INSTITUTO
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Novos desafios do ensino doutoral: políticas, configurações e percursos entre universidades e empresas

Ana Patrícia Silva dos Santos

Doutoramento em Sociologia

Orientadores(as):

Doutora Maria Teresa de Morais Sarmento Patrício, Professora Associada, Iscte-IUL

Doutora Taran Mari Thune, Professora, Universidade de Oslo

Agosto, 2022

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E POLÍTICAS PÚBLICAS

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“Mas tudo tem o seu fim: se começa, há-de acabar”

Peter Newell (1910), O livro inclinado, Coleção Orfeu Mini

“A viagem não acaba nunca. Só os viajantes acabam. E mesmo estes podem prolongar-se em memória, em lembrança, em narrativa. Quando o viajante se sentou na areia da praia e disse: Não há mais o que ver, sabia que não era assim. O fim duma viagem é apenas o começo de outra”.

José Saramago (1995), A viajem do elefante, p.179

Agradecimentos

Se me dissessem há poucos anos atrás que iria escrever os agradecimentos numa tese de doutoramento iria sorrir, incrédula. Mas aqui estou eu. Aconteceu.

Está ainda presente na memória o almoço de família que se seguiu à bênção das fitas, no ano de 2004, quando finalizei a licenciatura. Era o orgulho de família e o meu saudoso avô já podia dizer a quem quisesse ouvir: “a minha neta é doutora”. Não era na altura, mas agora espero vir a ser. Não pela garantia de futuro que tenho pela frente. Já passou o tempo em que era assim. Se continuasse na academia esperava-me mais uma sucessão de bolsas sem direitos ou uma imensidão de trabalhos com sentido que não são compatíveis com um rendimento mensal digno. O que me moveu também está muito longe da tentativa de proporcionar renovado orgulho à minha família. Provavelmente perguntar-se-ão, como uma boa parte da sociedade portuguesa, “para que serve tal diploma?”.

Foi um processo intenso, prolongado. Nem linear nem contínuo. Conjugado com outros processos – como a maternidade – com outros projetos – dentro e fora da academia – com o confronto com um corpo esquecido – e o seu inesperado invasor. Permitiu-me ter tempo para ler – talvez em demasia – para ir ao encontro de planos e projetos antigos, de conhecer pessoas de vários meios e lugares que enriqueceram o meu percurso. Foi esse o caminho que deu luz a esta tese.

Continuei a debruçar-me sobre a educação – o meu interesse permanente. Continuei a ir ao encontro e dar voz àqueles que são, recorrentemente, os mais esquecidos: neste caso, os próprios estudantes de doutoramento. Continuei a querer perceber e analisar os fenómenos da forma mais holística possível – ainda não sei se consegui.

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Abstract

O ensino doutoral tem atravessado transformações impulsionadas pela "sociedade do conhecimento". A introdução de colaborações universidade-empresa no ensino doutoral tornou-se desejável e promovida, embora os processos e efeitos envolvidos sejam geralmente desconhecidos. O presente estudo sociológico pretende contribuir para o seu conhecimento, tendo em conta três níveis de análise: o macro, das tendências europeias e especificidades das políticas nacionais; o meso, de práticas de colaboração; e o micro, dos percursos dos doutorandos. Particular atenção é dada às culturas dos dois setores, ao capital social existente e adquirido e ao papel dos doutorandos no processo. A partir da triangulação de instrumentos, os resultados evidenciam que o ensino doutoral, embora com tendências convergentes, reage, a nível nacional, de forma distinta das orientações europeias. O governo português tem atuado como promotor das colaborações, sobretudo a partir do acesso a financiamento, mas com instrumentos que variam em termos de foco e narrativa. A diversidade de modelos de colaboração é moldada, em particular, pelo capital cognitivo e relacional dos académicos. Os doutorandos, incorporando e traduzindo linguagens e lógicas diversas, são impulsionadores dos processos de colaboração e de transferência de conhecimento. Por último, tais contextos de formação e socialização têm influência nas experiências académicas e perceções dos doutorandos, mas sem implicar mudanças abruptas na cultura académica. Os resultados têm implicações significativas para a elaboração ou reconceptualização de políticas, sobretudo em países que se iniciam nestes processos, e em contextos académicos que pretendam potencializar colaborações profícuas para todos os envolvidos, em particular para os doutorandos.

Palavras-chave: ensino doutoral, programas de doutoramento, colaboração universidade-empresa, sociedade do conhecimento

Abstract

Doctoral education has undergone transformations driven by the “knowledge society”. The introduction of university-industry collaborations in doctoral education has become desirable and promoted, although the processes and effects involved are generally unknown. The present sociological study contributes to new knowledge of these, taking into account three levels of analysis: the macro, of European trends and specificities of the national policies; the meso, of collaboration practices; and the individual, of the paths of doctoral students. Particular attention is given to the cultures of the two sectors, to the existing and acquired social capital and to the role of doctoral students in the process. The results show that doctoral education reacts, at national level, differently to European guidelines. The Portuguese government has acted as a promoter of collaborations, mainly through access to funding, but with instruments that vary in terms of focus and narratives. The collaboration models are shaped, in particular, by the cognitive and relational capital of academics. Doctoral students, incorporating and translating different languages and logics, are drivers of collaboration processes and the consequent transfer of knowledge. Finally, such training and socialization contexts have influences on the academic experiences and perceptions of doctoral students, but without implying abrupt changes in academic culture. Such results have significant implications for the elaboration or reconceptualization of policies, especially in countries that are starting in these processes, and in academic contexts that intend to enhance fruitful collaborations for all those involved, in particular for doctoral students.

Keywords: doctoral education, doctoral programs, university-industry collaboration, knowledge society

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INTRODUÇÃO

1. A delimitação da problemática e do objeto de estudo: o ensino doutoral em colaboração com o tecido empresarial

Na chamada "sociedade do conhecimento" pressupõe-se que a produção de conhecimento é o principal estímulo para o desenvolvimento social e económico (Kehm 2007; Pinheiro, Langa & Pausits 2015). A agenda de modernização da Europa tem acompanhado tal crença e promovido um percurso de criação das condições para se afirmar como a economia mais competitiva e dinâmica do mundo, utilizando o conhecimento como recurso nacional e como vantagem competitiva (Comissão Europeia 2010) – ideia que o termo "Europa do conhecimento" consubstancia.

Neste contexto, as universidades ganham um maior reconhecimento, social e económico, do seu papel enquanto catalisadoras da produção de conhecimento e orquestradoras de inovação científica e tecnológica. Frequentemente descritas como "torres de marfim" (Shapin 2012), as universidades são pressionadas para produzir conhecimento relevante para a economia, socialmente responsável e que assegure padrões estipulados de qualidade (Magalhães e Amaral 2007; Banarjee e Morley 2013).

Com o impulso de tais movimentações, aquando da criação do Espaço Europeu do Ensino Superior e do Espaço Europeu da Investigação - estratégias reunidas na ideia de uma "Europa do conhecimento" – o ensino doutoral, inicialmente deixado de fora do Processo de Bolonha[1], tornou-se parte da agenda. Tem ganho uma atenção sem precedentes na ampla agenda social e política para modernizar o ensino superior, o sistema científico e o sistema de inovação. O seu potencial em termos de desenvolvimento económico e de promoção de inovação é identificado pela Comissão Europeia em diferentes documentos (ver, por exemplo, Comissão Europeia 2011).[2] Passou, então, a localizar-se, enquanto discurso, como matéria-prima para uma nova economia (como refere Barnacle 2005), como ponte que liga o Espaço Europeu de Ensino Superior e o Espaço Europeu de Investigação (na visão da European University Association 2005), ou inserindo-o no "triângulo do conhecimento" (como definido

[1] O Processo de Bolonha na Europa impulsionou uma reforma significativa no ensino superior. Um dos seus princípios centrais foi o reconhecimento de três "ciclos" no ensino superior - licenciatura, mestrado e doutoramento. O ensino doutoral foi integrado aquando do Comunicado de Berlim de 2003. Na maioria dos países europeus o doutoramento envolve três a quatro anos de estudo em tempo integral e a exigência da realização de uma investigação original.

[2] Ressalta-se que o sistema de ensino superior dos Estados Unidos, embora com uma estrutura bastante diferente do sistema de ensino superior europeu (tamanho, controlo descentralizado, diversidade institucional, competição entre instituições, alto nível de autonomia), serve frequentemente de modelo de comparação em tais discursos. Para uma visão ampliada sobre esse aspeto ver Altach (2007).

por Borrell-Damian 2009) com o intuito de promover relações mais estreitas entre os vértices ensino, investigação e inovação.

Com a passagem do ensino doutoral da "periferia" para o "centro", a prioridade estratégica dada a investimentos públicos que reforçassem a sua rápida expansão foi sentida entre fronteiras europeias, incluindo em Portugal. A importância da investigação e da inovação numa economia competitiva e globalizada é associada à disponibilidade de uma força de trabalho altamente qualificada (Auriol 2007; Auriol 2010), em particular ao aumento do número de doutorados. Neste sentido, os doutorados passam a ser enunciados em documentos de política supranacional como atores-chave para a criação, desenvolvimento e transferência de conhecimento e inovação (ver, por exemplo, Estratégia de Lisboa e Europa 2020). Concomitantemente, o foco do investimento estratégico das universidades tem vindo a orientar-se para os programas de doutoramento (Horta 2008) e a investigação académica, incluindo a produzida por doutorandos, torna-se um bem posicional (Marginson 2006).

Este cenário tem criado um novo contexto para o ensino doutoral. O repensar deste nível formativo na Europa tem levado a questionamentos sobre o seu propósito, estrutura e qualidade. Alguns autores consideram que o doutoramento - que tem sido, fundamentalmente, um grau de investigação (Golde e Dore 2001) e um requisito de entrada para posições académicas (Fulton e Holland 2001) - passa a ser uma das respostas aos desafios europeus e nacionais (Bleiklie e Hstaker 2004; Harman 2008). Uma das questões de interesse crescente neste contexto é a adequação - ou, mais concretamente, a inadequação - do modelo "tradicional" de ensino doutoral para a preparação de académicos e investigadores, tendo em consideração as necessidades, cada vez mais, diversificadas da sociedade, da economia e do mercado de trabalho (Kemp 1999; Evans 2002; Nerad 2004; Gemme e Gringas 2004; Enders 2005; Nerad e Heggelund 2005; Kehm 2009). O questionamento sobre as ligações entre o ensino doutoral e o mundo de trabalho é força central nesta movimentação, tal como têm sido no ensino superior em geral (ver Teichler 1999).

O modelo de ensino doutoral "tradicional" é, então, frequentemente criticado por não atender às necessidades sociais e económicas em rápida evolução; por ser demasiado focado, inflexível, teórico (Evans 2001; McWilliam et al. 2002; Pfeffer e Fong 2002; Kyvik e Olsen 2012; Banarjee e Morley 2013; De Grande et al. 2014; Roberts 2018). Questiona-se a tese enquanto elemento central ou a relação mestre-aprendiz (Park 2007); há tensões no privilegiar o produto (uma tese de qualidade) ou o processo (o desenvolvimento do investigador) (Park 2007; Bao, Kehm e Ma 2018); a aquisição de outro leque de capacidades e competências (apelidadas de "transversais") torna-se meta para as almejadas carreiras

dentro[3] e fora da academia (Kehm 2009). Iniciativas e orientações políticas na Europa apontam para a necessidade do ensino doutoral formar gerações de investigadores e doutorados "mais flexíveis, mais sintonizados com a investigação interdisciplinar, mais preparados para iniciativas empresariais" ("University Research in Transition", OCDE 1998, p. 77).

O ensino doutoral que, tal como as universidades em geral, encontra-se posicionado na interseção de uma multiplicidade de missões e funções, tornou-se "produto de múltiplos proprietários" (Nyquist 2002). Encontra-se, ainda, numa tensão relacionada com o seu papel social *versus* económico, com uma proposta utilitarista *versus* não utilitária do conhecimento, bem como a sua integração aos níveis local, nacional, regional ou global. Tal decorre da mudança da sua relação com a sociedade, economia e política, mas também da mudança do próprio papel da universidade na sociedade, economia e política.

É na coexistência de várias solicitações, interesses e papéis que as universidades promovem uma panóplia de novos modelos de programa de doutoramento, incluindo os organizados ou que incluem colaboração com o tecido empresarial (Borrell-Damian 2009; Banarjee e Morley 2013). Em Portugal, o ensino doutoral tem-se tornado objeto de formulação de políticas e os sucessivos governos introduziram mecanismos específicos de financiamento para encorajar diferentes tipos de colaboração entre universidades e organizações empresariais. Os modelos conceptuais relacionados com os processos de ciência e inovação promovidos nos anos 90 – os sistemas nacionais de inovação (Nelson 1993; Lundvall 2010), o "modo 2" de produção de conhecimento[4] (Nowotny, Limoges e Gibbons 1994), a "tripla hélice"[5] (Etzkowitz e Leydesdorff, 2000), a "universidade empreendedora" (Clark 1998) – reforçaram a valorização destes modelos (Azagra-Caro et al. 2019).

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[3] Tem havido, sobretudo nos EUA, uma preocupação sobre a pertinência e adequação do ensino doutoral na preparação dos doutorandos para tarefas e responsabilidades académicas cada vez mais diversificadas (ver Austin 2002; Wulff e Austin 2004; Golde e Walker 2006).

[4] Gibbons e colegas conceberam uma forma de produção de conhecimento que se tornou conhecida como "modo 2" em contraponto ao "modo 1". O conhecimento do "modo 1" refere-se a problemas dentro da comunidade académica, uma forma disciplinar, que privilegia o "conhecimento puro" e é apenas orientado por académicos. O "modo 2" de produção de conhecimento é geralmente impulsionado por necessidades ou problemas sociais ou económicos (Gibbons 2000), privilegia um conhecimento transdisciplinar (Gibbons et al. 1994).

[5] A contribuição teórica de Etzkowitz (1997, 2008) destaca os pontos fortes do relacionamento entre as três esferas do modelo "tripla hélice". Nesta visão considera-se que o crescimento económico é cada vez mais dependente da capacidade das empresas, universidades e governo colaborarem para desenvolver novos produtos, processos e serviços (Etzkowitz e Leydesdorff 2000).

A colaboração entre universidades e empresas é enfatizada e promovida com o intuito de aumentar o fluxo de conhecimento e inovação entre os setores (Dill 1995; Thune e Gulbrandsen 2014). É assumido que o reforço de colaborações desta natureza facilita a transferência de conhecimentos académicos, bem como a aplicação dos resultados da investigação a outros setores da economia (Comissão Europeia 2003; Auriol, Félix e Schaaper 2010). Considera-se que, por meio de processos colaborativos, universidade e empresa trocam ou partilham conhecimento tácito e experiência (Fernández-Esquinas et al. 2016), além de uma ampla gama de recursos tangíveis e intangíveis para atingir objetivos individuais (Galan-Muros e Davey 2017; Al-Tabbaa e Ankrah 2018). Implícito a esta perceção está a mudança do papel dos académicos (Clark 1998; Etzkowitz 2003; Shane 2004; Perkmann, King e Pavelin 2011), tal como o papel dos doutorandos no ensino doutoral.

A articulação entre setores de atividade não deixa, no entanto, de ser campo de controvérsias. Alguns autores sublinham os efeitos potencialmente prejudiciais de colaborações desta natureza e consideram que promovem um ensino superior cada vez mais subordinado às necessidades da sociedade e da economia (Slaughter e Rhoades 2004), assumindo as universidades e a ciência académica um papel instrumental (Noble 1977; Slaughter e Leslie 1997; Krimsky 2003; Perkmann, King e Pavelin 2011; Karseth e Solbrekke 2016; Tavares, Sin & Soares 2020). Os riscos percebidos incluem, ainda, a ameaça aos valores e normas científicas tradicionais, incluindo a liberdade e autonomia académicas (Kayrooz, Kinnear e Preston 2001; Harris 2005; Henkel 2005; Clegg 2008; Billot 2010), a ênfase em tópicos de investigação mais aplicados (Blumenthal et al. 1986; Behrens e Gray 2001), uma desaceleração da abertura e difusão do conhecimento (Nelson 2004; Murray e Stern 2007; Rosell e Agrawal 2009) e conflitos em termos de propriedade intelectual e credibilidade dos resultados científicos (Sauermann e Roach 2014; Tavares, Sin & Soares 2020). Tal dinâmica, segundo alguns autores, pode comprometer o ensino doutoral com um "novo tipo" de cultura científica cuja ênfase move-se da investigação movida pela curiosidade para investigação orientada para produzir conhecimento e tecnologia com aplicabilidade (Slaughter et al. 2002; Harman 2008). Em certa medida, esta discussão articula-se com o conceito proclamado por Ziman (2003) de "ciência instrumental" ou com o conceito de Slaughter e Rhoades (2004) de "capitalismo académico".

Enquanto a importância de tal debate político e social é incontestável, a análise e a reflexão sobre estes processos são dificultadas pela falta de investigação direcionada para considerar os processos promovidos, os seus resultados e efeitos. Muitos fatores inerentes a este percurso estão submersos no desconhecimento e uma série de questões permanecem sem resposta, incluindo: quais os mecanismos de influência das organizações europeias e os seus efeitos na difusão e convergência das políticas públicas para o ensino doutoral? Qual tem sido o percurso nacional em termos de medidas e instrumentos políticos para promover

as colaborações universidade-empresa no ensino doutoral? Qual a relação, se houver, entre as colaborações com o tecido empresarial nos programas de doutoramento e o perfil dos académicos envolvidos? De que forma se perceciona o papel dos doutorandos nos processos de colaboração com empresas? Quais as consequências do envolvimento em colaborações com empresas na experiência e trajetória dos doutorandos?

Um período em que o ensino doutoral está sob pressão para redefinir-se e onde se desencadeiam debates sobre os processos colaborativos desta natureza, também a nível nacional, destaca a necessidade e oferece oportunidades para analisar e compreender, de forma mais aprofundada, a complexidade dos fatores que intersectam as colaborações universidade-empresa[6] no ensino doutoral, procurando respostas que podem ser usadas para informar a tomada de decisão dos vários atores envolvidos (decisores políticos, organizações académicas e empresariais, e doutorandos).

Considera-se que, apesar do campo académico dispor de uma indiscutível autonomia, baseada nas suas estruturas, tradições e regras próprias, a influência de parceiros empresariais pode levar a configurações e reconfigurações do ensino doutoral e dos programas de doutoramento. A promoção de colaborações incorpora novos atores, culturas e padrões e com possíveis implicações para o ensino doutoral em aspetos fundamentais, como o valor do capital social dos académicos, o entendimento do papel dos doutorandos e as suas experiências e resultados.

Reconhece-se neste estudo a natureza multidimensional das colaborações com empresas no ensino doutoral e propõe-se, deste modo, um olhar abrangente, que considera um foco da análise trial: as colaborações enquanto política, enquanto processo e enquanto experiência. Mas especificamente, três objetivos específicos inter-relacionados servem para analisar aspetos considerados essenciais nesta problemática.

Um primeiro objetivo prende-se com a análise da centralidade política das colaborações universidade-empresa no ensino doutoral. Considerando-se que o campo do ensino doutoral necessita de enriquecer a compreensão da influência da política europeia nas políticas de ensino doutoral a nível nacional (como Marginson e Rhoades, 2002, consideram para o sistema de ensino superior), pretende-se caracterizar e confrontar as convergências europeias com o significado adquirido em dois contextos nacionais. Procura-se, assim,

6 Os termos “universidade-indústria” e “universidade-empresa” são utilizados alternadamente na literatura e nos estudos consultados, tal como nas orientações políticas. Neste estudo a assunção privilegiada é o termo “universidade-empresa” de forma a abranger a diversidade institucional do setor. Adaptado do Manual Frascati 2002 (OECD 2002), o termo “empresa” refere-se a entidades com fins lucrativos, incluindo todas as organizações e instituições cuja atividade principal é a produção de mercado de bens ou serviços (exceto ensino superior) para venda ao público em geral.

oferecer pistas de reflexão pertinentes que contribuam para o debate sobre a convergência ou divergência na evolução do ensino doutoral na Europa, tendo por base que o ensino superior é considerado um dos aspetos da sociedade moderna mais afetado por tendências e pressões globais (Altbach 2007). Em segundo lugar, a análise foca-se no contexto político nacional, analisando-se os mecanismos explicativos para o agendamento e formulação de políticas públicas e instrumentos desta natureza em Portugal.

