the different models and goals of higher education provisions and adequately measure students' potential skill sets.

In parallel, the Ministry of Education should encourage greater focus on preparing students for tertiary education as part of upper secondary VET curriculum, and ensure that all schools provide academic and career counselling to all students.

4. **Improve student financial support policies**

The current system of financial aid to students should be subject to a comprehensive review to assess the extent to which existing measures really help students from low-income backgrounds and to identify gaps in provision. The efficiency and effectiveness of the +Superior grants for students studying in specific institutions in the interior should be monitored closely in light of the recent reform and as part of the broader exercise. It should be discontinued if it is confirmed to have no enrolment impact. Although financial resources remain constrained, it may be possible to use resources saved through declining student numbers or reallocate resources from other parts of the tertiary education and research budget. Special attention should be given to the development of new

mechanisms of financial support adapted to the needs of working adults, and revision of existing policies, such as the *Programa Retomar*. Examples of the latter can include e.g. creating a higher income protection allowance for adults seeking means-tested student support.

5. **Adequately support students making the transition to tertiary education**

Special attention should be given to ensuring that students are well prepared and supported to complete tertiary education. Specific additional measures could include incentives (through performance agreements or other appropriate means) for systematic co-operation between upper secondary and tertiary education stakeholders – in particular professionally-oriented stakeholders – to encourage greater alignment of teaching content to help smoothen and support transition to tertiary education. Strengthening exchanges can also raise awareness among upper secondary students and teaching staff of existing opportunities and good practices. Additionally, developing and implementing systems at institutional level to monitor students' performance and to signal difficulties would be an effective way to support early intervention and promote student success. Detailed information on students' academic performance (including particular deficiencies and gaps) could also be provided to upper secondary institutions through feedback reports, for example, to help review and recalibrate schools' curriculum and teaching practices.

5. Doctoral training

5.1. Introduction

78.   Across the OECD, tertiary education institutions play a key role in training high-level subject specialists and researchers though doctoral degrees (PhDs). In Portugal, as in a number of other OECD countries, only tertiary institutions officially recognised as 'universities' currently have the right to award PhDs, reflecting the traditional concentration of research in this type of institution. As elsewhere, a majority of doctoral graduates in Portugal have historically gone on to work in teaching and research roles in universities or, to a lesser extent, public research. However, doctoral graduates in general – and in certain advanced fields in particular - have the potential to play a key role in research, analytical and management roles in many sectors in a knowledge-intensive economy. The ability of such highly trained individuals to use their advance knowledge and skills to contribute to the development of knowledge and innovation depends both on the quality and relevance of their training and on their ability of find work in role where they can actually exploit their additional skills.

79.   Undertaking a PhD – typically lasting four years – represents a significant investment in terms of time, resources and foregone earnings for the individual doctoral candidates. It is also an investment for society as a whole. Not only do many PhD candidates receive direct financial support from the public purse, but each talented individual engaged in doctoral research is diverted from other types of productive activity in the economy. It is therefore crucial that these investment decisions, by the individual and by the state, are made on the basis of a sound understanding of the likely costs and benefits of pursing a PhD. While the potential benefits in terms of individual fulfilment, creation and use of new knowledge and development of national research capacity are considerable, the risks – particularly in relation to doctoral graduates finding suitable subsequent employment – are also real.

80.   In light of these considerations, the two closely inter-related questions examined in this section are:

1. Is the allocation of resources to fund doctoral training in Portugal and the way doctoral training is organised adequate to meet the likely needs of a modern knowledge economy and how could these be improved?
2. To what extent are doctoral graduates able to find relevant work in Portugal, how might demand for doctoral candidates evolve and what could be done to increase opportunities for trained researchers to exploit their skills for the benefit of Portugal?

5.2. Diagnosis: Key points

5.2.1. Doctoral training in Portugal and the flow of doctoral graduates

81.   From a low base, Portugal has greatly expanded its capacity to train doctoral candidates in the last two decades. The number of individuals obtaining a doctoral degree in Portugal increased from under 1000 in the academic year 2004/05 to 2 344 in 2015/16, largely driven by a significant increase in the number of doctoral studentships awarded by the FCT from 2004 onwards. The number of studentships awarded

increased from less than 850 a year in the decade 1994-2003 to 1 233 in 2004 and reaching a peak of 2 030 studentships awarded in 2007. In the wake of the financial crisis, the number of studentships awarded annually fell sharply, to below 700 in 2013, before being increased again in 2016 and 2017, with the use of European Social Fund resources. The most recent doctoral graduation rates per 10 000 population in Portugal (for 2015) are on par with countries such as Austria, France or Belgium, but remain below the rates seen in Germany, Switzerland or the UK.

82. In the 1990s around 40% of doctoral grants awarded by the FCT were for candidates undertaking their PhD abroad. As domestic capacity for PhD training has increased, this proportion has fallen steadily, with candidates undertaking their PhD abroad now accounting for less than 5% of grants awarded. In parallel with this decline, 'mixed' PhDs, with supervision of candidates shared between a Portuguese and foreign institution, have increased as a share of grants, now accounting for around a third of grants awarded annually. The proportion of non-Portuguese nationals among doctoral grant recipients has also increased steadily over time, accounting for around 15% of all grants awarded in recent years and reflecting a growing internationalisation of Portugal's domestic research training activities.

83. Doctoral grants in Portugal have historically been funded on the basis of individual applications to the FCT, prepared jointly between the applicant and the host (supervising) institution. In 2012 and 2013, the FCT ran calls to fund doctoral programmes, each with a certain number of doctoral studentships attached and with selection of candidates decentralised to host institutions. A condition of the calls was that funded doctoral programmes involve a partnership between a one or more universities and at least one external research unit (in Portugal or abroad) or a company. In 2016 and 2017, the additional resources available for doctoral training have primarily been directed to funding individual studentships, awarded centrally by the FCT. In parallel, a targeted, centrally administered, call for studentships for PhDs in industry (*doutoramento em empresas*) was introduced. In 2015, 16 such grants were awarded, compared to 447 'standard' individual doctoral studentships.