Um segundo objetivo passa por contribuir para a sistematização de dados empíricos sobre a natureza e a extensão da colaboração com empresas em programas de doutoramento. As questões a analisar incluem o papel dos atores académicos e dos próprios doutorandos, tal como a continuidade dos processos. Procura-se trazer novos contributos para a discussão do conceito de capital social, em torno do qual existem múltiplos entendimentos, enfatizando-se a relação com os modelos colaborativos. Por outro lado, remete-se para a análise dos processos, fatores e contextos que possibilitam, ou pelo contrário impedem, o papel dos doutorandos nas colaborações universidade-empresa. A discussão passa pelo seu papel enquanto atenuadores das diferenças culturais e promotores da aproximação dos dois setores. A questão dos fluxos de transferência de conhecimento que resultam da colaboração serve para equacionar alguns pontos considerados essenciais na problemática mais geral das colaborações universidade-empresa.

Finalmente, o terceiro objetivo explora a forma como as trajetórias e as experiências académicas dos doutorandos afetam e são afetadas pela colaboração com empresas, em dimensões importantes como foco de investigação, processos de orientação, mobilidade intersectorial, competências adquiridas, produtividade científica. Tal análise permite ainda levar em consideração as culturas diversificadas dos dois setores de atividade, decorrentes da sua composição, estrutura e dinâmica. A questão fundamental é até que ponto é possível combinar valores e significados de trabalho científico na formulação clássica de Merton (1973[1942]) de "ethos da ciência" e empresariais na socialização e formação de investigadores. Para tal, considera-se importante incluir nesse debate as partes interessadas que não parecem ter sido, até agora, incluídas na discussão: os doutorandos (Johnston e Murray 2004; Chiang 2011). Apesar da importância que, em geral, lhes é atribuída nos processos colaborativos desta natureza, tanto na literatura como na política, as suas vozes têm sido pouco capturadas, como referem Slaughter e colegas (2002; algumas exceções são Thune 2009; e no contexto português, Tavares, Sin & Soares 2020).

Este estudo pretende, assim, promover uma conversa fundamentada num debate já aquecido, respondendo a questões cruciais sobre o presente das colaborações universidade-empresa nos programas de doutoramento em Portugal, com implicações para o seu futuro e para o futuro do ensino doutoral em Portugal. Sem uma discussão clara dos acontecimentos presentes, ações individuais e coletivas podem influenciar o cerne do ensino doutoral não

tendo em consideração os seus efeitos, positivos e negativos. O caso português, em particular, pode lançar luz sobre o que se passa num sistema científico em desenvolvimento em que as relações entre universidades e empresas são ainda ténues. Por outro lado, este estudo, ao contrário do que acontece na maioria dos estudos, não considera apenas um espectro definido de processos de colaboração formais (como, por exemplo, programas de doutoramento industriais), sendo consideradas formas formais e informais de colaboração entre atores académicos e empresariais, indo ao encontro dos diferentes modelos já mapeados na literatura (Perkmann et al. 2013; Grimpe e Hussinger 2013). Tal aspeto, tal como a abrangência de diferentes domínios da ciência, incluindo as ciências sociais, são considerados um passo inovador relativamente aos estudos existentes neste campo.

2. O ensino doutoral em movimento: instituições, programas, doutorandos e doutorados[7]

A disponibilidade de uma força de trabalho altamente qualificada passa a ser considerada como resposta aos desafios europeus e, como salientando anteriormente, nas últimas décadas, tem havido um esforço político e institucional para expandir o ensino doutoral.

Em Portugal, a prioridade estratégica atribuída à qualificação dos recursos humanos também permitiu expandir, desde os anos 90, o número de programas de doutoramento, de doutorandos e de doutorados. Se em 1998 estavam inscritos 638 alunos de doutoramento, em 2021 estavam inscritos 6.139 alunos de doutoramento (Pordata 2021). Houve também uma evolução do número de doutorados. Na década de 1990, foram concebidos 337 graus de doutoramento, enquanto apenas no ano de 2020 foram concebidos 1.941 graus.

Ainda assim e apesar da tendência de crescimento e de recuperação da posição relativamente à média europeia, os doutorandos representam uma proporção relativamente pequena da população (ver Figura 1.1.). Em 2020, os doutorados correspondiam a 18,9 ‰ da população portuguesa (Eurostat 2022), igualando o valor europeu (18,9 ‰), mas contrariando o argumento de que Portugal é um “país de doutores”.

O aumento de inscrições em programas de doutoramento pode também estar relacionado à deterioração das perspetivas profissionais dos graduados dos ciclos de ensino anteriores. O estudo clássico de Barbagli (1982) mostrou que o ensino superior foi ampliado quando as oportunidades de emprego eram menores, com um padrão que foi rotulado como “parque de estacionamento”. Assim, não seria surpreendente que um padrão semelhante

[7] Esta secção é adaptada do artigo Santos, P. (2016). Moving the universities to the “third mission” in Europe, new impulses and challenges in doctoral education. *Foro de Educación*, 14(21), 107-132.

tivesse surgido no ensino doutoral em tempos de instabilidade económica. É importante a este respeito considerar o aumento de doutoramentos em ciências sociais. Em Portugal, os doutoramentos neste domínio correspondiam, em 1990, a 29,7% dos graus concebidos e, em 2015, a 42,8% (DGECC 2017).

Figura 1. 1. Número de doutorados por 100.000 habitantes na UE27 e Portugal, entre 2004-2020

Fonte de dados: Eurostat | OCDE. Sorce: Pordata, 2022.

Além da expansão, tem emergido uma tendência para a diversidade de doutorandos. Pode ser observada uma ampliação das matrículas por parte de doutorandos com idades diferenciadas, a tempo parcial e internacionais (Evans 1997; Enders 2005; Auriol, Félix e Schaaper 2010; Nerad 2011). Num contexto de fronteiras porosas, onde as universidades passam a ser vistas como atores envolvidos na arena global (Marginson e Rhoades 2002), cada vez mais universidades oferecem programas internacionais de doutoramento, e Portugal não é exceção. Se nos anos 80 as instituições de ensino superior em Portugal não estavam em condições de responder à necessidade de formar recursos humanos altamente qualificados e a maioria dos graus de doutoramento era obtida no exterior (62%), as condições têm vindo a tornar-se mais favoráveis e a proporção de doutoramentos obtidos no estrangeiro decresceu, tal como o número de estudantes internacionais em universidades portuguesas aumentou. Os programas internacionais, mutuamente reconhecidos, que levam a diplomas duplos ou conjuntos, têm sido fundamentais para atrair estudantes internacionais. É o caso dos programas de doutoramento criados no âmbito do Programa de Parcerias em Portugal nas áreas das ciência, tecnologia, engenharia e matemática (Ferreira e Santos 2015).

É também possível observar um número crescente de mulheres que obtiveram o grau de

doutoramento na Europa. A proporção de mulheres entre os novos doutorados, em 2020, era de 47,6% no EU27 e 52,5% em Portugal (Pordata 2020). Embora tenha havido alguns ganhos, particularmente em relação ao acesso das mulheres, como outros grupos sub-representados, tem havido pouca ênfase nos aspetos qualitativos deste crescimento (Morley 2007). Por exemplo, sabe-se que homens e mulheres estão posicionados de forma desigual em diferentes domínios científicos – alguns dos domínios onde proliferam as mulheres têm perdido *status* (Morley 2005; Ropers-Huilman e Winters 2011), com efeito na sua empregabilidade. Além disso, alguns estudos indicam que as mulheres estão concentradas em áreas e instituições com níveis mais baixos de financiamento para a investigação (Lafferty e Fleming 2000).

Como resultado do visível aumento do número e diversificação de doutorandos, o ensino doutoral expandiu-se e novos tipos de instituições foram criados para fornecer modelos mais diversificados para um público também ele mais diversificado, seguindo as tendências e a evolução do próprio ensino superior (por exemplo, Scott 1995; Rothblatt 1997; Bladh 1999). Um aspeto a considerar a este respeito é o crescimento de escolas de doutoramento ou escolas de pós-graduação. O modelo de escolas doutorais ou pós-graduadas na Europa, inspirado no modelo norte-americano, tem dado impulso ao processo de redefinição do papel do ensino doutoral. Um relatório publicado em 2007, pela European University Association (EUA), que reuniu mais de 400 académicos da Europa, mostrou que 30% das instituições de ensino superior na Europa estabeleceram algum tipo de escola dessa natureza. No caso português um exemplo ilustrativo é o Madeira Interactive Technologies Institute (M-ITI) criado no final de 2009 pela Universidade da Madeira e Carnegie Universidade Mellon.[8] Este instituto foi projetado como uma estrutura de investigação e de ensino pós-graduado no sentido de aprimorar as capacidades de produção de conhecimento e de inovação da universidade, aumentando a sua internacionalização e interdisciplinaridade e proporcionando um melhor vínculo com a comunidade empresarial. As escolas desta natureza parecem tentar fundir as fronteiras tradicionais entre os tipos de investigação (básica, aplicada, de desenvolvimento), setores (empresa, governo, universidade) e áreas científicas.

No entanto, é importante notar que, embora haja um percurso no sentido do crescimento, ao mesmo tempo, tem havido um relativo abrandamento do recrutamento de doutorados pela academia (Taylor 2011; Cyranoski et al. 2011; Neumann e Tan 2011; Bin et al. 2016). Por outro lado, o nível de intensidade do fluxo de doutorados para o tecido empresarial não é semelhante entre países (Lee, Miozzo e Laredo 2010) e Portugal é um dos países da Europa

[8] Tal parceria era parte integrante de um programa de governo – denominado "Parcerias Internacionais" - que impulsionava iniciativas entre universidades portuguesas e universidades dos EUA. Para mais informação sobre os seus benefícios e desafios, consulte Santos (2015).

com o maior número de doutorados no ensino superior e uma menor prevalência de doutorados em empresas. Em 2006, em Portugal, 83,2% dos doutorandos empregados encontrava-se empregado no ensino superior, enquanto em 2012 apenas 4,2% dos estudantes de doutoramento trabalhava em empresas (Carreiras dos Doutorados - CDH, DGEEC 2012). Os resultados de 2015 indicam um ténue crescimento no sentido dos doutorados integrarem outros setores de atividade: 5% dos doutorados trabalha como investigador no setor empresarial e 13% em posições fora do setor académico sem componente de I&D (CDH 2015, DGECC 2017). Na sua generalidade, estes dados refletem a estrutura do tecido empresarial português, ainda maioritariamente constituído por pequenas e médias empresas, onde a importância dada à inovação e aos recursos humanos altamente qualificados é escassa.

3. Três tendências que moldam o ensino doutoral na Europa[9]

Nesta seção são discutidas três tendências que têm vindo a moldar o ensino doutoral na Europa. Não se pretende abordar todos os aspetos que integram estes movimentos, mas salientar três que, interligados e interdependentes, podem iluminar o todo. Em geral, considera-se que o ensino doutoral está a movimentar-se para a estruturação de programas, a diversificação de modelos e a maleabilidade de competências promovidas.

3.1. A estruturação dos programas de doutoramento

O ensino doutoral é, tradicionalmente, um lugar de flexibilidade, comparativamente à estruturação de outros níveis de ensino superior. As normas culturais e as configurações em que os doutorandos realizam as suas trajetórias são diversificadas (Paglis, Green e Bauer 2006), variando em termos nacionais, institucionais e entre campos científicos, e sendo moldadas, de forma particular, pelo chamado modelo humboldtiano ou modelo "mestre-aprendiz".

[9] Esta secção é adaptada dos seguintes artigos: Santos, P. (2016). Moving the universities to the "third mission" in Europe, new impulses and challenges in doctoral education. *Foro de Educación*, 14(21), 107-132; Santos, P. (2019). Ensino doutoral: ampliação, diversificação e maleabilidade. Em *Os 31 Desafios*. Imprensa Académica, Universidade da Madeira; e Santos, P. (2021). O ensino doutoral em movimento. *Em 31 Desafios para o Ensino superior,* Volume II. Imprensa Académica, Universidade da Madeira.

Contudo, a par e passo, o debate e as orientações europeias têm vindo a alterar este cenário. Os desenvolvimentos políticos, como a reorganização do ensino superior promovida pelo Processo de Bolonha, contribuíram para impulsionar a promoção de programas de doutoramento mais estruturados e centralizados (Park 2007; Kehm 2009). A este respeito, alguns autores têm identificado a tendência crescente na Europa para o desenvolvimento de programas de doutoramento estruturados, dirigidos por regulamentos e definições institucionais e direcionados para a formalização (Enders 2005; Park 2007; Borell-Damian 2009; Kehm 2009).

A introdução de programas estruturados encontra-se relacionada com as questões de "relevância" e de "qualidade" do ensino doutoral - questões caras a todos os níveis do ensino superior. Por um lado, uma certa normalização da experiência académica dos doutorandos sinaliza a importância do ensino doutoral para o esforço de desenvolver uma "sociedade do conhecimento" (Bleiklie e Hstaker 2004) e para elevar a adequação das competências dos doutorados para um espectro mais amplo de atividades profissionais. Por outro lado, há uma tentativa de elevar a qualidade do ensino doutoral através da definição de objetivos, processos, competências e resultados inseridos em regulamentos, critérios, procedimentos de avaliação e controlos do sucesso (Kehm 2006; Harman 2008; Loxley e Kearns 2018). Como Barrie (2006) argumenta, pretende-se definir que tipo de doutorado a instituição académica deseja produzir e informar como tal se incorpora nos programas de doutoramento que promovem.

Esta estruturação é também indicação da transferência de responsabilidade relativa ao ensino doutoral no sentido dos académicos e departamentos para as instituições de ensino superior. Os resultados do estudo da EUA (2018) mostram que as universidades revelam uma centralidade cada vez maior no ensino doutoral ao formalizar regras e regulamentos para aspetos como a definição do conteúdo dos programas.

Apesar do caminho no sentido da uniformização, um estudo que deu voz aos doutorandos e doutorados portugueses (Santos 2021), mostra que, em geral, estes atores não são defensores de tal tendência. A variedade de projetos de investigação, as diferentes origens e experiências académicas e profissionais dos doutorandos continuam e devem continuar, na sua perspetiva, a impulsionar uma cultura rica e diversificada para o ensino doutoral.

3.2. A diversificação dos modelos de programas de doutoramento

Simultaneamente, as universidades, impulsionadas pelos movimentos acima enunciados estão a tornar-se mais flexíveis sobre o que constitui um programa de doutoramento e como é realizado (Pearson e Ford 1997; Cryer 1998; Park 2007; Rip 2004; Santos 2021). Esta

tendência é considerada uma resposta para garantir a relevância dos temas de investigação e permitir que os doutorandos adquiram competências transferíveis, para além de capacidades académicas, no sentido de adequação a um espectro mais amplo de contextos profissionais (Nerad 2004; Jackson 2007; Harman 2008; Manathunga 2009; Kehm 2009; Park 2009; Banerjee e Morley 2013; Nerad e Evans 2014).

Como resultado, têm sido criados novos formatos e modelos híbridos de programas de doutoramento (Jacob 2000) que cruzam fronteiras disciplinares e organizacionais e coabitam com o modelo de formação académico-disciplinar (Enders 2005). Na Europa, os modelos de ensino doutoral multiplicam-se (Bao, Kehm e Ma 2018). São alvo de uma, cada vez maior, variedade epistemológica e estrutural: programas internacionais e europeus, colaborativos, interuniversitários, multidisciplinares, *online* e à distância, profissionais e empresariais.

Em particular, os programas de doutoramento profissional têm crescido significativamente na Europa - particularmente em países cujo sistema científico se encontra consolidado, como na Holanda, Reino Unido, Bélgica, Áustria e Dinamarca. São considerados distintos dos doutoramentos tradicionais no sentido em que são, sobretudo, destinados a doutorandos já empregados e a investigação é informada e informa problemas da prática profissional. A sua distinção passa ainda pelo facto de enfatizarem abordagens interdisciplinares e darem especial atenção ao empreendedorismo e à transferência de conhecimentos. O doutoramento profissional não é concedido em todas os domínios científicos, mas limitado a campos de prática profissional relativamente demarcados como, por exemplo, a saúde, o serviço social e a engenharia.

Por sua vez, os programas de doutoramento industrial são um modelo em voga nos países escandinavos e na França (Moghadam-Saman 2019), em que o trabalho de investigação é realizado com o objetivo de resolver um determinado problema numa empresa. Tal implica que a investigação realizada pelos doutorandos seja intimamente relacionada com a empresa (Tavares, Sin & Soares 2020).

Outro modelo do ensino doutoral que desafia o fosso cultural entre universidades e empresas são os programas de doutoramento com empresas, modelo que tem emergido em toda a Europa (Borrell-Damian 2009). Estes programas são entendidos como arenas de desenvolvimento e reforço de relações universidade-empresa mais amplas e catalisadores de processos de inovação nas empresas e da aplicabilidade do conhecimento produzido pelas universidades. Assume-se, ainda, que criam ou reforçam oportunidades de emprego para os doutorados fora da universidade. Em Portugal, tais ambições formaram o mote para, em 2012, serem criados os Programas de Doutoramento em Ambiente Empresarial, geridos pela Fundação para a Ciência e Tecnologia (FCT). A interdisciplinaridade e a mobilidade dos doutorandos são características da estrutura curricular desses programas que, em teoria, permitem que os doutorandos tenham uma visão ampla da área científica e possibilidades de

transferência dos seus conhecimentos e competências para o setor empresarial.

A divulgação de alguns desses modelos de um país de origem para outros países sugere que a estrutura de governança do sistema de ensino superior, que em alguns casos varia significativamente, nem sempre supera a influência supranacional (Moghadam-Saman 2019). Reforçando tal tendência, tais modelos têm sido objeto de relatórios por parte de organizações europeias, como é o caso da Associação Europeia das Universidades (European University Association, EUA).[10] Esta organização tem assumido um papel determinante na reestruturação do ensino doutoral na Europa - esperando que as colaborações intersectoriais, incluindo a promoção de modelos colaborativos de programas de doutoramento, promovam a justaposição de ideias, ferramentas e pessoas de diferentes domínios e, em ultima instância, processos de inovação. Afirmam que estes modelos estão mais sintonizados com as necessidades reais e são flexíveis o suficiente para responder às necessidades da economia do conhecimento (Usher 2002). Contudo, estas posições não estão livres de controvérsia[11] e criam discussões sobre a relevância económica do ensino doutoral *versus* a sua relevância enquanto processo formativo que permite expandir o conhecimento científico (Becher, Henkel e Kogan 1994).

3.3. A maleabilidade das competências

As tendências anteriores, paralelas e intrinsecamente relacionadas, aumentaram consideravelmente o interesse sobre as competências adquiridas pelos doutorados. Se os

[10] Um aspeto importante da atividade da EUA é a recolha de evidências empíricas sobre o ensino doutoral. Em 2005, esta organização publicou um primeiro relatório intitulado “Programas de doutoramento europeus para a Sociedade do Conhecimento”, onde mapeou o panorama dos programas de doutoramento na Europa. O documento focou-se ainda em discussões temáticas como interdisciplinaridade, colaboração com empresas e outros setores relevantes, promoção da internacionalização e formação em capacidades sociais. Em 2009, identificou “10 Fatores de Sucesso para as universidades europeias na próxima década”, entre eles a articulação com o tecido empresarial e outros setores relevantes. Em 2010, o compromisso foi reforçado por meio da definição de “Princípios para Inovação na Formação Doutoral”.

[11] Ver, por exemplo, Banerjee e Morley, 2013, que argumentam que a oposição binária entre os programas tradicionais - que produzem investigação original e contribuem para o conhecimento académico (“modo 1”) - e novos programas - que trazem uma contribuição original para a prática profissional e promovem a transferência de conhecimento (“modo 2”) - não é clara e que a avaliação de ambos os tipos continua a tender para o uso de princípios tradicionais como a força teórica e o rigor metodológico da investigação.

domínios científicos têm tido o papel de definir o conhecimento e as capacidades específicas a serem desenvolvidas pelos seus doutorandos (Marton, Hounsell e Entwistle 1997), um dos focos na mudança da formação de doutorados visa justamente a promoção de um conjunto diversificado de conhecimentos e capacidades transferíveis para diferentes contextos (De Grande et al. 2014).