84. To date, the allocation of PhD studentships between different fields of study – whether through individual calls or FCT-funded doctoral programmes - has been based on the number of applications and historical resource allocations to different fields. In recent years (2012-2015), engineering and technology, traditional strengths of the Portuguese tertiary education system, have accounted for around 30% of PhD grants, with a further 25% in 'natural and exact sciences' and 30% in humanities and social sciences. There is no clear prioritisation of fields or sub-fields, or assessment of the relevance of funding particular PhDs to national development goals. Research funding systems have a duty to take into account the value of all disciplines and allow adequate space for creativity and individual initiative in the way they allocate public support to research. Nevertheless, many research funding systems elsewhere in the OECD provide a greater degree of top-down steering and prioritisation of research fields than is currently the case in Portugal. Research Councils in the UK and Ireland, for example include the specification of priority fields in calls for individual scholarships or doctoral programmes or use specific support instruments for doctoral programmes in priority areas for national skills development.

85. Doctoral training in Portugal is structured in doctoral programmes, which must receive prior accreditation from the Agency for Assessment and Accreditation of Higher Education (A3ES). This provides a basic guarantee of quality. The FCT calls to

support doctoral programmes were, to a large extent, motivated by a desire to create greater critical mass in doctoral training in Portugal, by federating training capacity in different organisations, and increase the quality of the learning, networking and skills development opportunities available to doctoral candidates. Training had traditionally focused almost exclusively on individual research and research-specific skills, with limited focus on helping candidates to develop their other skills sets (communication, teaching, management etc.) for work inside or outside academia.

86.   The new generation of joint doctoral programmes supported – and which is still operating – has created innovative doctoral training partnerships between different institutions and research actors, some of which involve prestigious international partners such as MIT and other US universities. However, in comparison to similar support schemes in other OECD countries, it is likely that the FCT calls supported too many doctoral programmes, many of which lack the critical mass in terms of research capacity and the number of students admitted each year to guarantee doctoral candidates a world-class training experience.

87.   Broader concerns regarding Portugal's public funding for doctoral training are the considerable instability and unpredictability in the flow of public resources – in volume and the type of instruments used to allocate funding – and the concentration of public funding and decision-making responsibility in the FCT. The sharp variation in funding levels in the wake of the crisis and the shifts between individual scholarship schemes and doctoral programmes have made it harder for prospective candidates and research departments to plan ahead. The historical reliance of centralised calls for individual studentships by the FCT has left the organisation in a position where it has prime responsibility for 'picking winners'. Responsibility for funding decisions would ideally be more dispersed across the system, with individual research centres given more autonomy to select and fund PhD candidates that can contribute to their institutional research profiles and needs – pattern that is common in many other OECD countries.

5.2.2. Employment opportunities for doctoral graduates in Portugal

88.   It is difficult to obtain a good picture of where doctoral holders work in Portugal - or where doctoral graduates from Portugal work abroad - and of the nature of their occupations. The results of the latest survey on the Careers of Doctoral Holders (CDH) in Portugal, reflecting the situation on 31 December 2015, provide the best available information about the employment of doctoral graduates within the country. These suggest that 85% of doctorate holders work as post-docs, teaching staff or researchers in the tertiary education and public research sectors. A further 2% work as researchers in the business sector and 6% in positions outside the academic sector without an R&D component. Among those who had graduated in the last 2 years, 5% worked as researchers in business and 13% in non-R&D roles outside academia.

89.   While these data have limitations, notably related to the completeness of the respondent cohort, stakeholders in Portugal overwhelmingly concur with the view that an increasing proportion of doctorate holders in Portugal will need to find employment outside the academic and public research sectors. As discussed in the next section, employment in universities and polytechnics has been falling in recent years as a result of demographic decline and spending cuts. The Government has recently launched a new initiative to promote scientific employment. The new individual competition for post-doctoral contracts run by the FCT aims to support 500 post-doctoral positions in its first year. If the number of individuals graduating with a PhD remains stable, at around

2 300 year, and assuming that post-doctoral positions are the main route through which new PhD graduates can enter academia and the number of junior post-doctoral contracts offered each year remains stable, at least 1 800 PhD graduates a year will need to find work in other parts of the Portuguese economy or abroad.

90.   Private and public sector demand for PhD holders outside the academic sector in Portugal remains limited. This situation is primarily a reflection of the structure of the Portuguese economy, which is dominated by micro-businesses and specialised in low and medium-technology sectors. Discussions with stakeholders also suggest it reflects a tradition of limited cooperation between academic research and productive sectors and public services, which means than many business leaders are unaware or unconvinced of the need for highly qualified research staff. In addition to these core issues, there is in many cases limited direct alignment between the thematic focus of PhDs and possible applications of this knowledge, and associated skills acquired by PhD holders, in the wider economy.

91.   Reliable data on the level of out-migration from Portugal by highly educated individuals is not available. Data on inward migration in selected countries in Northern Europe, as well as anecdotal evidence from stakeholders in Portugal, suggest that significant numbers of highly qualified Portuguese graduates do leave the country to work in the private sector and academia elsewhere in the world. Although the current economic recovery in Portugal is likely to increase employment opportunities in the country, the risks associated with 'brain drain' should not be ignored in planning research and innovation policy.

5.3. Recommendations

1. **Ensure closer alignment between allocation of PhD funding and national research priorities and skills development needs**

Although it is important to maintain some demand-driven public support for doctoral research across fields of study, the current system of public support for doctoral training in Portugal limits the scope for the FCT to direct funding to develop Portugal's high-level skills in priority areas. It also risks making ineffective use of scarce resources, by leading to high quality candidates and programmes in some fields being rejected and lower quality PhDs or programmes in other disciplines being funded in an effort for fairness. In light of the competitive job market for PhD graduates, funding PhDs in areas where there is little demand for graduates is not only a poor use of public money, but encourages individuals to pursue a training and career path that diverts them from more productive options and may ultimately lead to frustration and disappointment.

Portugal should reserve PhD funding for the 'brightest and the best' and target its public support for doctoral training more rigorously. Prioritisation of some fields will inevitably mean other fields are deprioritised. As part of a wider reform of FCT funding for PhD training (see also next recommendation), the FCT should reserve a greater proportion of its training budget for PhDs in fields which the country has identified as specific priorities or where there is an identified need to develop high-level specialists. This prioritisation should be identified in the national strategic frameworks discussed in Chapter 3. Priority fields could be promoted either through dedicated priorities in centralised calls for individual scholarships or dedicated resources for doctoral programmes in priority fields (the UK's Centres for Doctoral Training (CDT) could be a useful reference model in this respect).

2. **Direct more public funding for PhDs to tertiary education institutions through reformed support for doctoral programmes**

Decision-making responsibility for selecting PhD candidates for public funding has historically been concentrated in the FCT. This creates a problem for the stability of funding when the FCT budget is cut, as happened in the recent crisis. More significantly, it leads to a situation where the FCT has prime responsibility for 'picking winners' by selecting the individuals best suited to pursue a doctoral degree. Other OECD countries tend to distribute responsibility for selecting doctoral candidates for funding more widely, notably by giving individual doctoral schools and departments freedom to select candidates for some or all publicly funding doctoral training places.

As part of the wider reform of support for doctoral training, the FCT should allocate at least half of the resources it has available to institutions to operate doctoral programmes. Funded programmes should have certain shared characteristics:

- Partnerships between universities (and potentially polytechnics) and relevant research centres with developed profiles in the fields in question, allowing expertise to be pooled and critical mass to be created.
- An annual entry cohort of at least 12 doctoral students to allow efficient delivery of common training elements and cohort benefits for candidates to be realised

- Well-developed mechanisms to provide mentoring and career guidance to doctoral candidates
- A set of relevant common training components, including a focus on transferable skills sets relevant to careers outside academia.

3. **Develop tailored selection and quality criteria for doctoral training programmes in the business or wider public sectors**

Through its support to individual PhD candidates and doctoral programmes, the FCT should seek to increase the number of doctoral candidates undertaking their PhD in a business or other non-academic setting. The selection criteria and general requirements for FCT-supported doctorates appear not to be adequately tailored to the needs to PhDs that are not based in universities and research centres. As such, the FCT should review the relevant selection criteria and conditions in consultation with representatives of businesses and public sector organisations that would be susceptible to hosting PhD candidates. The CASE scholarships used by UK Research Councils could be a useful reference point.

Given the composition of the Portuguese economy and the limited number of businesses likely to be able to host PhD candidates in the short to medium-term, it is also important that adequate opportunities are given to undertake PhDs in public sector organisations (hospitals, public service organisations and ministries) which potentially have considerable capacity to provide appropriate environments for PhDs researchers.

4. **Maintain and expand the practice of supporting 'mixed' PhD studentships**

The Review Team considers that the model of 'mixed' PhD studentships, whereby the doctoral candidate spends part of their PhD training period abroad is an example of good practice that should be maintained and strengthened. Mixed PhDs provide individuals the opportunity to gain valuable international experience and exposure to expertise and experience that are not necessarily available in Portugal. As such, the 'mixed' model should be retained in the reformed system of FCT support, both for individual studentships and studentships awarded through doctoral programmes.

5. **Improve data collection about the career paths of doctoral candidates and graduates, including those who move abroad.**

As discussed in this chapter, the quality of data available on the academic career paths and subsequent professional development of doctoral candidates and graduates is inadequate to support effective policy making by government and strategy setting by tertiary education institutions. Improved information is also of vital importance to career guidance services and those considering embarking on a doctoral degree. The absence of information on out-migration by doctoral graduates from Portugal is particularly problematic.

As a first step, the Portuguese authorities should require any doctoral candidate supported by the FCT to provide regular updates on their careers as a condition of funding. A suitably simple questionnaire system, respecting relevant privacy legislation, should be developed. The system could be open to students and graduates not supported by the FCT on a voluntary basis.

6. Academic careers

6.1. Introduction

92. The effectiveness of the higher education and public research system depends fundamentally on the staff who work in institutions and research units. Having well-trained, motivated staff is a pre-requisite for any effective system. This chapter examines on the structure and operation of academic careers in Portugal, with a focus on three key aspects: entry to academic careers; the profile of academic positions, rewards and progression possibilities and mobility between positions, international openness and retirement.

93. In relation to these three areas, the key questions addressed by the review include:

1. **Career Planning and Entry**. Do researchers who seek higher education and public research positions have an opportunity to anticipate career openings and plan their training accordingly, and an opportunity to effectively compete for the full range of posts available across Portugal's higher education and public research system?

2. **The Structure of Careers.** Does the legal framework governing academic and research careers provide staff with an opportunity to choose a career profile that suits their interests and abilities; to be evaluated and rewarded for their contributions to their institution, community, and the wider society; and to advance in recognition of their achievements?

3. **Career Mobility, Attractiveness and Retirement.** Has Portugal established a career system that supports beneficial mobility among researchers and academics among higher education institutions within Portugal, and that able to attract researchers working outside Portugal, and retain those who might choose to leave? Does the career system that permits researchers and academics to adjust their responsibilities across their life course, and retire from service in a timely way?

6.2. Diagnosis: Key points

6.2.1. Career Planning and Entry: Queuing and In-Breeding

94. Access to academic careers in Portugal has become increasingly difficult in recent years as a result of increasing supply of potentially qualified candidates for academic positions and falling demand for new academic staff from the tertiary education and public research sector. Since a peak in the total number of posts in 2010/11, around 5 500 posts have been lost in Portuguese universities and polytechnics. Three quarters of these have been in the private sector and 90% at the level of junior lecturer (*assistente*). However, there has also been a decline in the number of staff employed in core academic grades in universities and polytechnics. Staff numbers in the three core academic grades in the *private sector* declined by over 28% between 2010/11 and 2015/16. In the *public sector*, the picture has been more mixed. Here, there was a small increase in the total number of posts in core academic grades, with a 10% increase in the number of posts (1 200 additional posts) at the entry-level positions levels of

professor auxiliar (in universities) and *professor adjunto* (in polytechnics). Other core staff categories saw a modest fall in numbers of the same time period.

95.   As discussed in the previous section, a potentially desirable consequence of the increased flow of new doctorate holders and falling demand in the academic sector has been an increasing tendency for doctoral graduates to seek and find work in other sectors of the economy. A more problematic consequence has been the increase in the number of doctoral graduates in precarious post-doctoral positions, without formal employment contracts and with limited perspectives of obtaining a permanent academic post in the longer term.

96.   While almost 15 000 new doctoral graduates 'came onto the market' in Portugal between 2011 and 2016, in the same time period, just over 3 000 post-doctoral positions were funded directly by the FCT: a ratio of 1:5, even before competition for post-doc positions from older and international PhD graduates is taken into account. In the same timeframe, the number of entry level academic positions suitably for those completing periods as post-docs – as *professor auxiliar* or *professor adjunto* – fell by over 200 posts. Even allowing for promotion and retirement creating 'replacement positions', realistic opportunities for post-docs and other PhD holders to transition to core academic posts have been (and remain) few and far between.