A noção de "competências" passou a ser materializada em listas pré-definidas de capacidades e atributos considerados globalmente relevantes (Holmes 2013) - tal como tem acontecido em outros níveis do ensino superior. Tais competências, usualmente chamadas de "transversais", são consideradas essenciais para garantir a qualidade da formação dos investigadores, a relevância da investigação desenvolvida e tornar os doutorados "empregáveis" numa variedade de carreiras (Rip 2004; Bernstein et al. 2014; Bao, Kehm e Ma 2018), tendo em consideração um contexto de reduzidas oportunidades de empregabilidade no setor académico (De Grande et al. 2014).

As exigências por uma maior integração entre a formação para as atividades académicas e a formação para capacidades percebidas como necessárias no mercado de trabalho, encontram-se, recorrentemente, vinculadas a alegações de que os doutorados não têm as competências necessárias para diferentes contextos de trabalho. Entre as principais barreiras documentadas na literatura para vincular doutorados ao setor empresarial, sobretudo sob a perspetiva do setor empresarial e dos empresários, encontra-se a distância entre os perfis dos doutorados e as competências procuradas pelas empresas (MacDonald e Barker 2000; Jackson 2007; Borrell-Damian et al. 2010; Tomlinson 2018; para o contexto nacional ver Barroca, Meireles e Neto 2015).

A maior pressão exercida para doutorandos e doutorados desenvolverem uma gama mais ampla de capacidades e competências e melhorar a sua transferibilidade para outros setores invoca ainda processos de "aprendizagem experiencial", vistos como complementares a processos preconcebidos de formação. Assim, as experiências de mobilidade académica e de colaboração com o mundo exterior adquirem renovado valor. Participar em processos de mobilidade internacional e intersectorial é considerada uma oportunidade para experimentar diferentes ambientes de investigação, aceder a conhecimento codificado e tácito, refinar práticas científicas e técnicas e alargar as redes de contacto. Ou seja, aumentar o capital técnico, científico e social dos doutorandos (Recotillet 2007).

O conhecimento e competências generalistas *versus* especializadas dos doutorados tornou-se, então, um tema recorrente no debate dentro e fora da academia. Tal orientação para a ampliação da gama de capacidades dos doutorados foi, em certa medida, transferida para documentos de política - tendo novamente a EUA um papel fulcral nesse sentido - e, em menor medida, para as práticas institucionais. Contudo, tais resultados não são

inquestionáveis. Há indicações de que a necessidade deste tipo de conhecimento é superestimada. Em primeiro lugar, os empregadores que têm doutorados entre a sua força de trabalho valorizam mais as capacidades de investigação e o conhecimento científico do que os restantes empregadores, que tendem a enfatizar em maior medida competências gerais (De Grande et al. 2014). Em segundo lugar, Loxley e Kearns (2018) consideram que o desenvolvimento de tais capacidades é parte integrante do processo de doutoramento e o que tem ocorrido é a sua codificação e objetificação. Os dados do Inquérito aos Doutorados (DGEEC 2015) vão no mesmo sentido e indicam que a maioria dos doutorados concorda estar bem preparado para o primeiro emprego após o doutoramento (66,8%), mesmo no caso de doutorados cuja atividade profissional ocorre em empresas (51,5%).

4. O modelo de análise e questões exploratórias

A concretização de uma fase de exploração da problemática – constituída pela revisão da literatura e de entrevistas a atores privilegiados – revelou-se decisiva para o desenvolvimento do modelo de análise, cuja finalidade seria que contribuísse para a produção de conhecimento de relevância sociológica sobre os processos inerentes às colaborações universidade-empresa no ensino doutoral em Portugal.

Na literatura existente sobre as temáticas mencionadas, sobressai como tendência a adoção de focos analíticos unidimensionais. Tendo presente tal contexto, concebeu-se uma análise multidimensional, que tem em consideração a diversidade de escalas, fatores e atores intervenientes, procurando atender e inscrever-se numa relação dialética entre atributos, culturas e relações. Em particular, a partir de um esforço de sistematização, foram considerados três níveis autónomos, embora interdependentes, que revelam determinados aspetos do fenómeno em estudo: o nível macro, das políticas nacionais e o seu enquadramento nas políticas europeias; o nível meso, organizacional, dos programas de doutoramento que incluem os processos colaborativos e os atores académicos envolvidos na colaboração; e o nível micro, individual, das trajetórias de doutorandos e doutorados delimitadas pelo espaço de possibilidades (Bourdieu 2002 [1972]).

Os níveis descritos procuram responder a questionamentos distintos de forma a permitir uma maior desocultação e compreensão dos processos em análise. Desta forma, estabeleceram-se seis questões exploratórias que serviram de base ao desenrolar do presente estudo e que serão descritas nas subsecções seguintes.

4.1. O primeiro plano – a dimensão política

O primeiro plano (P1) centra-se no enquadramento das colaborações universidade-empresa no ensino doutoral no contexto político, nacional e europeu. Considera-se que uma das instâncias mais significativas na formulação da paisagem do ensino doutoral e das colaborações universidade-empresa é o setor político, visto que este tem vindo a tornar-se objeto de políticas nacionais e de programas de financiamento, bem como de regulamentos e medidas supranacionais (Kehm 2009; Bao, Kehm e Ma 2018).

Este nível de análise é perspetivado quer num plano desagregado, tendo por referência a sociedade portuguesa, quer num plano agregado, reforçando que alguns dos processos sociais contemporâneos mais importantes ocorrem numa escala transnacional (Green 2006) e, neste caso concreto, numa escala europeia.

Em primeiro lugar, este plano insere-se numa abordagem "macroscópica" (Archer 1979), analisando-se as tendências europeias em termos de orientações para o ensino doutoral. Neste contexto, não são alheios os fenómenos de europeização, que reforçaram a ação de organismos europeus, como a EUA e a Comissão Europeia, nem a consideração de que, nas últimas décadas, a maioria dos países europeus promoveu um conjunto de transformações, elencadas resumidamente no ponto anterior, no sentido daquilo que Kehm (2009) considera ser um "modelo europeu" para o ensino doutoral.

Contudo, neste estudo coloca-se a hipótese de que tais orientações ou modelo podem ser diferentemente apropriados e transformados tendo em conta as características – estruturais, institucionais e culturais - dos contextos nacionais. Tal vai ao encontro de um conjunto de estudos sobre políticas de ensino superior (Teichler 2002; Trondal 2002; Witte 2008; Dobbins e Knill 2009) que alertam para o caráter não homogeneizador dos processos de europeização. Tais estudos revelam que a pressão europeia raramente leva a efeitos semelhantes em todos os sistemas nacionais, culminando numa europeização "fragmentada e diferenciada" (Elken et al. 2010).

Desta forma, interessa compreender como as orientações europeias, enquanto políticas "viajantes" (Barzano 2011), são canalizadas, filtradas e/ou amortecidas pelos contextos nacionais específicos (Gornitzka 2014). Contribui-se, assim, para o debate e a análise sobre os processos de convergência ou de divergência na evolução dos sistemas de ensino superior na Europa, mas especificamente do sistema de ensino doutoral – uma das questões consideradas centrais na produção de conhecimento sobre a universidade contemporânea (Altbach 2007) e um dos elementos que propicia as maiores críticas endereçadas às comparações internacionais (Van Haecht 2005).

Uma primeira questão exploratória é apresentada com base nestas considerações:
Q1. Na evolução no ensino doutoral em Portugal é possível identificar tendências comuns com o modelo europeu, mas que desembocam em soluções e instrumentos diferenciados comparativamente a outros contextos europeus? Em particular, procuram-se respostas às

seguintes questões: quais são as principais linhas das políticas europeias e nacionais que afetam o ensino doutoral? É possível identificar uma convergência nos objetivos e caminhos no ensino doutoral entre a Europa e Portugal? Para além das tendências comuns, quais são as divergências na evolução em Portugal em termos de mecanismos, objetivos e configurações políticas para o ensino doutoral comparativamente a outros países europeus?

Considera-se que em sistemas nacionais altamente desenvolvidos, a resiliência nacional e as traduções podem ser a principal resposta a pressões exógenas desta natureza (Gornitzka 2013), mas num sistema em desenvolvimento tais respostas podem ser diferenciadas. Justifica-se, assim, uma análise circunscrita a dois casos europeus – o português e o belga - para analisar os efeitos diferenciados dos normativos europeus em função das estruturas nacionais pré-existentes. A comparação entre Portugal e Flanders permite identificar e interpretar as singularidades na apropriação dos modelos europeus em contextos de desenvolvimento económico e científico diferenciados. Mais do que o mesmo período histórico, o que se analisa são eventos e situações comparáveis (Archer 1979).

Em segundo lugar, procedeu-se a uma análise centrada na evolução das medidas de política de ensino superior, de ciência e de inovação destinadas a promover os processos de colaboração com o tecido empresarial no ensino doutoral em Portugal. Reforça-se neste nível a ideia de que os instrumentos de política nacional desempenham também um papel fundamental na realização das missões da universidade e nas suas prioridades. Indo ao encontro do pensamento de Bourdieu (2006 [2000], pp. 278-279): “as mudanças internas no campo estão frequentemente ligadas a mudanças nas relações com o exterior do campo. (...). Mas entre todas as trocas com o exterior do campo, as mais importantes são as que se estabelecem com o Estado”.

Ao contrário da análise clássica que privilegia uma conceção linear das políticas públicas (Van Zanten 2004), assume-se as crenças, os valores e as representações como elementos importantes na sua formulação (King 1973; Hall 1993; Gelinski e Seibel 2008). Assume-se, ainda, que os processos de construção das políticas públicas de promoção das colaborações com empresas no ensino doutoral caracterizam-se de uma amálgama de vontades, decisões, lideranças políticas e pressões externas (Peters e Hogwood 1986) com efeitos no agendamento político de certos problemas e nas formas consideradas as mais acertadas para os solucionar (Fischer, Miller e Sidney 2007). Por outro lado, tais desenvolvimentos políticos contribuem para definir as estruturas, constrangimentos e oportunidades, enquanto conjunto de regras e recursos, como considera Giddens (1984), que condicionam os contextos de atuação no ensino doutoral.

A segunda questão exploratória deste nível de análise é descrita da seguinte forma:

Q2. É possível identificar políticas destinadas à promoção de colaborações universidade-

empresa no ensino doutoral em Portugal que variam no tempo em termos de instrumentos e justificações associadas? As questões mais específicas que se colocam são assim descritas: como surgem as políticas nacionais incentivo à colaboração universidade-empresa no ensino doutoral? Pode-se falar de processos de continuidade ou descontinuidade destas políticas nacionais em termos de narrativas e instrumentos?

Esta análise sociohistórica procura conhecer as principais linhas políticas seguidas e respetivas mudanças através da análise do discurso e das narrativas como forma de mediação (Schmidt 2008). Esta abordagem pretende ir além da simples descrição e esboçar elementos de explicação (Maroy 2004) e de interpretação, de forma a compreender a evolução das medidas e dos instrumentos políticos e as suas particularidades. Mais especificamente, pretende-se definir os temas centrais discutidos, as suas narrativas, e contribuir para a compreensão de continuidades e ruturas, bem como das determinantes do seu desenvolvimento (Rodrigues 2015).

4.2. O segundo plano – a dimensão organizacional

Impõem-se, no segundo plano (P2), uma mudança de escala para uma abordagem meso no sentido de analisar, de forma contextualizada, as dinâmicas colaborativas nos programas de doutoramento. Este plano centra-se, então, nos programas de doutoramento que apresentam colaboração, assumindo-se que tais processos não se desenvolvem de modo único e são suscetíveis a um conjunto de influências.

Entende-se que as colaborações nos programas de doutoramento constituem processos num "espaço social estruturado" através de posições e significados (Bourdieu 2006 [2000], p. 42) e são embebidas de múltiplas formas e geometrias, condicionadas e condicionadoras dos atores envolvidos. Nesse sentido, o segundo nível de análise permite determinar fatores que explicam a existência de colaboração entre universidades e empresas em programas de doutoramento e os contextos sociais que moldam as suas características.

Uma primeira vertente essencial diz respeito à identificação de padrões de colaboração, sinalizando-se traços e dinâmicas. As configurações de colaboração são descortinadas pelas atividades subjacentes aos processos de colaboração (Slaughter et al. 2002), ou seja, a rede de ações que interligam atores académicos e empresariais no âmbito de cada programa. Outro eixo central relaciona-se com a caracterização dos atores organizacionais inscritos em tais colaborações e perspetivados em termos da sua influência nos modelos de colaboração existentes. Pode-se esperar que cada organização possua características particulares com influência na multiplicidade de configurações possíveis para as colaborações nos programas de doutoramento. Por outro lado, assume-se, ainda, que tais configurações das colaborações

nos programas de doutoramento têm efeito nos papéis assumidos por académicos e empresários.

Formula-se a terceira questão exploratória deste estudo da seguinte forma:

Q3. As características das organizações parceiras, tal como dos programas de doutoramento, desencadeiam modelos distintos de colaboração universidade-empresa em termos de atividades em colaboração e papéis assumidos por cada organização? Em específico, as questões a que se pretende responder são: quais são as atividades em colaboração mais recorrentes? Quais são os determinantes organizacionais – académicos e empresariais - nos processos de colaboração nos programas de doutoramento? Quais as características dos programas de doutoramento que podem explicar a colaboração e os modelos de colaboração com empresas em programas de doutoramento?

Tendo em consideração uma gama de estudos sobre colaborações universidade-empresa considera-se que algumas características das empresas ajudam a prever a ocorrência de tipos específicos de colaboração. Em particular, a dimensão (Cohen, Nelson e Walsh 2002; Fontana, Geuna e Matt 2006; Lança 2007) e a intensidade de I&D (Schartinger et al. 2002; Wallgren e Dahlgren 2005; Lança 2007; Borrell-Damian 2009) são factores relevados como influenciadores do interesse das empresas em colaborar com o setor académico. Por sua vez, características dos parceiros académicos como a tipologia da universidade (pública / privada) e o seu tamanho são também variáveis a ter em conta. Por último, mas não menos importante, as características do programa de doutoramento têm sido consideradas influentes em estudos anteriores, sobretudo o domínio científico em que se insere. Diversos estudos têm mostrado que a organização social, os valores e as normas dos domínios científicos configuram diferentes prioridades e opções estratégicas em processos de colaboração universidade-empresa (Becher 1989; Whitley 2000; O'Shea et al. 2005; Bozeman e Gaughan 2007; Belkhodja e Landry 2007; Borell-Damian 2009; mais concretamente para os programas de doutoramento ver Borell-Damian 2009).

Outra vertente relevante são as características dos atores individuais e a estrutura relacional existente entre atores académicos e atores empresariais. Considera-se que os atores sociais e as suas características são potencialmente influenciadores dos processos colaborativos.

A compreensão das organizações como “campos sociais” (Bourdieu 1989), implica entendê-las como ambientes delimitados, constituídos por conjuntos de regras, sistemas de valores e códigos comportamentais que, segundo uma gama de estudos, levam a que o sucesso da interação e colaboração seja condicionado pela familiaridade e relacionamentos anteriores entre parceiros (Mora-Valentin, Montoro-Sanchez e Guerras-Martin 2004; Butcher e Jeffrey 2007; Thune 2010) e, consequentemente, a relações de confiança e de maior compromisso (Ostrom 1990; Mattessich e Monsey 1992; Barnes, Pashby e Gibbons 2002).

Assume-se, assim, que as colaborações surgem de posições objetivas dos atores na estrutura social, da diversidade das suas trajetórias sociais e da própria especificidade de papéis que desempenham. Em concreto, considera-se a possibilidade da existência de práticas diferenciadas de colaboração relacionadas com as características individuais dos atores académicos e da mobilização do seu capital social, conceptualizado por Bourdieu (1986, p. 114) como "o conjunto realmente utilizável de recursos e poderes". Espera-se que a proximidade (institucional, científica e pessoal) dos atores académicos suporte os processos de colaboração e tenham um papel relevante na intensidade e continuidade da colaboração.

Considera-se a quarta questão exploratória formulada da seguinte forma:

Q4. As características dos atores académicos envolvidos, em particular o seu capital social, desencadeiam modelos de colaboração universidade-empresa, com diferentes intensidades e possibilidades de continuidade? Este eixo de análise orienta-se pelas seguintes questões fundamentais: como é que os processos de colaboração afetam e são afetados pelo capital social dos atores académicos? A maior ou menos intensidade da colaboração e a sua continuidade estão relacionados com a experiência e as relações anteriores dos académicos com os parceiros empresariais?

A abordagem valoriza os atores académicos envolvidos enquanto agentes que atuam em função das suas características sociais incorporadas (Bourdieu 2006 [2000], p. 134). Em particular, leva-se em conta que os diretores de programas de doutoramento podem desempenhar um papel relevante na orientação das práticas e no envolvimento com as comunidades não-académicas (ver, por exemplo, Olmos-Penuela, Castro-Martinez e D'Este 2014). Assim, a análise tem em conta as características dos agentes, a sua trajetória social, incluindo o campo científico de pertença e a experiência e envolvimento com o tecido empresarial (Van Looy et al. 2004; Bozeman, Dietz e Gaughan 2001; Gulbrandsen e Smeby 2005).

Em terceiro lugar, considera-se a posição ocupada por cada membro como sendo variável, em particular o papel desempenhado pelos doutorandos nos programas colaborativos.

A literatura tem enfatizado a importância dos doutorandos para a formação e manutenção da rede entre empresas e universidades e enquanto o canal principal de transferência ou circulação de conhecimento entre os dois setores de atividade (Gluck, Blumenthal e Stoto 1987; Dasgupta e David 1994; Powell, Koput e Smith-Doerr 1996; Mangematin 2000; Mougerou 2001; Slaughter et al. 2002; Mangematin e Robin 2003; Siegel et al. 2003; Thune, 2009; Larivière 2011; Salimi, Bekkers e Frenken 2016). No entanto, é importante saber como se concretiza este papel. Sendo as configurações das redes de colaboração, adotando a aceção de Elias (1997), enformadas pelo poder, importa perceber como varia o papel do ator

enquanto possível intermediário e elemento central nestes processos.

Do ponto de vista sociológico, o papel dos doutorandos nos processos de produção e transferência de conhecimento científico produzido ocorre num espaço de relações. Considera-se que os agentes, investidos de diferentes características e poderes, ajudam a definir configurações das colaborações nos programas de doutoramento e também diferentes papéis para quem, recorrentemente, se encontra no centro dos processos: os doutorandos. Considera-se, ainda, que dada a diversidade de possíveis as relações - sendo algumas mais intensivas do que outras - os seus efeitos vão variar em termos das possibilidades de transferência de conhecimento por parte do doutorando.

A quinta questão exploratória é definida da seguinte forma:

Q5. O papel dos doutorandos é central, mas variável e dependente do papel assumido pelas organizações académicas e empresariais, influenciado por sua vez as oportunidades de transferência de conhecimento. Esta questão é consubstanciada nas seguintes questões específicas: como os parceiros académicos e empresariais influenciam o papel dos doutorandos nos processos de colaboração universidade-empresa no ensino doutoral? De que forma essa variação tem implicações na possibilidade de transferência de conhecimento entre universidades e empresas?

4.3. O terceiro plano - a dimensão individual

Considera-se que as determinações políticas, organizacionais e sociais são insuficientes para dar conta das colaborações universidade-empresa no ensino doutoral. O foco da análise sociológica deve articular também a compreensão das trajetórias dos doutorandos e doutorados. O modelo integra, assim, um nível micro (P3) que analisa as trajetórias académicas de doutorandos e doutorados a partir das suas experiências e práticas, no sentido de melhor compreender que tipo de efeito e condicionamento exercem os modelos colaborativos na sua experiência e perceção.