97.   This trend is by no means unique to Portugal. In the US and other OECD countries, for example, there is an ongoing discussion about how to respond to the 'post-doc pile-up' created by expanded use of post-doctoral positions. Although, under the right circumstances, individuals can gain valuable research experience and develop other skills relevant to their future careers, spending prolonged periods as a post-doc has clear down sides. Alongside the stress and uncertainty created by short-term contracts (or grants as in Portugal), post-doc positions may lead individuals to specialise too narrowly and leave little time for them to prepare adequately for subsequent transition to a job outside the academic sector – even though this is statistically the most probable outcome for most.

98.   The new initiative to promote scientific employment launched by the Government in 2016 has the stated aim of creating more and more stable research posts in the academic sector and, in so doing, helping to address the precarious situation of post-doctoral fellows in Portugal. Key objectives of the new initiative are laudable. Creating new permanent research positions at different levels (from junior researcher to coordinating researcher), rather than temporary post-doc positions, is broadly consistent with recommendations made by US National Academies to tackle the 'post-doc pile-up' and enhance the productivity of the research system in the US, for example. However, the new initiative – and particularly the transitional procedures planned to support existing post-docs – also carries risks. For individual PhD graduates and existing post-docs, the new system risks perpetuating unrealistic expectations about the chances of obtaining a permanent academic post and diverting individuals for exploring job options and opportunities in other sectors. For institutions, the transitional regime risks tying (future) resources to existing areas of post-doctoral research activity and restricting opportunities to refocus activities in line with renewed institutional profiles and institutional and national development strategies.

99.   Entry to academic and research careers in Portugal is marked by a high degree endogamy or "in-breeding." On balance, "inbred" scholars produce less research and research of lower quality than do those who have been trained outside the institution in which they make their career (Tavares, Lanca, Amaral, 2017). Moreover, inbreeding is

widely thought to encourage traditionalism, and to endanger excellence and innovation (Altbach et al., 2015). Viewed in comparison to decades past, "recruitment processes in Portuguese academia have been opening up and decisions to hire candidates are increasingly based on merit." However, in spite of extensive legal reforms adopted in 2009 ((Tavares et al., 2015), "formal and informal barriers to open and meritocratic hiring still endure" (Horta, 2013). Doctoral and postdoctoral students with whom the Review Team met frequently expressed their aspiration to make a career in the institution in which they had been trained. Recent analyses by DGEEC (2017) shows that 70% of public university faculty received their PhD at the institution in which they hold their appointment, 19% took their PhD abroad, and another 10% hold a PhD from a different Portuguese university.

100. The level of inbreeding varies between and within public higher education institutions. In some organic units more than 95 percent of those holding career appointments have received their doctorate at the institution, while in others – exceptionally - fewer than 5 percent have done so. Additionally, there is significant variation in inbreeding by faculty rank. Variation in inbreeding arises from many factors, including exclusiveness (or, near-exclusiveness) of supply, the physical isolation of higher education institutions, the age and reputation of the institution, and, norms and practices that give favour to local candidates.

6.2.2. The Structure of Careers: Weak Differentiation and Performance-Based Rewards

101. Careers in public higher education institutions are structured to a large extent by national legal and regulatory frameworks. As well as defining staff categories and selection requirements, the specific legislation dealing with careers for university and polytechnic teaching staff also specifies maximum and minimum ratios for particular grades and staff categories, imposes minimum and maximum teaching hours and contains general guidelines relating to staff evaluation, promotion and pay. Portugal also has the specificity of having a distinct legal basis to regulate 'research careers', even though university – and increasingly polytechnic – teachers (*docentes*) are expected to conduct research as well as teach. The comparatively detailed regulation of academic careers in law in Portugal creates rigidities in the system, in particular in relation to the way staff use their time and profile themselves.

102. Interviewees in many of the institutions visited during the Review told the Review team that this centralised regulation of workload, in particular, created a significant obstacle to staff organising their time and developing their careers effectively. In particular it can be hard for staff to dedicate specific periods to research or for some staff members to profile themselves to a greater extent in research or teaching. Although the concerns of staff about the inflexibility of the legal provisions are legitimate, the principle that academic staff should both teach and conduct research is both fundamental to the European university tradition and crucial to ensuring high quality research-based instruction in universities and polytechnics. The most appropriate solution would appear to be to introduce more flexibility into the law to allow staff to develop more differentiated profiles, while maintaining the link between teaching and research.

103. Few public higher education institutions have provided opportunities for academic staff to collaborate in the design of performance evaluation systems that are well-understood and well-regarded, and that permit faculty members to choose

evaluation profiles that align to their preferred career profiles. Those higher education institutions that have chosen to adopt foundation status have the possibility to establish positions under private rather than public law, providing them with an opportunity to establishing their own policies with respect to compensation and teaching responsibilities. However, few institutions (six) have adopted foundation status, and few of those that have established alternative career policies for academics holding private law appointments.

104. Several factors have militated against the widespread implementation of effective performance evaluation and reward systems in Portuguese tertiary education institutions. As in other countries, the principle of academic autonomy and the absence of any tradition of performance evaluation for staff in tertiary education have made progress in this area slow. In addition, the rigid national pay scale applied in public institutions, with relative few pay steps in each grade and comparatively small pay differences between steps and the absence of public money to fund individual pay rises in recent years have made it difficult to develop systems of performance evaluation which link performance with financial rewards.

6.2.3. Career Mobility and Retirement: Low Mobility and Late Retirement

105. Those who hold career appointments in academia in Portugal tend not to move between institutions in the country. The data showing the proportions of academic staff in public universities that gained a PhD in the institution where they currently work (DGEEC, 2017b) points to very low rates of inter-institutional mobility throughout individuals' careers. The combination of a national salary scale and low differentiation in career profiles across institutions reduces the incentives the incentives for academics to move institutions to obtain a role that better fits their desired profile or in order to gain a pay rise. The numerous available opportunities to conduct research outside one's host institution through affiliation with an associated laboratory or R&D centre further reduce the incentives to move. As noted in the earlier discussion of in-breeding, limited mobility reduces the range of experience gained by individuals and the innovation and development benefits for institutions of bringing in 'new blood' (Altbach et al., 2015)..

106. In-breeding and the comparatively static nature of academic careers in Portugal Academic careers in Portugal are also contributing factors in explaining the comparatively low level of internationalisation among academic staff in the country. The proportion of international staff in tertiary education institutions has remained stable at a comparatively low level over the last decade. In the academic year 2015/16, of the 32 580 academic staff (all categories) in public and private higher education in Portugal, 1 110 (or 3.4%) were of non-Portuguese nationality.

107. Many of the factors that make Portugal an attractive destination for international students (notably in the EU-sponsored Erasmus+ programme), such as culture, climate, cost-of-living and the reputation of Portuguese higher education in certain specific disciplines, hold equally for international staff. As more programmes have been created that are taught partially or entirely in English, language has become less of a barrier for academics from abroad than it once was. The level of salaries in relation to the cost of living makes them comparatively competitive. However, alongside the tendency for in-breeding, limited job opportunities in recent years, pay cuts and freezes and the wider structural problems affecting the organisation and performance of the system that are discussed in this report, have all combined to reduce the more general attractiveness of Portuguese tertiary education for international academics.

108. Another aspect of the static nature of staffing in Portuguese tertiary education is that older staff often remain in post beyond pensionable retirement age, limiting opportunities for younger staff members to advance into more senior posts. This problem is particularly pronounced in the public and private university sectors. In public universities, 50% of full professors and 28% of associated professors were over 60 in 2015/16. The equivalent figures for the smaller private university sector were 71% and 29%. Across the public and private university sectors, 17% of staff in the core academic grades are over 60, meaning around 2 400 posts will be freed up by retirement in the next decade, assuming the posts in question are maintained in the system. The age profile of staff in the polytechnic sector is much younger.

109. Given the limited opportunities to tailor activities to current strengths, those who may be beyond the peak of their research productivity have few opportunities to reallocate their responsibilities to areas in which advanced seniority might improve performance, such as institutional administration and community engagement. Research (such as Stephan and Levin, 1992) has shown that the age of academic staff matters: those trained in the 1980s and 1990s, not to mention the 1970s, are less likely to be at the forefront in adopting and implementing new technologies and methods. The relationship between age and productivity is stronger in the physical and earth sciences than in the life sciences. Older scientists may also stifle the creativity and productivity of the relatively fewer younger scientists who are working in Portugal today.

6.3. Recommendations

1. **Improve information and guidance to prospective academic staff**

Portugal needs to ensure talented people are able to make the best use of their knowledge and skills for the good of the country. Ensuring the brightest and best are attracted to careers in academia and public research is an important part of this. However, the current system in Portugal – as in other OECD countries – too many young (and less young) doctoral graduates seek to embark on an academic career with unrealistic expectations about the probability of ultimately securing an academic post. This can lead to a sub-optimal use of talent. The tertiary education sector as a whole has a responsibility to be more transparent about the likely flow of job opportunities and the purpose of post-doctoral positions.

Relevant public authorities, including the FCT, along with tertiary education institutions, should develop guidance and information campaigns to ensure those considering an academic career are well informed, including:

- Making clear that post-doctoral positions are only appropriate for those seeking to pursue and advanced research career and should in no sense be viewed as the default step for those completing doctoral training[7].
- Publishing transparent information about likely recruitment of staff into entry level academic positions (*professor auxiliar*, *professor adjunto*, *investigador auxiliar*) by providing project recruitment plans for the next five years, which are updated annually.

2. **Ensure that post-doctoral positions (*Investigador júnior*) allow post-docs to gain skills and experience that can be exploited outside academia**

Recognising that entry to permanent academic posts will – and must – remain highly competitive, those who do embark on a period as a post-doc under the new system of post-doctoral support in Portugal must be supported to develop experience and skills which they can also use to obtain and thrive in work outside the academic sector in Portugal. As a condition for receiving direct or indirect funding from the state (primarily directed through the FCT), post-docs and their host institutions should be required to jointly produce a career and skills development plan setting out specific measures the post-doc will take to develop their wider skills sets and how the institution will support the post-doc in skills development and career planning. All post-docs should have access to a mentor, who is different from their direct supervisor, who can support them in career planning.

3. **Ensure fixed-term and permanent employment positions created through the new initiative for scientific employment support institutional profiling and development strategies.**

The new system to support scientific employment must be used to support the development of institutional profiles as recommended in Chapter 4. The best available candidates need to be employed in research and teaching activities that help the institution develop its areas of strength and build its profile. The objective is to create more permanent research posts is commendable and consistent with recommendations made in other research systems. However, it is imperative that the new system does not lead to poor quality candidates being employed on permanent contracts in fields which contribute

little to institutional development and the needs of Portuguese society more generally. To avoid this, the Portuguese authorities should:

- Ensure that alignment with institutional profiling and national development goals is a criterion in the selection of new post-docs and other research posts created through the initiative on scientific employment.
- Encourage applications to posts from individuals based or educated in institutions other than the host institution for the post.
- Allow institutions the maximum degree to flexibility in creating permanent academic posts after the subsidised fixed-term contract periods have expired, notably through avoiding a narrow definition of the scientific area in which the new post should be created.

4. **Ensure institutions and academic staff have flexibility to allocate staff time efficiently and to follow different career profiles**

Modify, to the extent necessary, the legal framework for academic careers to allow institutions to set their own policies with respect to time allocation to teaching, research and outreach in response to short-term changes in their responsibilities, and to create opportunities for staff to choose among differentiated career profiles for those who wish to adopt long-term changes to the balance of responsibilities they perform. Policymakers should use the new role of A3ES as an evaluator of higher education *institutions* as part of this process. Institutional review by A3ES should permit higher education institutions to demonstrate their fitness and capacity to take responsibility for workload and career profiles, and to become self-regulating with respect to workload and career profile policies rather than subject to national regulation.

5. **Encourage institutions to implement transparent staff performance review arrangements that are aligned to institutional mission, and support differentiation in pay and rewards.**

After transparent systems of performance review aligned to institutional mission are established, they should be used to support differentiation in compensation and other rewards. In the near term, these agreed evaluation systems should initially be used to support the allocation of benefits permissible under current law, such as performance bonuses, and temporary revisions to teaching obligations (within the national framework). In the longer run, performance evaluation plans should be used to support decisions about within-rank increases in compensation; limited adjustments to base compensation that may become available within a modified legislative framework; and to guide decisions for those who hold appointments under private law in foundation universities.