Analisa-se a relação existente entre a trajetória formativa e o sentido vivido subjetivamente pelos doutorandos enquanto elemento fundamental para a compreensão das dinâmicas colaborativas, tal como o capital simbólico e as competências adquiridas, num percurso dominado pelo setor académico ou pelo setor académico e empresarial – em diferentes configurações. A trajetória formativa é assumida como um tempo e um espaço que apoia o desenvolvimento dos investigadores (Gardner 2008; Pilbeam e Denyer 2009; McAlpine e Mitra 2015), concretizada num processo dinâmico e cumulativo que envolve dimensões implícitas e tácitas e interação e negociação com outros atores (Baker e Pifer 2011; Mantai 2017). Durante esse período, em contactos formais e informais, os doutorandos

constroem uma rede e apreendem normas específicas para a investigação académica (Anderson, Louis e Earle 1994; Finholt e Olson 1997).

Considera-se que as culturas diversificadas presentes nos dois setores de atividade, decorrentes da sua composição, estrutura e dinâmica podem influenciar as trajetórias dos doutorandos. Abrir os programas de doutoramento a parceiros empresariais é possivelmente abrir a diferentes valores, cultura e interesses que podem levar a potenciais situações de conflito vivenciadas pelos doutorandos. Contudo, os resultados sobre este tema são ambíguos. Alguns estudos salientam que as colaborações com empresas criam obstáculos à aprendizagem e socialização em valores académicos (Lyon 1995; Harman 2008), criando pressões para mudanças na natureza, âmbito e resultados da investigação desenvolvida e a sua divulgação (Gluck, Blumenthal e Stoto 1987; Powles 1994; Hodge 1995; Blumenthal et al. 1996; Slaughter et al. 2002; Gemme e Gringas 2004; Borrell-Damian 2009; Borrell-Damian et al. 2010). Em sentido contrário, outros estudos evidenciam que os orientadores académicos e empresariais são capazes de lidar com os potenciais dilemas, não colocando problemas particulares para os doutorandos (Salminen-Karlsson e Wallgren 2008) e não ameaçando os valores académicos (Harman 2008; Thune 2010) ou a liberdade, autonomia e produtividade académicas (Behrens e Gray 2001; Gemme e Gringas 2004; Sauermann e Roach 2014).

Este plano procura, ainda, explorar as tensões existentes entre condicionantes estruturais e oportunidades sociais e a agência exercida pelos doutorandos, vinculando-se a uma discussão mais alargada sobre a relação entre estrutura e agência, questão fundamental na teoria social. Privilegia-se o entendimento de Archer (1995) que considera que a influência condicionante do contexto estrutural e cultural funciona ao moldar as situações em que as pessoas se encontram, de tal modo que alguns cursos de ação são impedidos e desencorajados, enquanto outros são facilitados e encorajados. No entanto, tal não é determinante, reconhecendo-se que o seu efeito depende da posição social dos agentes e, subjetivamente, dos seus projetos e estratégias para os concretizar (Archer 2011).

Entende-se que as colaborações constituem processos sociais que originam efeitos nas trajetórias dos doutorandos e doutorados, embora assumindo-se também que estes são influenciados pelos projetos e ações próprios. O papel da agência na construção de trajetórias é, então, considerado crucial e os doutorandos agentes ativos e influenciadores da direção do seu doutoramento e do papel das colaborações nesse processo. Os doutorandos, preocupados com a construção da sua carreira podem agir estrategicamente em resposta a incentivos para melhorar o seu posicionamento (Belkhodja e Landry 2007). Esperam entrar na “terra prometida” e as suas práticas – tema de investigação, métodos empregados, tipo de comunicação dos resultados - estarão orientadas para a “maximização do lucro propriamente científico, isto é, a obtenção do reconhecimento” (Bourdieu 1983 [1976], p. 5).

Mais especificamente, Bourdieu afirma que os investigadores e, neste caso os doutorandos: "investem com referência a uma antecipação − consciente ou inconsciente − das hipóteses médias de lucro em função do capital acumulado (...). O que é percebido como importante e interessante é o que tem hipóteses de ser reconhecido como importante e interessante pelos outros; portanto, aquilo que tem a possibilidade de fazer aparecer aquele que o produz como importante e interessante aos olhos dos outros" (Bourdieu 1983 [1976], p. 4). Como tal, o doutorando pode aceitar uma maior influência no seu trabalho, desde que obtenha vantagens, pode ser mais focado nos tipos de resultados que são reconhecidos e recompensados pela pelo setor - académica ou empresarial – que gostariam de integrar.

Formula-se a quinta e última questão exploratória do presente estudo:

Q6. Os doutorandos e doutorados que integram processos colaborativos com empresas apresentam diferentes perceções das suas experiências de doutoramento, desempenho e capital social adquirido, comparativamente aos doutorandos com trajetórias académicas? Tal sugere uma série de questões específicas, entre elas: de que forma as colaborações nos programas de doutoramento universidade-empresa influenciam as trajetórias dos doutorandos? Quais as diferenças em termos de capacidades e competências adquiridas pelos doutorandos envolvidos em processos colaborativos comparativamente aos não envolvidos? Que tipo de condicionamento exercem os modelos colaborativos na experiência e perceção dos doutorandos? Até que ponto é possível combinar valores e normas académicas, a partir da formulação do *ethos* científico de Merton, e empresariais na socialização e formação dos investigadores?

Pretende-se caracterizar essas experiências e perceções de forma a analisar a influência da colaboração universidade-empresa em dimensões importantes da sua trajetória académica, como foco de pesquisa, mobilidade intersectorial, competências adquiridas, produtividade científica e expectativas de carreira. Pretende-se também explorar o papel do campo científico, a sua cultura e tradições, como variável com possibilidade de influenciar a experiência de colaboração dos doutorandos (Thune 2010).

5. A estratégia metodológica e os seus desafios

Um movimento interativo entre a reflexão teórica e o trabalho empírico caracterizou a trajetória de investigação e resultou na estratégia metodológica definida e concretizada. Seguiu-se o que se considera uma metodologia mista, intercalando a recolha e a análise de métodos qualitativos e quantitativos, uma vez que se considerou que unicidade metodológica

não seria suficiente para captar e interpretar a realidade a estudar (Creswell, Fetters e Ivankova 2004).

A estratégia metodológica incluiu, então, duas componentes, uma de natureza quantitativa e outra de natureza qualitativa, no sentido de apreender a natureza multifacetada dos processos sociais antecedentes e decorrentes das colaborações universidade-empresa, visando atender à pluralidade dos atores sociais em presença, de modos de colaboração, de condições e contextos concretos. Segundo Bourdieu (2006 [2000], p.15): "(...) torna-se necessário armarmo-nos de todos os instrumentos de conhecimento que, longe de colocar entre parênteses a multidimensionalidade e a multifuncionalidade das práticas, permitam construir modelos capazes de justificar com rigor e parcimónia as ações".

Tal "foco dual" permitiu ainda aprofundar a identificação de comunalidades e a exploração da diversidade num contexto onde a insuficiência de dados era notória (Ragin e Amoroso 2011). A possibilidade de triangulação metodológica de fontes, tipos de dados e métodos utilizados permitiu também aumentar ultrapassar os limites e potencializar as características e vantagens particulares de cada uma das componentes (Bryman 2006), promovendo a integridade dos resultados e a sua confirmação e validação (Denzin 1978; Merriam 1988).

Nesta seção apresenta-se, em linhas gerais, a estratégia de investigação adotada e as razões para a sua escolha. Uma explicação metodológica aprofundada não é aqui incluída, visto que em cada um dos artigos constituintes da presente tese a metodologia é apresentada detalhadamente. Trata-se, sobretudo, de clarificar e desenvolver alguns aspetos que não constam dos capítulos por razões relacionadas com a dimensão máxima estipulada.

A análise de dados é, desta forma, resultante do confronto de várias visões, linguagens, contextos, mas também metodologias e instrumentos que são resumidos na Tabela 1.1. e descritos de forma genérica nas subseções em baixo. Importa ainda salientar que o estudo avançou de forma dialógica, em geral no sentido da componente extensiva alimentar a construção dos instrumentos de natureza intensiva e servir de contexto à sua análise.

Tabela 1. 1. Métodos de recolha e análise de dados em cada capítulo

	Metodologia	**Recolha de informação**	**Amostra**	**Análise da informação**
Capítulo 1	Intensiva Extensiva	Análise documental Estudo de caso comparativo Dados estatísticos secundários	n = 148	Análise de conteúdo Análise univariada
Capítulo 2	Intensiva Extensiva	Análise documental Dados estatísticos secundários	n = 50	Análise de conteúdo Análise univariada
Capítulo 3	Extensiva	Inquérito por questionário	n = 244	Análise univariada, bivariada e multivariada
Capítulo 4	Extensiva	Inquérito por questionário	n = 244	Análise univariada, bivariada e multivariada
Capítulo 5	Intensiva	Entrevistas semiestruturadas Análise de Curriculum Vitae	n = 14 n = 12	Análise de conteúdo Análise univariada

5.1. Metodologia extensiva

A componente extensiva foi orientada por preocupações de generalização e comparação e assentou na exploração dos dados obtidos através da análise de fontes secundárias e de um inquérito por questionário aos diretores dos programas de doutoramento em Portugal.

Sobre os dados estatísticos secundários

Este estudo recorreu a um conjunto de informação produzida por organizações internacionais, em particular indicadores nacionais e internacionais oriundos de levantamentos estatísticos oficiais. Este tipo de informação foi particularmente útil para contextualizar e caracterizar o

contexto português e a sua evolução em termos de política científica e de ensino superior, comparativamente a outros países, nos Capítulos 1 e 2, mas também para apoiar a interpretação do cruzamento com outros dados e análises.

Torna-se necessário, no entanto, ressaltar três questões a propósito da utilização destes dados estatísticos. Os dados oficiais e documentos produzidos por organizações internacionais são produzidos com propósitos distintos, dos definidos para o presente estudo (Merriam 1988). Esta questão relaciona-se com um questionamento sobre a validade de tais indicadores para medir efetivamente o que se pretende estudar (Dolin 2007). Lepori e Bonaccorsi (2013) salientam a este respeito o défice de informação em termos dos significados conceptuais e de recolha dos indicadores por parte dos argumentos que os promoveram. Em segundo lugar, alguns autores consideram que se tratam de instrumentos que não são neutros e que funcionam como uma regulação suave, com repercussões nos debates políticos, nos *media* e na opinião pública (Rochex 2006; Lepori e Bonaccorsi 2013). Em terceiro lugar, estes dados ao se consubstanciarem em indicadores que traduzem a realidade e os contextos em categorias comuns, homogéneas e estandardizadas, de forma a poderem ser comparáveis, tende a reduzir a complexidade (Smith 2008).

Apesar das ressaltas descritas quanto à utilização destes dados, a sua disponibilidade, acessibilidade e diversidade permitiu a acumulação de conhecimento comparável entre países, nomeadamente no espaço da União Europeia, reforçando a reflexividade sobre a situação portuguesa neste domínio. Contudo, entende-se neste estudo a construção de indicadores como um processo social de definição e negociação de limites, envolvendo juízos de valor, bem como interesses e perspetivas políticas (Lepori e Bonaccorsi 2013), sendo a sua contextualização adequada um aspeto central na sua utilização e interpretação (Almklov 2008).

Sobre o inquérito por questionário

Apesar da crescente promoção da colaboração entre universidades e empresas no ensino doutoral, informações sistemáticas e atualizadas sobre a sua extensão e caracterização permanecem escassas. O inquérito por questionário realizado aos diretores dos programas de doutoramento em Portugal tinha como finalidade precisamente: i) mapear os processos de colaboração entre universidades e empresas existentes em programas de doutoramento, ii) desenvolver o conhecimento sobre as colaborações efetivas a partir das suas características, lógicas e atividades, identificar perfis de colaboração, e iii) aprofundar a análise dos fatores que se articulam com as mesmas.

É importante sublinhar que os dados em causa constituem, até ao momento, o único mapeamento direto das colaborações em programas de doutoramento em Portugal, cujos

resultados encontram-se sintetizados nos Capítulos 3 e 4. Não havendo uma listagem oficial ou um banco de dados apropriado para alcançar o "universo de trabalho", o primeiro passo foi construir uma base de dados para a inquirição com o universo completo, ou seja, listar todos os programas de ensino doutoral em todas as universidades do país, identificar os diretores de curso e listar os respetivos endereços de *e-mail*. Para tal, foi necessário utilizar diversas fontes nacionais que contemplavam diferentes informações e subgrupos de dados. A base de dados foi, então, construída a partir do cruzamento entre os dados fornecidos pela DGEEC 2017, pelo portal universitiesportugal.com promovido pelo Conselho de Reitores e pelos sítios das universidades. As contradições entre as fontes foram identificadas e corrigidas, sobretudo através do contacto direto com a universidade onde se integrava o programa de doutoramento ou com o próprio diretor/coordenador do programa. Ao longo deste processo, procurou-se reunir o máximo de informações respeitantes aos programas, como o domínio científico, as vagas, o número de ECT, o plano de estudos e a existência de colaborações nacionais e internacionais. Importou ainda ter em conta não apenas universidades do sistema público, como também universidades do ensino privado, visto que partilham um mesmo espaço, mas possuem margens distintas de responsabilidades e possibilidades de atuação.

O questionário foi revisto por três peritos e pré-testado com quatro diretores de programas de doutoramento em ciências médicas e da saúde, ciências sociais, ciências da engenharia e tecnologia e ciências da vida. Tal permitiu perceber a relevância da agenda de pesquisa e avaliar a qualidade da conceção do questionário. Durante o processo foi possível ter a perceção dos diretores sobre o conteúdo, clareza e relevância das questões e das modalidades de resposta. Os comentários e interações dos atores permitiram fazer ajustes na elaboração das questões. Em particular, foram removidas ambiguidades percebidas, alguns conceitos que considerados vagos e a adaptação e relevância das questões a diferentes níveis de colaboração com empresas, em especial os níveis mais informais. No entanto, o instrumento mostrou-se robusto em termos da capacidade dos inquiridos compreenderem as questões e fornecerem respostas significativas. Também se percebeu que, em alguns casos, os diretores dos programas não reportavam um conjunto de informação que se pretendia averiguar e que seria importante articular os dados quantitativos com dados provenientes de entrevistas – instrumento não previsto no projeto inicial, mas que se concretizou com a realização de seis entrevistas a diretores.

Salienta-se também que a classificação dos domínios científicos apresentada no inquérito partiu de uma visão pluralista (Bryant 2000), utilizando uma adaptação da classificação proposta pelo Manual Frascati 2015 e dos domínios científicos proposta pela Fundação para a Ciência e Tecnologia (2012). Tais classificações foram contestadas para alguns diretores de programas de doutoramento, durante o processo de inquirição, revelando que os sistemas

de classificação tendem a ocultar a natureza controversa do seu estabelecimento ao se apresentarem como naturalmente existentes (Bowker e Leigh Star 1999; Lepori e Bonaccorsi 2013). A controvérsia admite uma coexistência de assunções quanto à legitimidade destas classificações, sobretudo no caso da classificação elaborada pela Fundação para a Ciência e Tecnologia e em programas de doutoramento interdisciplinares, e sugerem que se trata de um exercício onde existem casos híbridos e incertos.

5.2. Metodologia intensiva

A metodologia intensiva empregada neste estudo teve como objetivo principal conhecer, aprofundadamente, os processos complexos em análise de forma mais contextualizada (Yin 2009), iluminando as experiências e interpretando os eventos e fenómenos sociais à luz das narrativas e perspetivas existentes. Para Machado Pais (2003, p. 36) as metodologias qualitativas "acariciam" o social, ao tornar visível o que nem sempre é empiricamente detetável. Trata de significados, discursos, crenças, valores atribuídos aos fenómenos que não podem ser apenas alvo de análises quantitativas e extensivas.

Sobre a análise documental

A análise documental constituiu um procedimento transversal à totalidade da pesquisa, mas foi privilegiada nos Capítulos 1 e 2. Esta vertente foi apoiada pela categorização de documentos legislativos e relatórios institucionais sobre política de ensino superior e ciência, que traduzam orientações relativas ao papel do ensino doutoral na sociedade, na economia, tal como medidas para promovê-lo.

No caso da componente supranacional, a análise concentra-se especialmente nas diretivas e recomendações de instâncias europeias, como a EUA e a Comissão Europeia. A escolha deste nível de comparação, em relação a uma dimensão mais ampla (internacional), deveu-se ao facto da análise europeia incluir instâncias onde Portugal é elemento integrante e onde é provável que circulem orientações que podem influenciar a definição de políticas ao nível nacional. Por outro lado, deve-se também à maior disponibilidade de informação passível de ser utilizada.

Consideraram-se na análise as características textuais dos documentos como um sistema de significantes (Hodder 2003), privilegiando, por exemplo, a escolha de palavras e como os conteúdos são apresentados e justificados. A identificação dessas características permite fazer inferências sobre como os documentos funcionam para produzir certas noções de ensino doutoral e de colaboração universidade-empresa, criando um imperativo para promoção de uma certa forma de pensar estes processos (Winslett 2014). Explorar este

trabalho de composição discursiva implicou explorar a existência de relações entre dimensões materiais ou discursivas (Veloso 2004).

Tal como referido para a utilização de dados estatísticos secundários, torna-se, no entanto, necessário ter em conta que estes documentos foram produzidos com propósitos distintos da investigação e para determinado uso ou público (Merriam 1988), pelo que importa identificar o seu contexto e natureza de forma a melhor poder interpretar o seu conteúdo.

Sobre o estudo de caso comparativo

O estudo de caso comparativo foi utilizado no Capítulo 1. Esta abordagem metodológica segue estudos semelhantes na literatura (por exemplo, Dakowska 2015) e concentrou-se nas principais tendências de convergências política identificadas, mas também aspetos diferenciadores da sua apropriação. O foco foi ainda a identificação de (mudanças nas) normas, valores e crenças que os atores políticos europeus usaram para legitimar as suas ações e uma análise de como tais normas, valores e crenças proeminentes promovidas a nível europeu estão incluídas nessas legitimações (Enders e de Boer 2009).

Neste estudo escolheram-se dois contextos empíricos – Portugal e Flanders - como exemplificativos para observação de um processo mais abrangente, com o propósito de responder aos eixos de investigação e tecer algumas interpretações e explicações. Tal possibilita descrições ricas e a extrapolação de conhecimento de casos únicos para outros estudos (Lincoln e Guba 1985) e pode contribuir para desenvolvimento de conhecimento teórico (Gomm, Hammersley e Foster 2000). No entanto, foi imprescindível relacionar estes casos com o conhecimento sobre o contexto mais amplo de forma a que pudessem iluminar o problema em análise (Stake 1994; Gomm, Hammersley e Foster 2000).

A seleção de casos foi baseada numa lógica sociológica e não estatística (Gobo 2008; Brannen e Nilsen 2011). Procurou-se casos "exemplificativos" (Bryman 2008 [2004], p. 51) ou "analiticamente significativos" (Yin, 2009) que permitissem analisar os processos em causa e responder às perguntas de investigação. Seguiu-se, ainda, a estratégia de casos comparáveis de Lijphart (1971, 1975), o que significa a seleção de países que são diferentes nas questões exploradas, mas são semelhantes em variáveis adicionais que podem ter efeitos no resultado a ser explicado (por exemplo, a dimensão do país). Tal ajuda também a garantir a comparabilidade. Várias fontes, sobretudo de natureza qualitativa, foram usadas para sustentar cada caso. Portanto, a análise é baseada em informações documentais e dados estatísticos, fontes de dados alinhadas com as usadas em estudos que analisam outras mudanças ou reformas no ensino superior (ver Gornitzka, Kogan e Amaral 2005).

Sobre as entrevistas

A partir dos três perfis de colaboração encontrados na análise dos resultados do inquérito foram selecionados seis programas de doutoramento[12] para incorporar uma metodologia de estudos de caso que visava a sua análise intensiva relativamente à problemática em estudo (Ragin e Amoroso 2011)[13] Os estudos de caso foram ainda selecionados tendo em conta a localização geográfica da universidade onde são promovidos. Considerou-se que o contexto regional em que universidades estão inseridas e as suas características específicas eram variáveis com a capacidade de facilitar ou dificultar o desenvolvimento e a consolidação de colaborações entre universidades e empresas. Nesse sentido, o estudo localiza-se num só distrito – o distrito de Lisboa - embora tenha em conta diferentes contextos universitários.

Para tal, recorreu-se a entrevistas aos atores na interface destes processos, tal como a um grupo de controlo não envolvido em processos colaborativos mas enquadrado no domínios científicos selecionados Foram realizadas 25 entrevistas em profundidade dirigidas aos seguintes perfis de entrevistados: a) diretores ou coordenadores dos programas de doutoramento; b) doutorados; c) doutorandos d) profissionais de empresas colaboradoras nos programas de doutoramento. Embora esta tese se tenha concentrado nas entrevistas aos doutorandos e doutorados, analisadas no Capítulo 5, a distribuição completa dos entrevistados pode ser encontrada na Tabela 1.2.

Tabela 1. 2. Caracterização dos entrevistados

	Com colaboração	**Sem colaboração**
Diretores de programas de doutoramento	n = 3	n = 3
Doutorandos	n = 3	n = 3
Doutorados	n = 4	n = 4
Empresários	n = 3	---

Não havendo acesso direto a doutorandos, doutorados e empresários, a seleção

12 Ver Anexo D.

13 A análise dos resultados do inquérito não se concentrou em disciplinas específicas, mas em domínios de conhecimento de acordo com a conceptualização da FCT: Ciências da Vida e da Saúde, Ciências Sociais e Humanas, Ciências Naturais e do Ambiente, Ciências Exatas e Engenharia.

destes atores foi realizada com o apoio dos diretores dos programas de doutoramento, que permitiram "ganhar acesso" aos atores (Burgess 1997). Neste sentido, uma preocupação legítima foi o potencial viés resultante da forma como foram identificados os entrevistados. Contudo, a escolha dos entrevistados não tinha propósitos de garantir representatividade, mas antes assegurar que se tinham em conta as suas perspetivas. Acrescenta-se ainda que, podendo haver um sentimento de obrigatoriedade em responder a uma solicitação do diretor do programa de doutoramento, houve, em geral, uma reação positiva por parte dos entrevistados, que viam a entrevista como uma oportunidade de relatar a sua experiência.

As entrevistas foram focalizadas numa perspetiva descritiva sobre os percursos e processos colaborativos (natureza e intensidade da colaboração) e os seus efeitos (papel da mobilidade intersectorial no percurso formativo, orientação, competências adquiridas, resultados). Por outro lado, tiveram em conta objetivos explicativos para vislumbrar mais do que o que o que acontece, procurando as perceções sobre os valores associados à colaboração, motivações, áreas onde o conflito de interesses podia comprometer os percursos académicos dos doutorandos e expectativas de empregabilidade.

Construiu-se um guião semi-directivo e não um guião rígido – ou "interrogatório burocrático" (Bourdieu 2001, p. 610).[14] O guião das entrevistas aos vários conjuntos de entrevistados caracterizou-se por dimensões comuns e outras específicas em função do interlocutor. Cada transcrição foi analisada de forma independente e submetida a um processo paralelo de registo e codificação reflexiva. Tal trabalho de categorização, de verificação e de recategorização iterativa contribuiu para o desdobramento em unidades e análise.[15] Outro aspeto que se teve em conta foi a utilização do léxico dos entrevistados como uma "pista valiosa" na análise.

Complementariamente e com o propósito de reconstituição da produtividade académica e não académica dos doutorandos procedeu-se à análise dos *Curriculum Vitae* dos doutorandos e doutorados. Não havendo consenso na literatura sobre como medir a produtividade científica (por exemplo, Clemente 1973; Fox 1983; Babu e Singh 1998), neste estudo, mais concretamente no Capítulo 5, foram utilizadas informações sobre a produtividade científica dos doutorandos e doutorados obtidas a partir da análise dos seus currículos durante o período de doutoramento.[16]

[14] Os guiões de entrevista criados para doutorandos e doutorados encontram-se nos Anexos E e F.

[15] A árvore de codificação obtida através da análise das entrevistas é apresentada no Anexo G.

[16] No Anexo H encontra-se a tabela resultante da análise do currículo vitae dos doutorandos e doutorados entrevistados.

Na estratégia para a construção dos dados para este trabalho reconheceu-se alguns dos problemas e limitações metodológicas identificados para a utilização da análise dos *curriculum vitae* como fonte de dados (Chubin, Porter e Boeckmann 1981; Wyer e Conrad 1984; Dietz et al. 2000). A titulo de exemplo, salienta-se que o facto da informação ser auto-relatada, está sujeita a ser construída de forma favorável aos entrevistados. Também o formato semiestruturado dos currículos, aquém de um modelo puramente padronizado, origina a eliminação de informações pertinentes ou a inclusão de dados não relevantes, aspetos que foram atenuados com o cruzamento dos dados obtidos a partir desta metodologia e dos dados obtidos com a realização das entrevistas.

5.3. Outras questões: a não-invisibilidade e a não-neutralidade da investigadora

No presente estudo assumiu-se um posicionamento epistemológico contra a invisibilidade da investigadora. Inspirada em Haraway (1988), tentou-se concretizar a figura de investigador que constrói um conhecimento "não inocente". Parte-se, então, do pressuposto defendido por Bourdieu e colegas (2010), de que não são neutras nem as escolhas metodológicas, nem a nossa própria posição no espaço social. O investigador aborda o mundo a partir de um conjunto de crenças relacionadas com a natureza da realidade, o modelo de conhecer e a relação entre o investigador e o investigado e o modo de aceder e obter conhecimento da tal realidade.

Para Madureira Pinto (1984) não há procedimentos técnico-metodológicos neutros e, nesse sentido, é importante promover o ecletismo na utilização dos instrumentos e técnicas de recolha de dados e promover a integração da teoria na reflexão metodológica. A triangulação dos dados obtidos através de diferentes técnicas de recolha e de análise foi, então, uma forma de minimizar a sempre existente subjetividade decorrente da maior proximidade que se cria entre investigadores e objeto de estudo, assim como aumentar a coerência, a clarificação e a ilustração de resultados (Greene, Caracelli e Graham 1989).

Neste caso em concreto, hove uma consciência de que a biografia pessoal e profissional da investigadora assumia importância no estudo e ter em consideração o "reflexo" que "produz na realidade social e cultural em estudo" (Caria 1999, pp. 17-18). Para Bourdieu (2001) a proximidade assegura as condições principais de uma comunicação "não violenta" e revelou-se na prática num clima de reciprocidade imprescindível para a abertura nas entrevistas.

Contudo, a familiaridade tem limites na medida em que pode levar à pré-construção de determinados aspetos da problemática ou à imposição de definições das situações e vivências aos entrevistados. Desta forma, tornou-se impreterível acionar um processo metodológico reflexivo baseado no questionamento sistemático e permanente sobre aquilo que se observou, caracterizou e estudou. Burawoy (2003) defende um modelo reflexivo de ciência

que se caracteriza pelo diálogo entre observador e participantes; pelo diálogo da teoria consigo mesma. Este objetivo foi sendo especificado e trabalhado numa perspetiva de vigilância epistemológica constante, numa reflexividade reflexa (Bourdieu 1998) e numa atitude de interpretação provisória e contextualizada.

6. A organização do estudo

A presente tese está dividida em cinco capítulos empíricos, apresentados sob a forma de artigos científicos. Cada capítulo tem a intenção de responder ao desenvolvimento das dimensões inscritas no modelo de análise proposto. Desta forma, os capítulos são centrados em torno dos três níveis de análise e nas questões exploratórias anteriormente descritas e que constam na Tabela 1.3. Todos os artigos fazem uma revisão de biográfica atualizada sobre a temática em específico e apresentam aprofundadamente a metodologia e os instrumentos utilizados, juntamente com o tipo de análise desenvolvida.

Importa salientar que cada capítulo apresenta a possibilidade de leitura autónoma, podendo ser lida de forma sequencial ou não, havendo também relações metodológicas e analíticas entre os capítulos.

Tabela 1. 3. Esboço dos capítulos

	Título	Tema	Plano de análise	Questão exploratória
Capítulo 1	"National policy responses to European institutional pressures on doctoral education: the case of Flanders and Portugal" F. Van Deynze & P. Santos *Publicado em: European Journal of Higher Education (2020)*	Influência das orientações políticas europeias no ensino doutoral em Portugal	P1	Q1
Capítulo 2	"Public policies for university-business collaboration in Portugal: an analysis centered on doctoral education" P. Santos *Publicado em: Portuguese Journal of Social Science (2021)*	Colaborações U-E no ensino doutoral nas políticas públicas nacionais	P1	Q2
Capítulo 3	"Social capital and university-business collaboration in doctoral education" P. Santos & T. Thune *Submetido a: Industry and Higher Education (2021)*	Importância do capital social dos académicos nas colaborações U-E no ensino doutoral	P2	Q4
Capítulo 4	"Students matter: the role of doctoral students in university–industry collaborations" P. Santos, L. Veloso & P. Urze *Publicado em: Higher Education Research & Development (2020)*	Papel dos doutorandos nas colaborações U-E no ensino doutoral	P2	Q3 Q5
Capítulo 5	"Academic culture in doctoral education: are companies making a difference in the experiences and practices of doctoral students in Portugal?" P. Santos & M. T. Patrício	Trajetórias e experiências dos doutorandos em percursos formativos com colaboração U-E	P3	Q6

	Publicado em: International Journal of Doctoral Studies (2020).			

O *Capítulo 1* - "National policy responses to European institutional pressures on doctoral education: the case of Flanders and Portugal" - centra-se nas dinâmicas de mudança na Europa no que diz respeito ao ensino doutoral. A análise neste artigo está focada em Portugal e na Bélgica, dois países da União Europeia com tamanho e população semelhantes, mas com diferentes estados de maturidade do sistema científico nacional. Mapearam-se as orientações políticas no sentido de definir os temas centrais discutidos e contribuir para a compreensão das tendências gerais. Em seguida, exploraram-se as formas como os dois contextos nacionais se apropriam e contextualizam tais orientações, tendo por base o modelo teórico de Gornitzka (2013). O exercício comparativo é sistematizado, no sentido de lançar pistas de discussão sobre a convergência europeia e os significados adquiridos nos contextos nacionais, quer do ponto de vista das ideias e do conteúdo, quer do ponto de vista dos processos de implementação.

O *Capítulo 2* - "Public policies for university-business collaboration in Portugal: an analysis centered on doctoral education" - contextualiza o papel do ensino doutoral nas políticas públicas. Este capítulo, de continuidade face ao anterior, aprofunda a análise das principais linhas das políticas nacionais no âmbito do ensino doutoral, em particular são identificadas as medidas e os instrumentos. O capítulo organiza-se em torno da narrativa cronológica, baseando-se na reconstrução da evolução das medidas e instrumentos, mas também nas narrativas justificativas, incluindo os discursos que legitimam tais medidas.

O *Capítulo 3* - "Social capital and university-business collaboration in doctoral education" - responde às questões de investigação direcionadas para a relevância do capital social dos atores académicos na formação e sucesso das colaborações entre empresas e universidades nos programas de doutoramento. Os conceitos teóricos que formaram a base deste capítulo centram-se em torno do capital social, mais especificamente do capital relacional e capital cognitivo. A perspetiva de análise incide no capital social dos académicos envolvidos, procurando-se aprofundar a compreensão dos fatores que diversificam os processos de colaboração com empresas em programas de doutoramento.

O *Capítulo 4* - "Students matter: the role of doctoral students in university–industry collaborations" - visa contribuir para a discussão acerca do papel que os doutorandos assumem nos processos de colaboração com empresas nos programas de doutoramento. Este capítulo continua a explorar as respostas dos diretores ao inquérito, procurando identificar os padrões em termos da influência das características dos programas, das

universidades e das empresas na existência e características das colaborações, bem como caracterizar o papel dos atores na produção e disseminação de conhecimento.

O *Capítulo 5* - "Academic Culture in Doctoral Education: are companies making a difference in the experiences and practices of doctoral students in Portugal?" – teve como objetivo analisar de que forma a colaboração com o setor empresarial influência a trajetória de doutorandos e os seus resultados. Portanto, as experiências de formação de doutorandos envolvidos em colaborações com empresas (trajetória híbridas) são comparadas com as experiências de formação de doutorandos sem esse envolvimento (trajetórias académicas), procurando evidenciar aspetos partilhados e diferenciadores dos seus percursos.

Finalmente, o capítulo de *Conclusão* está dividido em duas partes. A primeira parte é o momento de sistematização e articulação de um conjunto relevante de resultados relativos a cada plano de análise. Na segunda é o momento de balanço do percurso de investigação, incluindo uma análise critica sobre os seus procedimentos e resultados e a identificação de linhas de investigação que permanecem em aberto. Conclui-se este trabalho numa discussão sobre as possíveis implicações políticas, mas também organizacionais, dos resultados do estudo.

CAPÍTULO 1. National policy responses to European institutional pressures on doctoral education: the case of Flanders and Portugal[17]

17 Van Deynze, F. & Santos, P. (2020). National policy responses to European institutional pressures on doctoral education: the case of Flanders and Portugal, *European Journal of Higher Education,* 10:4, 347-36. https://doi.org/10.1080/21568235.2020.1756368.

Abstract

During the past two decades, a shared set of norms and ideas on doctoral education and its purposes has emerged. As the EU strives to transform itself into a knowledge society, countries are expected to have more doctorate holders and orient doctoral education towards the non-academic labour market. However, the interaction between the changes on the European and the national level has not been explicitly conceptualized. This study aims to do that, discussing the different ways in which national policy actors have engaged with this European model in doctoral education. By channelling, buffering and filtering these institutional pressures, they navigate the relationship between the European model, their own preferences and the domestic situation. Using document analysis, we address the cases of Flanders and Portugal, two higher education systems which follow this European model, but also note significant differences owing to their institutional legacies and domestic context.

Keywords: Doctoral education, European higher education, employability, European policies, channelling-buffering-filtering

Introduction

More doctoral degrees are being awarded than ever before. For OECD countries, a rise of 69% is reported, from 158.000 doctoral equivalent degrees in 2000 to 266.881 in 2016 (OECD 2014, 2016). This is partly due to government efforts, who hope to reap the economic and societal benefits of being ahead in the global knowledge economy[18] (Nerad 2010).

However, this growth in PhD production has not been met with unequivocal support. Concerns are voiced about there being "too many PhD's", leading to a "PhD" crisis, stemming from the fact that senior academic positions have not kept pace with massive growth at the junior level (e.g. Cuthbert & Molla 2014; Cyranoski et al. 2011). Counterarguments argue for the value that doctorate holders bring to non-academic jobs, though they may not always be adequately prepared for this.

Overall, these debates revolve around the societal questions of what doctorate holders are good for, how to prepare them for this purpose and whether there are enough of them. These debates have led to an expansion of doctoral education, hoping to graduate more

18 Knowledge economy discourse initially emerged at the level of public policy in the late nineties (Olssen & Peters 2005). It was spread by reports from the OECD and World Bank, and the idea that knowledge would be essential for future economic success began to inform governmental policies around the globe.

doctorate holders, as well as a reorientation, bringing it in line with the ascribed societal and economic purposes.

In Europe, this expansion and reorientation is stimulated by several policy initiatives. Political interest in establishing the "Europe of knowledge" has implicitly expanded the jurisdiction of European bodies (Elken et al. 2010) and linked doctoral education to political and economic goals. This is visible in the Lisbon Agenda and the Europe 2020-strategy, as well as the Bologna Process (Kottmann 2011; Vittorio 2015). Amongst others, these advocate for investments in science, increasing the number of researchers and aligning the doctoral process to be more in line with the creation of a competitive knowledge economy. However, since these aren't binding directives, it is unclear to what extent national policies line up with these developments, and what national characteristics influence implementation of these measures.

Thus far, research on doctoral education in Europe has either focused on this emerging European governance level (Kottmann 2011; Vittorio 2015), or on individual countries (e.g. Green & Powell 2005; Gudmundsson 2008). Lastly, some have addressed single country governmental reforms within the context of these European developments (Kivistö, Pekkola, & Siekkinen 2017; Vittorio 2015). However, it has not been explicitly theorized how and why national policy actors engage with these European developments.

This study intends to contribute to this literature by means of a comparative case study of two higher education systems that have been underresearched in this regard, namely Portugal and Flanders.[19] It also makes a theoretical contribution by applying Gornitzka's (2013) "channel, filter, buffer" model, on how national policymakers engage with international institutional pressures, to a new context. We chose these cases for their relatively similar size and expansion of doctoral education, but also for their different institutional legacies. Portugal is a "developing system" and Flanders a "developed system", which means differences for employability in the non-academic sector (Santos, Horta & Heitor 2016).

The questions addressed by this article are the following: (1) How did national policy actors engage with developments on the European level regarding doctoral education? (2) What factors explain the different responses to European institutional pressures regarding doctoral production and reorientation?

The next section addresses these European developments in detail. Afterwards, we advance the theoretical framework before explaining our methodology and case selection. We then advance our analysis and conclude with discussing the results and the political implications.

19 Flanders is a region in the Belgian federal state. Since the late eighties, education and science policy are almost wholly within the jurisdiction of the regional authorities.

European policy processes in doctoral education

Doctoral education was first put on the policy agenda for its possible contribution in turning the EU into a globally competitive knowledge economy/society.

In 2000, the Lisbon strategy expressed the desire to turn Europe into the most dynamic knowledge-based economy by 2010 (European Council 2000). One pillar on which this rests is the "European Research Area" (ERA), an integrated labour market in science which should be populated by highly skilled, mobile and plentiful human capital (European Commission 2000). Member states later agreed in Barcelona to increase investments in R&D and innovation to 3% of national GDP by 2010 (European Council 2002). The Lisbon Strategy was to be implemented through "soft power" means, engaging countries through mutual discussion, goal setting and comparison of results.

Though the ERA and Lisbon Strategy connect research(ers) with the benefits of a knowledge economy/society, it is the concurrent Bologna Process and the creation of a European Higher Education Area (EHEA) that explicitly links doctoral education to these goals for the first time. In 2003, the Council of Ministers for Education describe the ERA and EHEA as the "two pillars of the knowledge based society" (Conference of Ministers responsible for Higher Education 2003). Doctoral education is singled out as a focal area, to be incorporated as the "third cycle" within the Bologna Process.

The 2005 Bergen Communiqué expanded on this. A key concern is the drive to achieve "an overall increase in the numbers of doctoral candidates taking up research careers in the EHEA", and the promotion of "interdisciplinary training and the development of transferable skills", in order to "meet the needs of the wider employment market" (Conference of European Ministers Responsible for Higher Education 2005). Doctoral degrees were to be included in the EHEA's overarching Qualifications Framework, which expects that holders of a third cycle degree are able to "promote, within academic and professional contexts, technological, social or cultural advancement in a knowledge based society" (European Higher Education Area 2005).

The Communiqué also institutionalized governance structures such as the Bologna Follow-up group. This included stakeholder organizations such as the European University Association (EUA). This involvement resulted in the Salzburg Principles, which reiterated the need to address employability of doctorate holders within the wider labour market, as well as the need for interdisciplinarity and transferable skills training (das Zukunftsministerium, Bundesministerium für Bildung, Wissenschaft und Kultur Österreich, European University Association and Bologna Process 2005). Critical mass and sufficient funding are considered

necessary to ensure “the development of quality doctoral programmes and the successful completion by doctoral candidates”.

In 2005, the European Commission also approved the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers, composed of guidelines for researchers, their institutions and funders. This includes “access to research training and continuous development” to professionally develop researchers and improve their employability. It also states that “Employers and/or funders should ensure that career advice and job placement assistance (…), is offered to researchers at all stages of their careers, regardless of their contractual situation” (European Commission 2005).

Five years later, the European Commission announced replaced the Lisbon Strategy with “Europe 2020”. This reiterated the general norm of a “3% investment of GDP in Research & Development”, though national roadmaps would be drawn up with individualized goals (European Commission 2010).[20]

In 2011, the ERA Steering Group on Human Resources and Mobility developed the Principles of Innovative Doctoral Training (European Commission 2011). The stated importance of interdisciplinary research options, exposure to industry and other sectors, as well as transferable skills training, echo the original Salzburg principles, as well as the Salzburg II recommendations (European University Association 2010). These are further strengthened at the ministerial conference in Bucharest, which names employability as one of the four key issues in doctoral education (EHEA Ministerial Conference 2012). Since then, attention to doctoral education at the highest supranational level has somewhat drifted away from these issues.