6. **Promote near-term measures to increase inter-institutional mobility and timely retirement, while, in the long-term, adopting reforms that increase domestic and international mobility.**

In the near term, promote inter-institutional mobility through short-term faculty exchange programmes and expanded opportunities for visiting appointments through funds allocated by FCT, and awarded by higher education institutions. Additionally, ensure that research staff retires at a fully pensionable age, in line with national legislation, to ensure senior positions are freed up. The reforms described above – with wider institutional responsibility to set workload, career profile, and compensation policies that are aligned

to differentiated institutional profiles -- will significantly increase domestic mobility by creating incentives for mobility that are presently absent. These reforms, in combination with the further development of private law employment in foundation universities, will make Portugal a significantly more attractive destination for researchers than it is at present.

7. High-skilled employment, cooperation with TEIs and innovation in the business sector

7.1. Introduction

110. Portugal has significantly increased its innovation capacity since it joined the European Union, but significant barriers to innovation in the economy remain. This calls for coordinated efforts in research, innovation and higher education policy to increase the knowledge-intensity of the private sector, supporting in a consistent manner both the supply and demand side of knowledge. This includes fostering the employment of highly skilled people in the private sector, strengthening collaborative R&D between businesses and HEIs and research units, the creation of new firms, the strengthening of knowledge-intensive clusters and different types of intermediary organisations, and embedding Portuguese businesses and research units more firmly in international knowledge and value chains. Alongside support to research-based innovation, the upgrading of low-tech SMEs and the strengthening of managerial skills are crucial mechanisms for increasing the level of innovation in Portugal.

111. Against this backdrop, the Review considers two key questions in this section:

1. How can Portugal revitalise its industries, support the emergence of new sectors and strengthen firms' competitiveness through innovation?
2. How can Portugal ensure that public research and the knowledge transfer infrastructure help support a virtuous cycle of research and innovation?

7.2. Diagnosis: Key points

7.2.1. Innovation dynamics

112. The Portuguese business sector has significantly enhanced its innovation capacity over the two last decades, in particular during the period preceding the outbreak of the 2008 crisis. This improvement is reflected in particular in the increase of business R&D expenditures and the number of researchers working in the business sector, the stronger focus of research organisations on knowledge transfer and the development of intermediary organisations to support such activities. However, the investment of Portuguese industry and service sectors in R&D and innovation has slowed down as a result of the crisis. Some recent positive trends, still to be confirmed in coming years, show an increase of the participation of Portuguese firms in business innovation support schemes led by the national innovation agency (ANI), including by companies newly engaged in innovation activities.

113. Innovation input and, especially, output indicators (patents) have nonetheless remained at a low level compared to the OECD average, partly due to the dominance of SMEs and the weight of traditional sectors (textiles, food and beverage, ceramics/materials, paper/wood/furniture) in the economy. However, a few traditional industries (the shoe industry, but also textiles, clothing and moulding) have managed quite successfully a shift towards higher added-value products and services and increasing exports. Several firms in these sectors 'challenge' the distinction between low, medium and high tech industries by committing significant resources in process and product innovation activities.

114. Nonetheless, despite a decrease of the concentration of R&D activities in a limited number of large enterprises, the vast majority of other firms in these sectors do not innovate and remain confined to local, regional or, at best, national markets. These structural problems have become more acute as research activities in some formerly strong sectors (telecommunications, energy) have declined and new emerging sectors have not yet taken over.

115. The business demand for knowledge, channelled through research organisations, intermediaries or directly through employment of high-skilled new recruits (including PhDs), remains weak. While a proportion of firms similar to comparable countries seem to be engaged in innovation activities, these remain of limited scale in Portugal, low knowledge intensity, and remain very close to the market or limited to the purchase of new machinery, equipment and software. Foreign direct investment (FDI) is comparatively limited and cannot compensate for this lack of domestic business innovation. Moreover, despite rare significant industrial R&D investments (e.g. Bosch performing research in Braga on new car multimedia technologies), most inward investment is concentrated in services with modest knowledge intensity (e.g. accounting, HR management, etc.).

7.2.2. Regional distribution of innovation activities

116. The innovation landscape in Portugal is characterised by strong regional imbalances, with a clear concentration of knowledge-intensive activities on the coastal areas (around Lisbon and Porto), as well as in the North and Centre regions. The interior of the country is characterised by low knowledge intensity economic activities, and its challenges are compounded by demographic decline and significant outward migration.

117. Higher education institutions in these regions remain comparatively unattractive for students and staff from other regions, both as a result of their perceived remoteness and a lack of clear specialisation in areas of excellence. The comparative weakness of the higher education sector in interior regions and an apparent mismatch between training provided and the needs of regional industries with greatest knowledge-based growth potential create a vicious circle that hinders the catch-up of the lagging regions.

118. It is not clear whether investments made using European Structural Funds, which have been targeted on innovation-related activities in Portugal's 'less developed' and 'transition' regions8, can offset this trend and facilitate the convergence. Despite the Smart Specialisation approach that governs the allocation of these funds, the project-based nature of Structural Fund investments, as well as their emphasis on research excellence do not ensure sufficient stability to build sustainable and regionally relevant innovation ecosystems. Moreover, national funds tend to be used to compensate the regions (Lisbon region and to a lesser extent the Algarve) that in 'more developed' and 'transition' regions.

119. Since 2008, the Structural Funds have supported the formation of competitiveness and technology poles and clusters. International experience, but also some of the above mentioned industry renewal success stories in Portugal, show that these localised initiatives can be instrumental in developing new activities even in more remote areas, around technology centres and/or TEIs, in particular Polytechnics. Despite a generally positive evaluation of this 'poles and clusters' programme in 2013, several improvements were suggested to the governance model of the programme, in order to improve strategic monitoring and learning. The evaluation also emphasised that the

relevance of these schemes to local strengths and weaknesses could be improved by a better connection with the regional Smart Specialisation Strategies.

7.2.3. Supply and demand of highly qualified personnel

120. As noted in sections 4 and 5, Portugal has improved the level of qualification of its population over the past decades. It now offers a well-qualified human resource base of graduates and PhD holders and comparatively low labour costs.

121. However, despite the lack of relevant data on high-skill labour market bottlenecks, it appears through interviews that firms in some sectors (in particular ICT) have increasing difficulties finding appropriately skilled staff for their development needs. Also, while PhD studies have been a strong priority in recent years, the demand for PhD graduates working in research outside the academic sector remains very low. The importance of refocussing the PhD training system in Portugal is highlighted in Section 4.

7.2.4. Knowledge exchange and entrepreneurship

122. Portuguese industry and public research and higher education institutions are insufficiently connected to each other. Several new initiatives, including the recent Collaborative Laboratories (CoLABs), could play a role to reduce this gap. However, given the characteristics of the industry structure, the needed support to knowledge exchange goes far beyond science-industry relationships. More generic and systematic support to innovation, even in low tech firms, is essential and intermediary organisations, now about to be strengthened with government institutional funding, will be key in this wide upgrading process.

123. Although hard to measure given the diversity and intangibility of knowledge transfer channels, the low number of public-private co-publications, the share of patents co-filed between HEIs and firms and the share of Portuguese publications cited in patents all converge to show the limited extent of the science-industry relationships in Portugal. Notable exceptions are, for example, success stories in the University of Coimbra, the engineering schools at the universities of Porto, Lisbon, Aveiro, or the Polytechnic of Bragança.

124. Besides the structural problems already mentioned on the industry side, an additional important barrier to knowledge transfer is the lack of effective incentives in higher education and research institutions to cooperate with the private sectors, both at institutional and individual researchers' levels.

125. Structured and institutionalised partnerships between HEIs and industry are rare, as demonstrated by the very limited share of higher education expenditures financed by business firms, although there are some notable examples. These include the decision by Hovione, a pharmaceutical company, to sponsor an analytical chemistry laboratory in collaboration with several polytechnics, which at the same time offer courses relevant to the company's needs. Bosch in Braga is another good example of a partnership encompassing research, higher education and professional training. These initiatives could serve as role models for other companies or wider schemes. However, they also demonstrate that building such partnerships require years of private investment and public support.

126. The recently launched CoLABs initiative should allow deepening and expanding a limited number of research-industry partnerships, following the model of similar

initiatives such as the Carnot Institutes in France. Although each of the six selected partnerships can in theory have significant economic and social impacts in areas of national strategic interests (ocean economy, digital transformation, agriculture, environment), this approach can only concern the collaborative research 'elites' and cannot be considered as an instrument to systematise research-industry relationships. It is unlikely than many firms can commit on a long-term basis the required investment in cooperative research with TEIs.

127. Against this backdrop, the infrastructure of intermediary organisations is essential to support the SMEs that do not have the financial and innovation capacity to directly engage in cooperation with HEIs. The Government has progressively created a diversified system of intermediary organisations (transfer offices, technology centres, S&T parks, incubators, poles and clusters) to fulfil a wide range of business knowledge transfer and service needs, from science-based to very incremental and problem-solving innovations. It has been documented that some of these intermediary organisations, in particular Technology Centres, have been in several cases very instrumental in this upgrading process. They not only gradually provided the needed technologies and skills, but also promoted and supported collective actions among these – sometimes competing – firms. This upgrading process came, however, at the price of significant job losses in these sectors.

128. While some of these intermediary organisations benefited from Structural Funds at the origin, these organisations have since then received no basic funding. This has resulted, especially during the crisis years, in a marked slippage toward consulting engineering and other commercial activities, at the detriment of the share of more "upstream" applied research and innovation collaborative activities. The Interface Programme launched by the government in 2017 consist of several key measures for selected intermediary organisations (labelled as *Centros de Interface Tecnológico* [CIT] following a call for applications) to help these organisations rebalance their portfolio of activities between risky collaborative applied research and innovation activities and commercial activities. These measures include, in particular, some multi-annual basic funding, measures to support the hiring of PhDs by these organisations in collaborations with industry as well as financial support for acquiring new equipment. This institutional funding, if limited to the funding of public service missions and linked to regular evaluations, could have a significant and wide-ranging effect on the upgrading of the domestic firms innovation capacity.

7.2.5. *Government support to business innovation*

129. The economic success of many Portuguese firms was most often not brought about by science-based innovation, but is rather rooted in incremental innovation and learning by doing. It is therefore essential that public support covers the wide range of types of innovation, from the knowledge-intensive projects based on internal R&D and collaboration with academic research to rather informal and incremental innovation activities.

130. Recognising this imperative, the portfolio of support instruments has evolved over time in relation to the different generations of Structural Funds, which finance the bulk of the direct innovation financial incentives available to business firms. An analysis of their allocation over the period 2000-2020 – hence covering three generations of Funds –allows to show that there has been a marked increase in the support to business innovation, which is currently the principal objective in PT2020, to the detriment of the

support to advanced training of human resources, research infrastructures and equipment, which attracted most of the resources during the initial periods of building of the TERI system.

131. However, business firms still largely rely on their own resources to finance their innovation activities. Direct financial government support to business innovation remains rather marginal. While Portuguese firms seem to be proportionally as numerous as their relevant foreign counterparts to benefit from direct public support, the average financial amounts they are granted per project are relatively small. The bureaucracy and red tape associated to applications to competitive instruments financed via Structural Funds was considered a major deterrent by the companies interviewed during the Review.

132. In this context, the R&D tax incentive scheme SIFIDE is the main instrument to support R&D *stricto sensu* (0,1% of GDP, while direct funding instrument accounts for only 0,05%). Consistently with international trends, whereby the availability, generosity and simplicity of use of R&D tax incentives have significantly increased in the OECD area and beyond over the past decade, Portugal has reformed SIFIDE in order to improve its attractiveness and effectiveness. As a result of these recent changes, the Portuguese tax incentive scheme is currently among the most generous among all OECD countries, with France and Spain.

7.3. Recommendations

1. **Strengthen regionally-based (cluster) sectoral initiatives in order to promote their upgrading and competitiveness on global markets, in line with the national priorities**

Efforts should be devoted in particular to enhance the regional network density of these clusters by facilitating and incentivising their relationships with the HEIs (Polytechnics and 'regional universities') and the various other intermediaries. The broadening of their range of missions and corresponding activities should be encouraged according to local needs, e.g. special forms training (on innovation, IP management, digital transformation, internationalisation, etc.) and other support services to local companies. The type of public support they receive, currently focused on innovation projects in a rather narrow sense in the framework of the Structural Funds, should be adapted to this broadened portfolio of activities.