Summarizing, the European Union tries to influence doctoral education through “soft law”, relying on the shared understanding of goals, priorities and norms. Important elements of this shared understanding for this paper are the idea that: (1) more human resources in research is needed, (2) doctoral candidates should acquire the skills needed by the wider labour market, (3) intersectoral collaboration and mobility should be supported.

These European influences may impact national level policymaking through various pathways, through exchanging ideas and norms between countries and universities, government officials, stakeholder organizations and higher education professionals. However, doctoral education and aspects related to it have only been tangentially (the “3% norm”) translated into specific indicators on a European level and have not been the subject of binding legislation. This leaves significant leeway to countries as to whether, and how, they want to achieve these general goals.

20 For Belgium 3%, for Portugal 2%.

Theoretical framework

This study focuses on how national policymakers engage with European institutional pressures. We first discuss how these institutional pressures can be characterized before conceptualizing the three different ways policymakers may engage with them.

Drawing on the literature, there are two main ways in which institutional pressures may exert influence (Börzel & Risse 2003; Gornitzka 2013; Vukasovic 2013). The first is regulative pressures that work through coercion, conditionality or manipulation of economic costs/benefits. The second is institutional pressures that work through socialization and communication. Socialization refers to following a normative pressure to behave and think in a certain way, because it seen as appropriate and implies recognition as a fellow group member, whereas communication refers to coming to a shared understanding and worldview, leading to a cognitive pressure to look at the world in a certain way.

With regards to doctoral education, the EU lacks formal jurisdiction and thus lacks direct hard power instruments relying on coercive pressures. Instead, soft power instruments relying on normative and cognitive pressures are used. As detailed in the previous section, this has taken the form of agreeing on common principles for doctoral education, as well as setting shared goals and standards.

Following Gornitzka's framework (2013) for how national policy makers respond to institutional pressures, we identify three basic responses.[21] This framework is especially useful for understanding responses to soft power pressures, as such institutional pressures offer more leeway compared to more constraining hard power instruments.

Channel

National policymakers may channel external pressures to the domestic context, meaning there is a tight link between these pressures and specific national responses. They reference norms and ideas, legitimizing them and using them to inform and legitimate local policy. They may also strengthen them by channelling normative and cultural-cognitive pressures and adding regulative pressures, punishing deviance and rewarding compliance (e.g. turning "more researchers"-pressure into "more funding for doctoral education").

Policy-makers may genuinely see these pressures are legitimate and/or sensible, or deploy them opportunisticly. References may be used to mute potential veto players on the

21 Though called "responses", it is more helpful to think of the national policy actors as "engaging and interacting" with these pressures in ways that show more agency than "responding" might imply.

national scene (Gornitzka 2013). They can be used to justify pre-existing policy preferences and policies (Gornitzka 2013; Vukasovic & Huisman 2018) or invoked to tackle issues that aren't directly related (Musselin 2009).

This response is more likely when normative and cognitive pressures are clear and widely shared and taken for granted, both national and internationally. The presence of domestic norm entrepreneurs, local actors advocating for these institutional pressures, also makes it more likely that national policy-makers will incorporate these pressures into policy (Börzel & Risse, 2009).

Filter

Filtering is a policy response where external pressures are sifted, selectively mixed and matched with national policy legacies, trajectories and system characteristics in order to make them better fit the local context (Gornitzka 2013). They may do this to make reforms more palatable where there is little domestic agreement, appeasing potential veto players who may otherwise resist changes.

Adaptation is done slowly through an incremental process of piecemeal change. This may be done through policy layering, implanting new policy elements onto existing policies. This is likely when policy makers are prone to reforms, but institutional arrangements are change resistant, which higher education sectors have been argued to be (Gornitzka, Maassen & De Boer 2017). Filtering may also take place when external institutional pressures are supported domestically, but when the content is vague or deliberately left open to national reinterpretation, as with European institutional pressures on doctoral education.

Buffer

Whereas channelling is saying "yes" to European institutional pressures and filtering "yes, but…", buffering is saying "no". Buffering differs from channelling and filtering in that external pressures do not lead to national policy changes. Here we can distinguish active and passive buffering. Active buffering refers to direct contestation, taking a stand against institutional pressures, whereas passive buffering consists of avoiding and ignoring the pressure, or concealing non-conformity by decoupling talk and action (Oliver 1991). Policymakers are likely to go against institutional pressures if they clash with internal objectives and interests, and diverge or conflict dramatically with institutional values or legacies (Gornitzka 2013).

In conclusion, based on this model, national policy-makers can respond to European institutional pressures in doctoral education in three different ways. They can channel them to

the domestic context, they may filter and adapt them to the local context, or they may buffer and resist them.

Methodology and case selection

The analysis is based on a comparative case study, an approach that seeks to analyse certain phenomena in more than one national setting (Hantrais 2009).

Portugal and Flanders can be considered typical cases in that they are both higher education systems where doctoral education was expanded in the wake of European initiatives, along with discursive changes regarding its societal purposes. They can be considered followers of the assumed general European trend (Kehm 2007). However, there has been scant scholarly attention paid to the different ways in which national policymakers have engaged with this general trend. This study complexifies this general trend, points to national differences in engaging with it, and clarifies some of the national characteristics which shape this.

Since there is no systematic review of policy measures regarding doctoral education for both cases, we addressed the research questions through document analysis. These include higher education, science and innovation policy documents between 1990 and 2017.[22] Some are specifically concerned with doctoral education, others are broader in scope.

For Portugal, this resulted in a corpus of 57 documents considered relevant: programmes, regulations, resolutions, orders, plans, strategies, decrees, working papers/white papers. The actors involved were governments, council of ministers, assembly of the republic and ministries of science and higher education. It also includes recognized organizations that mediate between the governmental level and the executive pillars of scientific and technological policy (in Portugal, ANI – Agência Nacional de Inovação e FCT – Foundation for Science and Technology), transforming policy measures into policy instruments and manage them.

For Flanders, the corpus consisted of 91 documents with a similar policy-oriented character. These include documents from the ministers and departments responsible for research and education, the interuniversity council and the scientific and education advisory councils. The documents vary from ministers' policy letters and notes, advisory council's research reports and advice based thereon, yearly activity reports from the interuniversity council as well as binding regulatory texts such as laws, decrees and circulatory letters.

22 Ver Anexo A.

Background information

With over half of Belgium's population living within its borders, Flanders is the largest region within the federal Belgian state. For all intents and purposes, education and science policy are entirely within the remit of the regional governments. As such, the Flemish higher education system is almost as autonomous as a national higher education system, such as Portugal's.

Flanders has a strongly institutionalized higher education landscape. Doctoral education is the prerogative of the five universities. Though universities differ in size and status, they do not differ significantly in other regards relevant for this study. Portugal's higher education landscape is more differentiated. According to ETER (2014), in 2014 there were 27 doctorate awarding institutions in Portugal.

Belgium[23] and Portugal are similarly sized countries, but with scientific systems at different development stages. While Belgium has a "developed scientific system", Portugal has a "scientific system in development", which has consequences for resources available for training and integrating doctorate holders (Santos, Horta & Heitor 2016). The European Innovation Scoreboard reflects this, with Portugal considered a "moderate innovator", below EU average, and Belgium a "strong innovator", with a performance above or close to the EU average (European Commission 2019).

The interdependence of doctoral education with general scientific development makes it important to be aware of a nation's total R&D expenditure, the share of company R&D in this, as well as differences in doctoral graduates' employment in different sectors (Table 1.1).

Table 1. 1. Characterization data of the research system in Belgium, Portugal and EU-28

	Belgium	Portugal	EU-28
R&D expenditure (2017)	2,58% of GDP	1,33% of GDP	2,6% of GDP
Company R&D expenditure (2015)	1,72% of GDP	0,58% of GDP	1,31% of GDP

Source: Eurostat (2017), Pordata (2018).

Both Flanders and Portugal have increased R&D expenditure since the early 1990s. Despite a growing trend, neither has reached the 3% of GDP goal set by the Lisbon Strategy, but, as Table 2.1 shows, Flanders is closer (Eurostat 2017). Portugal also has weaknesses regarding the profile of specialization of the companies. The Portuguese economy is mainly composed

23 Lacking comparative regional data, Belgium is used as a proxy for Flanders in this paragraph. This is unlikely to significantly distort the resulting image, if anything downplaying differences rather than exaggerating them.

of small and medium-sized enterprises, specialized in low- or medium-low-technology economic activities, with a small percentage of employees with a higher education diploma. Flanders has also expressed concern about the need to grow the private R&D sector, lacking larger, research-intensive companies. However, numbers differ significantly.

Also, in Portugal, the higher education sector (universities and public research institutes) is the main employer of doctoral graduates with only 2% of them working as researchers in the business sector (DGEEC 2017), whereas in Flanders, 72% of doctorate holders leave (Belgian) academia after graduation (VARIO 2016).

Analysis

Increase and diversification of the number of doctorates and programmes

Flanders

Since the early nineties, the Flemish government decided to invest more in research. This was motivated by the idea that knowledge had become more globally important, the shift to an information or knowledge society, a lack of natural resources and assumed societal, cultural and economic benefits of investment in science. The desire to increase the number of researchers thus predates European developments. Investments in doctoral education were a byproduct. This was aided by a tax-exempt scholarship system implemented on the federal level in 1993, allowing universities to 'hire' doctoral candidates as students rather than as employees.

European institutional pressures only really started playing a role for doctoral education in the early 2000s. Following the advent of the Lisbon strategy and associated processes, references to these processes were used to legitimize further investments. These were now explicitly focused on increasing the number of doctorate holders. This channeling of European norms took place across the policy landscape, with both governmental and academic policy actors in favour of the expansion.

State funding for universities also became partly dependent on the amount of doctoral degrees awarded. In Flanders, universities are funded through a competitive, closed envelope system, i.e. a set-amount of money is distributed amongst universities according to their score on certain parameters. Though there are several funding streams, between 2000 and 2010 the amount of doctoral degrees awarded came to play a role in all of them, serving as a proxy for research performance. In doing so, the government built on New Public Management inspired governance reforms which had started in the nineties, shifting towards a steering system that operates "at a distance", giving circumscribed autonomy to universities.

The influence of European pressures seems clearest when looking at the increase of doctoral candidates. The number of doctoral students and graduates increased fairly steadily across the board. Between 1990–1991 and 2014–2015, the amount of starting doctoral students almost tripled from 886 to 2417 (ECOOM 2017). More people graduated too, quadrupling from 501 in 1991–1992 to 1956 in 2015–2016. Completion rates increased during this period, nearly evening out pre-existing disciplinary differences.

Though no specific national targets were put forward based on European goals, European normative pressures were used to argue for the necessity of this increase, and were used to legitimate further investments into doctoral education. However, these European pressures did not necessarily cause this increase, as the desire to do so predates these institutional pressures, rather serving to justify and entrench these national goals.

Portugal

In the light of Portugal's accession to the EU in 1986, new research policies were implemented. These aimed at the structuration and expansion of the research, technology and innovation system, mostly through investment in advanced training and support infrastructures (Martins & Conceição 2015). Since the nineties especially, these goals motivated measures to increase the number of doctorates, justified by the need for a highly qualified workforce and comparisons to European forerunner countries, leading to the desire to catch up with the "European average". Human capital theory (Becker 1964) became the dominant justification, since these measures focus mostly on the creation of a scientific workforce to stimulate economic development.

Thus, European norms were channelled and served as a yardstick to evaluate the national performance. However, these processes show signs of filtering, especially considering the Portuguese context was different from European reference countries – mainly due to its different starting position and a lack of financial resources.

Since 1991, PhD grants from government institutions have been an important instrument to increase the number of PhD students. From 1998 to 2016, 21.437 scholarships were approved. An abrupt decrease in the amount of approved scholarships took place between 2013 and 2015, as a consequence of the financial crisis and a change in the government. The argument that there are "too many PhDs" gained ground at that time mainly due to the ruling centre-right government (Rodrigues & Heitor 2015). Buffering momentarily took place, based on economic rationales and ideological differences.

As the number of doctoral graduates increased, so did the capacity of universities to create doctoral programmes. This stems from the political importance of highly specialized human resources, but also derives from a filtering process based on the Portuguese desire to mitigate

“brain drain”. Such an effort to internalize the training capacity in Portugal has led to the proportion of doctorates obtained abroad to decrease, from 62% in 1980–10% in 2010 (Pordata 2018).

In summary, the number of PhDs came to be understood as a measure for the incremental investment in scientific human resources and an indicator of the capacity for knowledge creation and innovation. National policy-makers channelled these normative goals and cognitive ideas into Portugal, using them to legitimize their policies. However, more domestic concerns and constraints, as well as a lack of clear norms with regards to how achieve an increase, means that the implementation shows signs of filtering to the local context.

Encouraging and promoting the diversification of the employability of doctorate holders

Flanders

During the nineties, the minister responsible for research hoped universities would rationalize doctoral education by offering more effective and cost-efficient training programmes through interuniversity collaboration and resource pooling. Though there was an awareness of developments towards more structured doctoral education in nearby countries, these did not materialize in Flanders. Policy actors left this to individual universities and faculties. This led to a fragmented landscape of doctoral training programmes which were aimed at developing research skills and research completion, with large differences regarding formality, structure and compulsory nature. Universities were financially rewarded for having these, but this funding was not earmarked for supporting these programmes, and was eventually cancelled in the early 2000s.

Concerns about an oversupply of doctorate holders and a lack of employable skills were occasionally voiced throughout the nineties and the first years of the following decade. These gained momentum during the mid-2000s, receiving significant media and political attention. News articles focused on the large amount of doctorate holders graduating, showcasing stories of doctorate holders struggling with their job search. Combined with concurrent European developments, this created a window of opportunity.

Actors within universities, active in EUA-activities and organized in the interuniversity council, channelled European pressures in a bottom-up manner. Amongst others, they referenced the Lisbon strategy and Bologna’s inclusion of doctoral education as the “third cycle” to argue for the establishment of doctoral schools. The first doctoral school was established in 2007. Within a few years, all universities had similar structures, offering courses on specialized, research-oriented skills, as well as transferable skills such as career planning, leadership, communication and knowledge valorization. Compared to previous doctoral

training programmes, they are more institutionally supported, with a dedicated staff at the university level, and focus more on broader career development rather than disciplinary specialization.

However, though European norms on transferable skills training and how to organize doctoral education were channelled to motivate the establishment of doctoral schools, implementation shows signs of filtering. As before, there continues to be a large degree of freedom for candidates and faculties as to what the curriculum looks like, how it fits in the doctoral trajectory and what elements are compulsory.

In 2008, “Industrial PhD” scholarships were introduced, called Baekelandt mandates. They are in line with European discourse and grew out of a comparison with scholarships in other European countries such as the UK, France and the Netherlands. These mandates are co-financed by universities and companies, with the doctoral candidate spending half their time within the company, which codetermines the subject and content of the research. Baekelandt mandates are often referenced as an important step towards bringing different sectors together and ensuring research valorization. However, despite increased investments, it remains fairly limited, financing less than 1.5% of starting doctoral candidates. Again, though European developments were channelled and informed policy initiatives, the end result shows signs of filtering, a modest layer added to existing funding schemes.

In 2011, the government established a 4 million Euro fund earmarked for the support of junior researchers with regards to (transferable skills) training, career development, internationalization and interuniversity cooperation. The fund legitimizes and finances the earlier established doctoral school system, strengthening reorientation towards the nonacademic labour market. Aside from financing the doctoral schools, these funds are also used to provide career coaching, organizing job fairs and information campaigns aimed at doctorate holders and possible employers. National policy actors thus channel and strengthen European pressures, assigning funding to back up normative pressures.

Most recently, these elements (transferable skills training, doctoral schools and Baekelandt mandates) were reiterated in a parliamentary resolution approved in 2017, briefly referencing Europe 2020 and its focus on employment and growth. The resolution pleads for extra efforts to guarantee a smooth flow from the doctorate to the wider labour market, citing the importance of innovation and entrepreneurialism for the knowledge economy. Parliamentarians argued for a mentality shift among candidates and supervisors, pointing out that less than 20% of doctorate holders end up in academia, despite 53% expecting this. The interuniversity council agreed with these goals, but pointed out that employability concerns were overstated and they were already taking action.

Portugal

Until the mid-90's, public intervention targeting the employability of doctorate holders emphasized the qualification of the scientific and higher education system. This was focused on academia in general, not merely on research. One instrument used intermittently was financial support for hiring doctorate holders in the public sector.

The low employability of doctorates outside academia was long ignored in Portugal. But the ambition to follow European movements put this subject on the agenda, leading to a channelling response. In 1997, and until 2007, the government established the "Program to Support the Integration of Masters and Doctors in Business". The programme was intended to encourage collaboration by supporting companies in hiring highly qualified human resources through cost-sharing during the first three years.

Around the 2000s the issue of doctoral employability outside academia became an important issue in European discourse and political measures turned from doctoral holders to doctoral students and programmes. In 2004, the government also launched PhD scholarships in companies. One of the goals was to reduce the gap between science and business culture to increase the hiring of doctorate holders. These grants require a work plan that specifies the support for the research activity in the company and for PhD students to have an academic orientation and business supervision (Foundation for Science and Technology 2012).

Consequently, between 2006 and 2010, the notion of "employability" acquired a strong ideological use in Portuguese politics. The economic and social relevance of doctoral programmes and education became more important, in the sense that doctoral experience should be more applicable in non-academic settings. This approach to the skills and attributes of PhDs is illustrated by the document titled "Science in Portugal" from the Assembly of the Republic (Gomes 2010). This was justified by the idea that doctoral programmes at the time were "oriented to train researchers and not citizens particularly well qualified to create value in society in various professional activities" (p.15). Different terms were included in the document – "capabilities", "competencies", "attributes" – and led to a list of those considered necessary or desirable.

In 2012, the FCT supported Programmes in Business Environment. These programmes are financed for at least 25% by companies and training of new researchers is adapted to business needs and contexts. PhD programmes are seen as arenas for the development of university-business relations and restructured to bridge gaps, as identified by private sector employers, between the profile of doctorates and the capabilities required by companies. In accordance with guidelines of European bodies, such doctoral programmes give special attention to the relevance of research topics, entrepreneurship and knowledge transfer.

Since 2016, government documents also emphasize a new justification, related to precarity and the struggle of researchers and doctorate holders. For this reason, a new

individual competition was launched for post-doctoral contracts, aiming to create increasingly stable research posts in the academic sector (500 in the first year). Among the initiatives is the creation of permanent research positions at different levels (from junior researcher to research coordinator) rather than postdoctoral positions without a work contract and access to social security.

Overall, Portuguese policy makers have channelled European norms and concepts regarding employability and skills, using them to justify national policies, such as those aimed at reorienting doctoral programmes. However, as before, these institutional pressures had to be filtered, with some distinct elements such as supporting the hiring of doctorate holders in companies in order to build up more of a R&D landscape, as well as the goal of further qualifying the higher education sector, where the amount of doctorate holders amongst staff is considered to be too low still. However, whilst the government's concern about employability is clearly expressed, the government or its agencies don't usually clarify the level of employment and employability they wish to achieve, especially for the private sector.

Case comparison

The three questions driving European institutional pressures, namely (1) What are PhD's good for in society, (2) How do we prepare them for that purpose, and (3) Do we have enough of them, also play locally.

Both systems enacted policies to increase the number of doctorate holders. This was already a goal before the Lisbon agenda. For Flanders this is due to the desire to develop a knowledge economy, offsetting a lack of natural resources, for Portugal this was more about qualifying higher education staff and human resources for companies. Both also channelled European norms to legitimize further investments in doctoral education, and in the Flemish case, also to uphold an indicator driven funding mechanism. Portugal buffered European pressures following the financial crisis, reducing investments in scholarships, though favouring priority scientific areas and researchers considered "excellent". This can be attributed to political disagreement and a lack of national resources, leading to more fickle political support compared to Flanders.

In summary, in both systems, European institutional pressures to increase the number of researchers and investments in R&D were channelled and strengthened by funding regulations. They served to justify pre-existing preferences, as well as means to pursue other pre-existing goals.

However, European ideas linking doctoral education to the establishment of the knowledge economy did not initially lead to policy instruments aimed at changing the process of doctoral education to better fit this knowledge economy. Over time this misfit became more

pronounced. Concern about a lack of academic career options was countered by policymakers as being motivated by an outdated view on the purpose of doctoral education, combined with a lack of skills and familiarity between doctoral graduates and employers. European pressures were channelled and filtered to the local context to legitimize policy initiatives aimed at overcoming these entrenched views.