2. **Set up regional innovation platforms to provide domestic SMEs easy access to critical resources for upgrading their innovation capabilities (information, expertise, specific equipment, etc.).**

These permanent (non-project based) local platforms should be resourced with the relevant experienced staff and equipment (e.g. for metrology and testing) to be able to support local companies to engage in innovation activities. Emulating the best international practices of 'technology extension' services, their activities should include not only specific hands-on support activities to individual (or groups of) SMEs (technical assistance and consulting, interface between experts, from academia and industry) but also public mission services (provision of information, awareness-raising, promotion of innovation, general capability building, etc.). These public mission services should be financed by the government. Their beneficiary targets should in particular include SMEs

with only limited in-house innovation capabilities that rarely co-operate with academia, do not hire highly-skilled staff and seldom use shared equipment. These companies generally do not innovate, either for lack of entrepreneurial culture, skills, incentives or, simply, identified innovation opportunities.

Several organisations deliver some of these activities, in particular Polytechnics, Technology centres (and other intermediary organisations), Clusters and Poles or even networks financed by ANI's Mobilizing projects. Building on the experience and resources of these organisations, the added value of the regional innovation platforms lies in their systematic approach and the wide range of services they would provide.

The precise composition and status of these platforms is beyond the scope of this Review and could only be the result of negotiations with public national and regional authorities and the existing providers of some of these services.

Different options exist, including creating them within or in close connection with Polytechnics, which could be the backbone of these platforms in each of their respective speciality. Several of the polytechnics the Review team visited have already engaged in significant collaborations with regional industries and services but these remain often on a limited scale. Support and incentives should be granted to these institutions so that they become acknowledged as key providers of research and innovation services in companies.

3. **Keep on supporting the upgrading of polytechnics toward 'practice-based knowledge-intensive institutions' dedicated to local development**

Polytechnics should supported and incentivised to build a profile in enhanced professional education (short courses on emerging technologies, digitalisation, innovation management or other matters of primary relevance to industry) and collaborative research. This would allow them to play a more extensive role in the provision of professional skills to support the upgrading of industry and services that they currently do.

Polytechnics could be incentivised to provide enhanced professional education through accreditation and other means (including. institutional evaluation and performance contracts), in close connection with their research activities. The on-going specific FCT support to research in polytechnics in collaboration with industry should be continued.

The revision of the legal basis of polytechnics to allow them to award doctoral degrees under certain conditions (see recommendation in section 3.3), pertaining in particular to their third mission activities, will be also instrumental to develop such enhanced professional education profile and connect it to their research capacity.

4. **Ensure that intermediary organisations have a sufficient level of guaranteed multi-annual funding to maintain and expand their networks, infrastructures and support services**

Intermediary organisations (clusters, technology centres, applied research centres, etc.) fulfil various tasks to support innovation in firms and public organisations. It is widely acknowledged that some of these tasks have the nature of public mission and should therefore be funded via stable state or EU funding (at a level of 20 to 30% of their turnover, as most of their competitors) in order to avoid significant drift toward more

lucrative commercial activities (engineering consulting, etc.). The government has recently announced the launch of the Interface Programme, which includes several support schemes (including a share of basic funding) for selected 'labelled' intermediary organisations. This programme should be implemented and maintained on a continuous basis for intermediary organisations that have successfully fulfilled the objectives announced in their development plans.

5. **Support the mutualisation and partnerships between knowledge transfer organisations, when relevant**

Several studies have shown that the performance of knowledge transfer organisations and services are positively linked to the size of the higher education institutions to which they are connected. In such a context where 'size matters', the mutualisation of knowledge transfer services of different institutions should be promoted in order to encourage critical mass of project deal flows and strengthen the specialised expertise of internal staff of these organisations.

Various models of such groupings and partnerships –for instance the Technology Transfer Alliances – exist and could serve as examples (e.g. Innovation Transfer Network [ITN] in the US, SATT in France). These initiatives differ according to the methods to mutualise knowledge transfer services, from the creation of networks and consortiums where some resources and shared and exchanges encouraged, to the merger of TTOs. The models also vary according to the logic of mutualisation, regional (one TTO to serve all universities and research institutions in a given region) or thematic (specialised 'hubs' of TTOs in specialised thematic areas).

8. Conclusion and way forward

133. Following significant structural reforms undertaken after the crisis, the growth of the economy has resumed and is well-established. The recovery is supported by domestic consumption growth and a pick-up in major export market growth and increased public investment.[9] These positive results rely partly on the progress made in expanding the capacity and improving the quality of the higher education, research and innovation system during the years preceding the crisis, as well as during the difficult times of budget austerity that followed it. The public and private expenditures on higher education, research and innovation are also on the rise again, which should strengthen these positive trends.

134. Against this backdrop the government has set the objective of reaching 3% of R&D intensity (R&D expenditure as a percentage of GDP) in 2030. This objective would necessitate, if the private business sector bears two-third of this R&D investment

effort, a two-fold increase of public expenditure between 2018 and 2030, with annual rises in public spending of nearly €100 million. It would require a simultaneous increase in private expenditures by a factor of almost four. This would require a level of growth over a duration that Portugal has not previously achieved. Setting to one side growth in private investment – which is effectively outside the control of MCTES -- we note that achieving this goal requires an annual rise in public spending of nearly €100 million. This investment would be beneficial to the nation, but if made using existing governing mechanisms and allocation processes, it would not consistently contribute to innovation and productivity growth. Rather, a commitment of public spending on this level should be linked to the reforms we have identified in the review.

Endnotes

[1] The Netherlands, Ireland, UK, Norway, Sweden, France.

[2] The Programme of the Constitutional Government and the Grandes Opções do Plano [GOP]

[3] Including funding for CoLABS, GoPortugal, Atlantic International Research Centre, among others.

[4] It should be noted that an interministerial working group was foreseen in the 2016 "Commitment with knowledge and science" Agenda.

[5] The EUA's 2017 Autonomy Scorecard places Portugal 7/29 for 'organisational' and 'financial' autonomy; 18/29 for 'staffing' autonomy and 20/29 for 'academic' autonomy.

[6] University of Porto, University of Aveiro, ISCTE Lisbon (since 2009), University of Minho and Universidade Nova de Lisboa (since 2015-2016).

[7] This recommendation stems from National Academies (2014)

[8] Covering the entire country with the exception of the Lisbon region.

[9] OECD (2017), *OECD Economic Outlook, Interim Report September 2017*, OECD Publishing, Paris. http://dx.doi.org/10.1787/eco_outlook-v2017-sup1-en