In Flanders, transferable skills training is available to all doctoral candidates, as the relatively small and less diverse higher education landscape is equally supported by the government. In Portugal, with its more diverse system, scarce resources are focused on specific programmes. University actors in Flanders have also been more active in transnational networks such as the EUA, channelling European institutions into the system and up towards governmental policy-makers. As such, there is more of a bottom-up dynamic in Flanders.

Portugal has been more willing to support the hiring of doctorate holders. This can be explained by difference in non-academic R&D opportunities. Though both systems consider this an issue, it is more pertinent in Portugal, which might explain why the government is more proactive in supporting the establishment of this sector by subsidizing employment of doctorate holders, compared to Flanders which refrains from market intervention and has relied on information campaigns.

In conclusion, national policy actors in Flanders and Portugal have mostly followed European developments. However, these played different roles according to differences in the domestic context. Institutional pressures arguing for increasing and reorienting PhD production were mostly channelled, with some national variety. Implementation shows signs of filtering to the local context, especially those modifying the purpose and process of the PhD. There are two main reasons for this. First of all, these European institutional pressures tend not to prescribe specific policy instruments, offering considerable leeway. Secondly, areas related to the process and purpose of doctoral education, may be more sensitive to reform, as they are more likely to clash with entrenched academic values.

Conclusion

This study shows the different roles that European institutional pressures on doctoral education have played in national policy contexts. National policy actors have mostly channeled these pressures, seeking to increase the number of doctoral candidates, reorienting the doctoral trajectory towards non-academic careers. Some policy preferences legitimated by reference to European developments were already in place beforehand, suggesting opportunistic use by domestic actors. However, considering the long timespan over which these developments took place, it becomes hard for both the researcher and the involved actors to disentangle these original preferences from those deriving from European influences. It is reasonable to assume

that this opportunistic use, even if this was not already driven by a genuine support, has now been irrevocably mingled with this.

Though these pressures have been channelled to legitimize policy goals, their implementation into policy instruments show signs of filtering and adaptation to the local context. This is to be expected considering the characteristic of these institutional pressures, which prescribe a general goal and why it is important, but leave open as to how to realize these goals in practice. More so, these goals themselves may differ in clarity, thus effecting the response. This is evident when comparing national responses to more easily measurable institutional pressures concerning increasing the number of researchers, to those regarding the professional purpose of doctoral education.

Examples of active buffering are rare. This may be due to the case selection. It is possible that other countries have more actively resisted elements of these institutional pressure at one point or another. Due to the methodology employed, passive buffering is harder to detect as on the basis of document analysis it is difficult to tell whether a lack of engagement is due to intentional ignoring institutional pressures, or due to a genuine lack of awareness of their existence. Buffering could also be taking place within the universities and faculties, rather than on the national policy stage. Further research could expand on buffering as a policy response, using interviews to consult the actors involved and clarify their motivation.

CAPÍTULO 2. Public policies for university-business collaboration in Portugal: an analysis centered on doctoral education[24]

[24] Santos, P. (2021). Public policies for university-business collaboration in Portugal: an analysis centred on doctoral education. *Portuguese Journal of Social Science*, 20 (1+2) pp. 65–86.

Abstract

In Portugal, as in other European countries, government policies have driven the modernization of doctoral education, in which collaboration with companies is one of its axes; however, this has been insufficiently studied at the national level. This study focuses on the role of public polices in promoting university-business collaboration by tracking higher education and science policies. The main public policy instruments are analysed, identifying objectives and narratives. The methodological strategy comprises documental analysis. The findings show public policies have played a role in facilitating collaboration of this nature throughout successive governments. These policy measures are justified by the urgency of endowing companies with more qualified staff, aimed at boosting the country's economic development; from a more individual perspective, the need to ensure the employability of doctorate holders; or from a more institutional angle, the alignment of doctoral programmes with the business sector and an interconnection of cultures.

Keyword: doctoral education, university-business collaboration, public policies, higher education policies, science policies, innovation policies

Introduction

Doctoral education was a political domain far from decision-making in Europe (Neave & Maassen 2007). The interest in the virtue of doctoral education increased with the Lisbon Strategy and the idea of the “Europe of knowledge”. This context elevated research and higher education policy to one of the most important strategies in order to make Europe a “more competitive and dynamic” knowledge society. The creation of a European Higher Education Area, specifically its inclusion in the Bologna Process (2003), and the specific proposals taken for the construction of a European Research Area created the space for doctoral education in European politics (Bao, Kehm e Ma 2018).

This brought implications for the debate and considerations about doctoral education processes (and their quality) and products (and their usefulness). Doctoral education was then opened to the flow of objectives from other political areas, especially economic ones, and from other sectors, such as the business sector. As a result, the promotion of university-business collaboration was politically reinforced with different requirements for doctoral students and doctorate holders - “knowledge workers” (European Commission 2005) - and doctoral programmes.

Such orientations and narratives at the European level have influenced and/or conditioned

national political agendas, but political decision-making regarding higher education, and doctoral education in particular, is ultimately carried out at the national level (Van Deynze & Santos 2020). In Portugal, doctoral education started to be seen as a "strategic resource" (Kehm 2009), and successive governments have been investing in university-business collaboration.

As a result of public policies, the number of doctoral students in Portugal has expanded at an accelerated rate: in 1998, there were 638 students and by 2017 there were 4,924 students. There was also an increasing evolution of doctorate holders, totalising 27,752 in 2015. As the number of graduations increased, so did the ability of universities to create doctoral programmes. In the 2017-2018 academic year, there were approximately 592 doctoral programmes in several scientific areas.

It is in this context that collaboration with companies in doctoral education has become part of the political agenda. Little is known about how guidelines and measures in higher education and in the scientific system have influenced these collaborations in Portugal. This requires a better understanding of the nature and the role played by public policies.

This study focuses on the role of public polices in promoting university-business collaboration in doctoral programmes in Portugal by tracking higher education and science policies and considering three elements – doctoral students, doctorate holders and doctoral programmes. More specifically, the research question is: how and why has public policy promoted collaboration with companies in doctoral education in Portugal? It is assumed as a hypothesis that the governments in Portugal have been playing an increasingly interventionist role in this area, in the sense argued by Bourdieu (2006 [2000], p.130): "the more a good or service is considered indispensable, the higher the likelihood that its production will be controlled by the State".

To answer this question, this article begins with a reflection on approaches to conceptualize the role of universities and public policy in a knowledge society. The second section briefly describes the methodology. The following analysis is based on the proposal by Enders and de Boer (2009). It focuses first on the chronological narrative (*how?*), namely the identification of changes in policies, based on the reconstruction of the evolution of political responses, in terms of measures and instruments. Next, the objectives and content of the instruments used are analysed - justifying narratives - including values and beliefs that the political actors used to legitimize their actions (*why?*). Finally, the main considerations that emerged from this analysis are revealed, providing recommendations for public policy itself, as well as clues for future developments on this topic.

Public polices in university-business collaboration

In the so-called “knowledge society”, theoretical models of university and government proliferate. These models embody beliefs about the existence of certain social and economic problems and how they should be resolved.

The idea of the universities' “third mission” has been assumed as a way of adapting the university to meet the complex demands and expectations of society (Mok & Welch 2003). This goes in the same direction as the concept of “entrepreneurial university”, which combines education and research with the capitalization of knowledge (Clark 1998). The assumption is that this role is the result of an evolution of the university: from the “ivory tower” to a significant national actor, that provides the raw material of the economy through knowledge and graduates (Wright 2016).

With this framework, universities started to be considered key agents in the future of Europe, in need of restructuring and modernization. Doctoral education has also started to consider accommodating new configurations of knowledge production, establishing alliances with an increasing number of actors. Bleiklie and Hstaker (2004) found that doctoral degrees were redefined in public policies in Norway, Sweden and the United Kingdom to serve the economy and society in general.

Among the restructurings proclaimed and promoted in universities by the narrative of “knowledge society” is the defence of better connections with the business sector (Roolaht 2015). The underlying idea is that this collaboration would facilitate knowledge transfer and sector mobility, generating ideas and innovation, boosting productivity and, therefore, economic growth (Odei & Anderson 2018). A range of studies emphasizes a variety of intersectoral collaboration and its consequences for innovation and economic development, in particular, the dissemination of knowledge through publications and conferences, the graduation of doctorate holders, and the creation and licensing of spinoffs (Cosh & Hughes 2010; Lakitan, Hidayat & Herlinda 2012).

The persistent barriers between universities and companies were at the centre of the discussion of these proposals, associated with the belief that economic growth would be dependent on a new way of knowledge production. It is in this context that “mode 2” of knowledge production was conceived. According to Gibbons and colleagues (1994), “mode 2” is a more interdisciplinary, intersectoral and heterogeneous way of doing research, for more practical purposes compared to “mode 1”.[25] Later, Carayannis and Gonzalez (2006) developed

[25] "Mode 1" is a disciplinary model that implied that basic university research was converted into applied research that, subsequently, companies transform into experimental development and introduce into the market (Gibbons et al. 1994).

the concept of “mode 3” underlining that an advanced knowledge system can integrate different knowledge and innovation paradigms. It would be composed of a pluralism and diversity of agents, actors and organizations, in a dynamic relationship (linear and non-linear).

Taken together, these proposals have given rise to theoretical models on the role of the university and knowledge, but also on the changing the role of national governments. The best known is the model of production and transfer of knowledge between universities, companies and government, designed by Etzkowitz and Leydesdorff (2000): the “triple helix”. In this model the three “helices” intertwine to produce changes in higher education and research systems.[26] It is an approach that aims to link universities, companies and government to facilitate the economic development and competitiveness of countries. For Assbring and Nuur (2017) this model has become the starting point for political discourse, assuming that provides a framework for policymaker to mobilize these actors for knowledge building processes.

In general, the idea is that the role of the State in a “knowledge society” is to optimize the capacity of resources to generate “knowledge” that can be transformed into “innovation”, dynamizing and diversifying the economy and maximizing the development of the country (Wright 2016). Governments encourage collaboration between universities and business through a range of means and instruments, including tax incentives, direct funding, or programmes whose funding encourages cross-sectoral collaboration in various fields (Bloom, Griffith & Reenen 2002; Guellec and Potterie 2003), including in doctoral education.

Ferlie and colleagues (2009) propose the idea of network governance, with a greater range of actors and in which the government plays an influential role, assuming itself as a facilitator of the relationship. In Portugal, a study that analyse 244 doctoral programmes found that 57.8% of the programmes funded by a specific government scheme involve collaboration with companies (Santos, Veloso & Urze 2020). The role of public funding has also been considered central. Odei and Anderson (2018) analysed different public funding schemes for collaboration between universities and companies and found that this funding was the most significant source for companies, because it helps to overcome the obstacle of funding scarcity that prevents sharing knowledge and innovation.

Other authors have analysed the consequences of public support for intersectoral collaboration in the business sector. Santos and colleagues (2016) point to the trajectory of countries, such as Germany, suggesting that public-private partnerships financed by public funds, such as support for collaborative research and employment of doctorate holders, may have critical roles in promoting innovation in the “traditional” sectors and in the creation of high-tech sectors, contributing to the diversification of the economy. Falk (2007), on the other hand,

[26] The “triple helix” model has also evolved and Carayannis and Campbell (2006) conceived the “quadruple helix”, which adds media and culture as the fourth helix.

concluded that the increase in public funds does not necessarily lead to more innovation in companies, but that the originated behavioural changes must be considered results that justify the investment. In the specific case of doctoral education, Cruz-Castro and Sanz-Menéndez (2005) found that, after government support for the insertion of doctorate holders in Spanish companies, most of the graduates remained in the companies.

For some authors, the collaboration between universities and companies comes from a new public management and managerialism imposed by government policies (Alexander, Miller & Fielding 2015). This has pushed academic research to increase competitiveness and higher education towards issues of social relevance and efficiency (Olssen 2016). The adoption of the "strategic research" concept, according to Henkel (2004), represented this path of recognition of the importance of research and, at the same time, places limits on public support. Regarding doctoral education, Harman (2008) considers that the new organization of doctoral programmes aims to improve quality and efficiency, which imposes an increase in regulations, criteria, defined rights and obligations, and procedures for success assessment.

This discussion raises important questions for an analysis about the Portuguese context, where there is very little literature on the importance of public policy in strengthening university-business collaboration, and non-existent in terms of its relationship with doctoral education. Do measures that promote collaboration between universities and companies in doctoral education move away from a model where there is a single starting point of research (the university) and an endpoint of the economy (companies) to a non-linear model? Is the role of the Portuguese State mainly that of financier? Are the justifications for action related to the terms of the new public management?

Methodology

The methodology is based on the collection and analysis of political documents, from 1994 to 2015. Primary sources consist of 50 documents with implications for university-business collaboration in doctoral education, including programmes, regulations, resolutions, plans, strategies, decree-laws and public interventions (Table 2.1).[27]

Table 2. 1. Number of documents per time period and type of document

[27] Ver Anexo A.

Time period	Total number	Type	Number for type
1994-2001	18	Law	6
		Programme	4
		Regulation	5
		Council of Ministers Resolution	1
		Report	1
		White Paper	1
2002-2010	16	Law	8
		Programme	3
		Regulation	2
		Report	2
		Minister speech	1
2011-2015	16	Law	4
		Programme	6
		Regulation	2
		Council of Ministers Resolution	1
		Report	2
		Manifest	1
Total	**50**		**50**

A content analysis was carried out based on a longitudinal dimension to report the evolution of these policies. This enabled us to chronologically sort the documents under review, reconstructing the political attention given to this topic and the changes in the agenda over time. It also allowed their classification and clustering into thematic groups, in terms of the nature of the instruments used and the type of justifications involved.

This analysis was triangulated with reports and indicators from Portuguese and international institutions, in order to support interpretation. At the national level, these are mainly reports from organizations that populate the so-called “intermediate space” (Rip & Van der Meulen, 1996), mediating the level of policy definition and the main pillars of execution (such as the National Innovation Agency [ANI] and the Foundation for Science and Technology [FCT]). At the international level, consultation of reports was mobilized to characterize the national context, compared to European trends, and to understand how national responses are part of a larger political discussion (Gornitzka 2013).

Public policies bringing together doctoral education and the business sector

Chronological narrative

The purpose of this section is to understand how collaboration between doctoral education and companies has been promoted through a chronological narrative of the political attention given to this subject between 1994 and 2015. To this end, three phases of change are distinguished, based on the nature of the instruments created, as "a set of techniques by which governmental authorities wield their power in attempting to ensure support and affect or prevent social change" (Vedung 1998, p. 21).

1994-2001 – Hiring of doctorates by companies

Policy measures in the 1990s implemented mechanisms of greater proximity between the university and the business sector, for example, through the creation of the Innovation Agency (1993), technology parks and partnership projects. In the second half of the 1990s, a new government led to a shift in the orientation of scientific policy (Rodrigues 2015). In 1997, the FCT, replacing the National Board of Scientific and Technological Research, gave priority to doctoral and postdoctoral scholarships. These doctoral grants would be an important tool in promoting advanced qualification, including in higher education, and scientific and technological production. By 2019, FCT funding for advanced training already reached 98 million euros (FCT 2020).

This is also the period when the first outlines of public policies promoting collaboration between universities and companies in doctoral education were defined, arising from a marked science policy for growth and European convergence objectives. This phase is characterized by supporting the hiring of doctorate holders for the qualification of the business sector (PRAXIS XXI in 1994 and POCTI in 2000), being at the forefront of European developments. The purpose of the PRAXIS Programme was to increase and ensure the competitiveness of national companies. Hiring doctorate holders was done for a period of up to three years, with open-ended contracts benefiting from an additional subsidy. Between 1997 and 2001, government supported the hiring of 43 doctorate holders (FCT 2002). This programme was extinguished with the closure of the III Community Framework, but the issue of support for hiring doctorate holders has remained on the political agenda up to the present time, embodied in different instruments.

As a result of the Lisbon Agenda (2000-2004), which required "more and better" researchers, the reinforcement of the research system in this period led to growing research and development (R&D) activity in companies, testified by the increased number of companies that declared such activities and by the increase in company expenses associated to R&D.

For such, a tax incentive was promoted for companies that develop R&D (SIFIDE). This instrument contributed to foster collaboration in R&D that went beyond the logic of projects (Fernandes 2014) and remains active today, having been reformulated to support directly the hiring of doctorate holders by companies.

Efficiency, excellence and competition became key words in political statements during these years, inspired by the New Public Management (as mentioned by Amaral, Tavares & Santos 2013). This has resulted in a more rational allocation of resources, in which policymaker seek effectiveness and efficiency through the identification of scientific sectors with the greatest economic potential and the granting of competitive funding to researchers and institutions.

2002-2010 – Socialization and training of doctoral students in companies

Crossed by different political cycles, this period is situated in the context of the expansion of the scientific system and the doctoral education system in Portugal. The vision focused on reducing the deficit in the Portuguese research system's capacity compared to the European average (Heitor 2015). The "Commitment to Science" (2005) describes this vision through the title "Overcoming scientific and technological backwardness" and assumed the importance of encouraging the employment of doctorate holders, considering that this would facilitate the creation of "critical mass" and the dissemination of knowledge, stimulating scientific development.

As a consequence, this period is the one in which Portugal is closer to the average of European countries (Rodrigues 2015). The "Towards a European Research Area - Key Figures 2001" (European Commission 2001) emphasized the growth and dynamism in the research sector, both the growth of doctorate holders (the highest in the European Union), and the growth of R&D financed by companies (one of the three highest). In 2007, the goal of 1% of GDP invested in R&D was met and the business sector started to represent 51% of R&D expenditure (FCT 2013a).

An innovation policy also started to be part of the political discourse at this time, namely from the launch of PROINOV (Integrated Programme to Support Innovation) whose purpose was to "develop the innovation system, defined as a set of interconnected institutions that contribute to create, develop, absorb, use and share economically useful knowledge in a given national territory" (Council Ministers 2001). From here, this concept was adopted by a significant part of the policy documents in Portugal, such as the Technological Plan (2006-2009).

Measures related to the hiring of doctorate holders in companies continued to be created and implemented, but were boosted through the use of virtual means. This was the case, in

2004, of the creation of the “deGRAU Científico” website, a job exchange for post-graduate careers in companies. From 2005 to 2008, the Neotec programme was managed by Innovation Agency (ADI), leading to the creation of new technology-based companies that hired highly qualified human resources. Another programme encouraging the placement of doctorate holders in companies was the “Stimulus for hiring doctorate holders in R&D institutions and companies” (2007), aimed at financing at least 1000 new individual research contracts until 2009.

Political instruments were introduced which focused not only on doctorate holders and their employability, but also on doctoral students and their socialization process. Doctoral Scholarships in Companies were created and are still active today. These are grants for the development of research work in a business environment that, according to the regulation, presuppose a work plan specifying “the objectives, the conditions to support the researcher's research activity in the company and the expected interaction between the company and the university institution” (FCT Regulation N.º 234/2012). Between 2010 and 2012, 398 scholarships were approved, however these grants corresponded to an average of 1.2% of the total financed grants (FCT 2013b).

In 2007, as a result of the review of the Portuguese higher education system requested to the OECD (2007), the Portuguese government launched another programme: “Partnerships for the future”. One of the objectives of the programme was to promote academic collaboration with companies based on the integration of doctoral students in research projects developed with both sectors in areas considered to be of high priority. Doctoral programmes were created with institutions in the United States, such as at the Massachusetts Institute of Technology. In a study about this partnership, a questionnaire for doctoral students and doctorate holders of these programmes showed limitations of the university-company collaboration (Patrício & Santos 2020). Nevertheless, about 40% of students had some link to companies, where the most significant link was access to technology and/or data provided by the company, followed by having a company as a partner and input or feedback from companies.

2011-2015 – Promotion of a collaborative model of doctoral programmes

This phase coincides with the economic crises that interrupted the growth path. Budgetary control was imposed, and public investment in R&D decreased, reinforcing private divestment. There was a decrease in support for scientific employment, putting an end to a large majority of supported doctoral research contracts, and funding for doctoral and postdoctoral fellowships. This decrease is visible when comparing the number of approved grants in 2007 (2,031 grants) and in 2014 (453 grants). The argument that there were too “many doctorate holders” gained ground at that time.

Seeking to align the doctoral education offer with national priorities and the needs of the business community, in this period public policies promoted the reconfiguration of doctoral programmes away from the traditional “master-apprentice model” (Kehm,2009). That was the central idea for adopting new funding schemes for doctoral programmes - the FCT Doctoral Programmes (2012), including Doctoral Programmes in the Business Environment. Here, European processes can be understood as a “window of opportunity” (Kingdon 1984/2011), making available to the national government justifications that would facilitate this kind of change.

These programmes had a direct financing line, companies were included in the planning and development dynamics, as well as in their co-financing (at least, in 25%), and doctoral grants were no longer centralized at FCT but managed by the universities. In 2012 and 2013, seven programmes were approved, corresponding to 184 doctoral grants. As an example, the PhD Programme in Refining, Petrochemical and Chemical Engineering brought together more than twenty institutions, including national and multinational companies (such as GALP) and a consortium of five universities. It was also planned at this stage to reinforce the incorporation of projects developed in small and medium-sized enterprises in the curricular plan of doctoral programmes, namely in the areas of management, technologies and innovation, development and technology (Industrial growth strategy for growth and employment 2014-2020, 2013).

However, despite this effort to promote collaboration based on external incentives, a questionnaire applied to directors of doctoral programmes in Portugal in the 2016-2017 academic year designed to access university-business collaboration trends and practices found that the initiative to establish a collaboration between doctoral programmes and companies is mainly the result of individual action (72.3%), with the initiative being of governmental origin only in 2.3% of cases (Santos & Thune 2021). The way in which collaboration is operationalized is mainly due to requests from academic actors (professors, researchers, doctoral students) or entrepreneurs (human resources, including those who are doing a PhD).

This is a period with significant political investment in collaboration. There was a recurrent orientation of public support to companies, mainly to strengthen their competitiveness, embodied in indications for fostering collaboration with companies. This vision is reflected in the “Operational Program for Competitiveness and Internationalization” (2014), integrated in the Portugal 2020 Strategy, which prioritizes the “promotion of business investment in R&D, development of links and synergies between companies, research and development centres and the higher education sector” (XIX Government 2014).

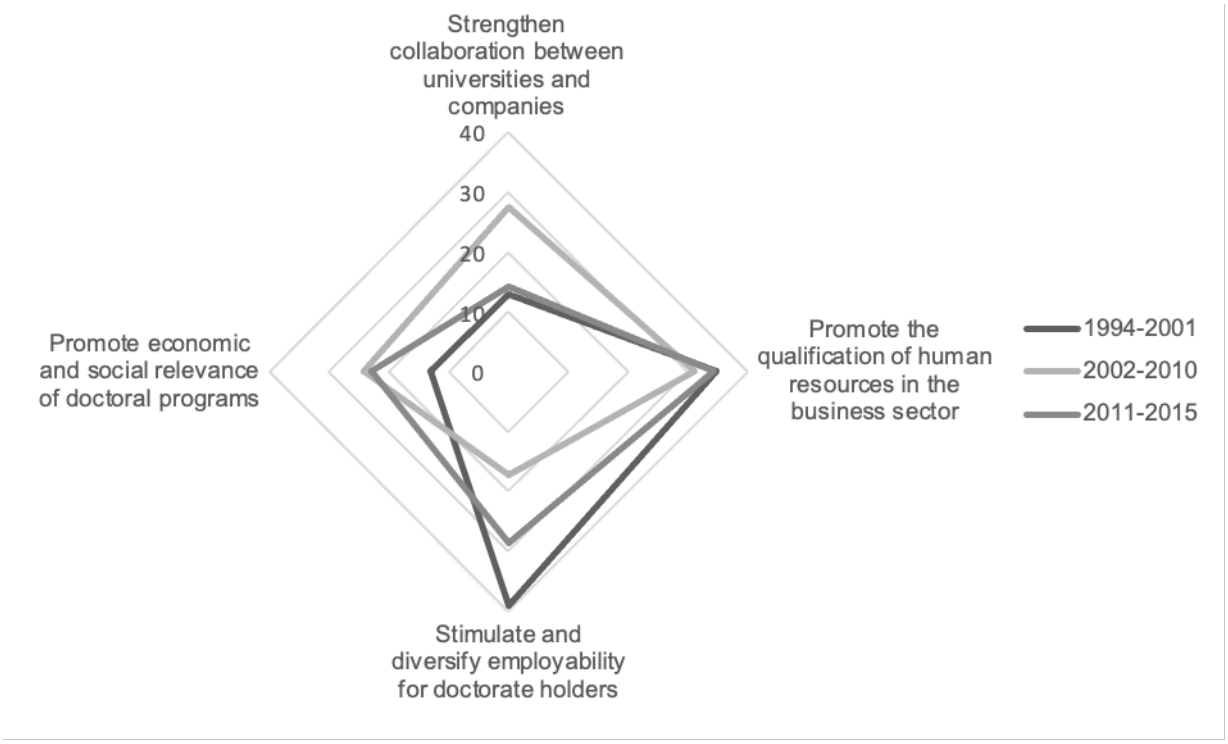
To summarize, the chronological analysis demonstrates that this topic aroused a continuous and growing interest of the governments, evident in the number of documents. It

should also be noted that two types of measures coexist: permanent measures aimed at developing national, country and business sector capacities (such as integration of doctorate holders in companies); and non-permanent measures, which substantiate the choices of political leaders (including new formats of doctoral programmes). It was also found that public intervention was evinced through the adoption of a range of instruments that acted on the supply side (socialization and training of doctoral students and adaptation of doctoral programmes) and on the demand side (fostering collaborative and hiring doctorate holders by companies). Financial instruments – offered to companies, doctoral students and universities – were the most frequently used. Information instruments, in the form of recommendations and guidelines, are rarer, comparatively at the European level.

Justifying narratives

Public intervention in this area is also embodied through the adoption of objectives and narratives. In general, these policies are organized around the following objectives, in decreasing order of importance: i) promote the qualification of human resources in the Portuguese business sector (in 32.7% of the documents analysed), ii) stimulate and diversify employability for doctorate holders (28.6%); iii) promote economic and social relevance of doctoral programmes (in 19.4%); and iv) strengthen collaboration between universities and companies (in 19.4%). Figure 2.1 presents the relevance of these objectives in each of the phases indicated in the chronological narrative. The narrative associated with each of the objectives is discussed below.

Figure 2. 1. Objectives of political instruments,1994-2015 (%)



i) Promote the qualification of human resources in the Portuguese business sector

This is the most prominent objective for public intervention in this area. The justification is that the availability of a highly qualified workforce (doctorate holders) stimulates business R&D and innovation processes in companies and, consequently, the country's economic development. This argument, also infiltrated in European discourses (Johnston & Murray 2004), is organized around assumptions on the nature and requirements of the knowledge economy, where elements such as competitiveness are increasingly present.

The logic of encouraging the modernization of companies is based on a negative diagnosis. The document "Operational Programme for Competitiveness and Internationalization" emphasizes the "insufficient relevance of activities producing goods and services" and the "low intensity of innovation, technology and knowledge of the productive fabric" (pp. 69-70). The "lag" that separates Portugal from other countries is also an important argument in this speech in order to justify political intervention.

State intervention underlines the idea that formal knowledge and tacit knowledge required by companies are incorporated in highly qualified human capital, supporting the justification of hiring of doctorate holders in companies. In the Technological Plan, support for the integration of doctorate holders in companies was linked to the idea of creating "a new economic model, (...) fostering competition based on qualified human resources, R&D and innovation" (Great Options of the Plan 2005 - 2009). Likewise, in the "Industrial Development Strategy for Growth

and Employment 2014-2020" (2013), tax incentive and financial support measures, which promote the integration of doctorate holders in companies, are justified by "promoting technological innovation and scientific development in companies and improving productive structures" (p.69).

The term "innovation" is invoked in an apparently shared understanding of development and growth. The human capital theory also seems to be impregnated with this discourse and measures focused on the creation of a workforce that stimulates the country's economic development. Loxley & Kearns (2018) consider that this discourse and these arguments are central to the macro policy of repositioning doctoral education in society.

ii) Stimulate and diversify employability for doctorate holders

This is one of the most prominent objectives in European discourse (Van Deynze & Santos 2020), and the second most prominent in national policies. Here the focus is on doctoral students and doctorate holders, especially in their ability to integrate innovation and development processes in the business sector.

The discourse is manifest by associating the employability of doctorate holders and their knowledge and skills with the rapid changes in the labour market. The notion of employability is defined in terms of attributes that graduates must have, relying not only on their disciplinary expertise, but also on relevant knowledge and skills for a wide range of sectors. Capabilities become a subcomponent of human capital (Tomlinson 2018).

One of the assumptions of this approach is that doctoral students are trained very narrowly in their field and lack professional skills necessary for employment outside the academy. This is visible, for example, in the document entitled "Science in Portugal" prepared by a committee of the Assembly of the Republic (2010). The justification for this debate was linked to the idea that "other essential competencies for the subsequent qualification of the doctorate holders in society and its institutions (...) are not generally developed during the doctoral programme" (p.15). The Portuguese Government's "Operational Human Capital Programme" (2014) also considers that: "The doctoral and post-doctoral training should contemplate the acquisition of transversal skills, (…), which facilitate the transfer of knowledge, with a view to socio-professional insertion (…) and employability in the productive sector" (article 22). This issue remains on the agenda at a national level.[28]

[28] The "Evaluation report on the implementation of the Scientific Employment Stimulus Programme" (2020) states that "the training of doctorate holders does not promote certain transversal skills seen as relevant by companies, namely the ability to communicate, plan, lead and management" (p.8).

Another and more recent line of discourse for public action and funding is the lack of professional opportunities in academia compared with the increased number of doctorate holders. This is highlighted in the “Industrial Development Strategy for Growth and Jobs 2014-2020” (2013), but also at European level (see EUA 2005). The aim is to improve the range of skills that doctoral students develop and acquire as a way of improving their job prospects in a broader job market and in a context where academic positions are scarce. This logic reinforces the application of knowledge in specific professional situations and justifies measures such as doctoral scholarships in companies, whose intention would be to provide opportunities for doctoral students to acquire knowledge in the private sector and, with this, a greater probability of professional insertion.

iii) Promote economic and social relevance of doctoral programmes

This objective was reinforced by the previous ones, but it focuses, to a greater extent, on the universities that promote doctoral programmes. The political agenda in the improvement of doctoral programmes is centred on the quality and relevance of the training of doctorate holders, towards using the knowledge of doctoral students and graduates for innovation and also for enhancing their own job opportunities. The Portuguese Government's “Specific Regulation of the Domain of Human Capital’ (2015), as part of the Europe 2020 Strategy, is an example by highlighting one of the specific objectives as: “Bringing higher education and advanced training offerings closer to market needs with a view to the transition of graduates to the labour market” (Article 19). This objective is still recurrent in the “Evaluation report on the implementation of the Scientific Employment Stimulus Programme” (2020).

The narrative for a new organization of doctoral programmes can also be seen as part of an effort to make programmes more efficient and predictable. Additional explicit standards in terms of objectives, competencies to be promoted and demonstration of results achieved and returns on public investment may reflect the New Public Management model, as noted by Halse and Mowbray (2011).

This narrative suggests a supposed incompatibility between what doctoral education provides and what entrepreneurs demand. The relationship between universities and employers in doctoral education is characterized as loosely coupled. The active intervention of governments in the restructuring of doctoral programmes, more clearly designed for the demands and needs of the labour market, influenced by the North American model, gains strength in this context. The first step was taken with the launch of the FCT Doctoral Programmes in Business Environment. These doctoral programmes are viewed as arenas for the development of university-business relations and restructured as a way to fill the gaps identified by employers in the private sector concerning the profile of doctorate holders and

their skills, as well as the nature of the research developed in order to support innovation in companies (related to the first justification).

This is where the public intervention zone has more conflicts. Academics draw attention to the possible consequences of the participation of the private sector, its interests and procedures, in its scientific autonomy. The “meddling” of the State as something that would delegitimize the freedom and autonomy of academics and disciplinary groups in the creation of doctoral programmes is also a highlighted aspect.

iv) Strengthen collaboration between universities and companies

Based on the assumption that there is a significant cultural divide between universities and companies, to a lesser extent, some political discourse is centred on the importance of measures and instruments designed to help the two sectors to communicate and collaborate more effectively. The focus here is on both types of institutions, universities and business.

This narrative is based on an understanding of innovation as a network phenomenon (Winslett, 2014). Enthusiasm is nested in assumptions about the possibility of transferring knowledge and innovation, due to the juxtaposition of ideas, tools and people from different domains, which can bring long-term benefits and provide access to resources, materials, knowledge and experience that might not be available in each sector. It is in this sense that the “Specific Regulation on Competitiveness and Internationalization” (2015, p. 70) considers that one of the thematic goals is “to reinforce the transfer of scientific and technological knowledge to the business sector, promoting greater efficiency in the R&I System and the creation of value".

Various barriers to the connection of doctorate holders to companies that restrict the mechanisms of knowledge transfer are highlighted. One of these barriers emphasizes that universities have a “degree of relationship with the business sector that is less than desirable” (Specific Regulation on Competitiveness and Internationalization, 2015, p. 70). Research is considered for mainly academic purposes, and therefore has a minor impact on the production and competitiveness process. It should also be considered the productive sector does not actively support R&D, which results in a low capacity for innovation.

The central argument for political intervention is that measures are needed to influence the behaviour of companies and universities, such as the creation of partnerships in doctoral programmes to encourage and establish bonds. This includes a debate in favour of intersectoral mobility and its possible virtues. In this field, doctoral students and doctorate holders are understood as “agents of change” (Stewart 1999), contributing, during or after their graduation, to transform research results and skills into economic development and diversity.

Political measures present solutions (or instruments) to problems (or objectives) that vary over time and focus on different actors. Although these narratives are articulated, our analysis reveals that some discourses emphasize individual actors (doctoral students and doctorate holders) while other focus on the role of organizations (universities and companies). Also, government policy has ceased to prioritize justifications related to the need for critical mass for companies, adding justifications focused on issues such as the types of skills required by the knowledge-based economy or the adaptation of doctoral education to the growing needs of the labour market. In other words, without abandoning justifications on the demand side, justifications on the supply side have been added.

Conclusions

This political framework for university-business collaboration in doctoral education has been submerged in narratives whose emphasis is mainly economic and whose discourses are clearly reactive in response to the needs and transformations of the "knowledge society", as pointed out by Bleiklie and Hstaker (2004) for other countries. The recurring image is that the merits of doctoral education depend, to a large extent, on its social and economic utility. It is the adoption of the theoretical thinking of human capital that makes doctoral education, its programmes, doctoral students and doctorate holders unavoidable aspects of policies, justifying investment in this area.

Regarding doctoral education, Harman (2008) considers that the new organization of doctoral programmes aims to improve quality and efficiency, which imposes increased layers of regulations, criteria, defined rights and obligations, and procedures for success assessment.

These policies have different focuses. In the first phase, priority was given to interventions for hiring doctoral students and graduates in companies. Then, without abandoning the supply-side measures, the focus shifted to doctoral students and their socialization and training in the business context; and, finally, it moved to focus on changes in the objectives and structure of doctoral programmes, including greater involvement of business partners. In general, the responsibility for collaboration lies mainly with doctoral students and doctorate holders - who must develop attributes to be "employable"; universities and their doctoral programmes - that must be active in creating collaboration and receptive to the interests of companies; and, to a lesser extent, on business partners - who should value collaboration and doctorates holders.

The policy measures under analysis have provided models for university-business collaboration in doctoral programmes. In general, the discourse associated with these models are linked to non-linear knowledge paradigms in which knowledge flows in several directions. The reinforcement of knowledge transfer and circulation is promoted based on a diversified array of instruments which stimulate collaboration routines and circulation of people, as

described in the literature. But these models do not seem to significantly transform the traditional government approach. Governments echo a “triple helix” model in an attempt to increase collaboration between universities and companies in doctoral education, taking on the role of a promoter based on financial incentives. This may have to do with the importance of this incentive for companies (as suggested by Odei & Anderson 2018), but also for universities.

It is important to note that the measures are consistent with European trends and are in line with the dominant explanatory logic. In some cases, European guidelines triggered the emergence of the problem and its timing, as in the promotion of collaborative doctoral programmes. In other cases, they reinforced the guidelines and paths already started, such as in supporting the employability of doctorate holders in the business context.

There is evidence that public policies in Portugal, and their respective instruments, were active promoters of the articulation between doctoral education and the business sector. The Manifesto of scientists and entrepreneurs - “Scientists and entrepreneurs, we speak with one voice” (2020) - is the most recent example of a rapprochement between the two sectors. However, integration rates for doctorate holders in the business sector are low and collaboration in programmes is mostly informal. These are time-consuming processes where the power of experience and prior relationships is important. In addition, the way in which these processes are developed and the extent of the effects of these measures remain untapped. What are the intended and unintended consequences of these programmes and instruments? This question can serve as a motto for subsequent studies. It is also important to investigate how policies of this nature, in particular the new models of doctoral programmes, are appropriated and transformed according to the institutional, organizational and relational characteristics of the actors involved.

Although this theme challenges simple solutions, three political recommendations are made. First, the intersection between different fields of policy in this domain - higher education, science, innovation and economics - leads to the coexistence of documents and instruments focused on different processes and funding. In this context, better coordination between the two main agencies in this field – the FCT and ANI - would be beneficial. The second recommendation is linked to the idea that some measures have been developed to promote intersectoral mobility, but more in the university-business direction and less in the business-university direction. One possibility to address this would be the creation of financial support to train companies' human resources in doctoral programmes. The third recommendation refers to the concentration of investment in specific scientific fields, that integrated the narratives in the period under analysis and in the current period, based on the idea of concentrating on scientific sectors with the greatest economic potential. It is necessary to value policies that boost the (economic and social) contribution of each area in the composition of

the Portuguese economy. It would be important, for example, to promote collaborative programmes with the public sector or third sector organizations, where doctorate holders also represent a minor percentage.

CAPÍTULO 3. Social capital and university-business collaboration in doctoral education[29]

29 Santos, P. & Thune, T. (2021). Social capital and university-business collaboration in doctoral education, *Industry and Higher Education*. https://doi.org/10.1177/09504222211069804

Abstract

University-business collaboration in doctoral education has been promoted by governments and universities. In contexts where there is limited contact between the academic and business sectors, the individuals and their social capital might play an important role in the formation and success of such partnerships, including the frequency of interaction and continuity of partnerships. Here, data from a survey of directors of doctoral programmes in Portugal was used to explore these aspects. The social capital of the directors seems to increase both the intensity and continuity of collaboration, especially in scientific fields considered to be more distant from companies and where university-business collaboration is relatively less common. Previous collaboration will create relational capital, resulting in mutual knowledge and trust, which, in turn, leads to more intense and sustainable collaboration. Academic experience with companies – reflecting cognitive aspects of social capital – increases the diversity of university-business collaboration in doctoral programmes, while also reinforcing the possibility of long-term collaborations. The findings indicate that academics' social capital is an important factor in determining the success of collaborative doctoral education, and should be taken into account when designing and supporting collaborative doctoral programmes.

Keywords: Doctoral education programmes, university-business collaboration, social capital, relational capital, cognitive capital

Introduction

In recent decades, strengthening the links between universities and companies has become a major ambition in research and higher education policy. It is well-known that university-business relations embody a range of varied forms depending on the features of disciplines (D'Este & Patel 2007), industry and company characteristics (Bekkers & Freitas 2008), as well as the experiences and skills of the actors themselves (Gulbrandsen & Thune 2017). Forms of collaboration range from formal agreements over transfer of intellectual property and large-scale research partnerships to informal networks of different types. Whereas most attention has been put on collaboration activities connected to research and technology transfer, recent research has also addressed collaboration related to training, education and mobility of people and knowledge across sectoral boundaries (Perkmann, et al. 2021).

One area of interest in recent research on university-business relationships has been collaboration in doctoral education. Although not a recent phenomenon, as programmes to

support collaborative doctoral education have existed for decades, many initiatives and programmes have been set up by governments and universities more recently to support these connections on a larger scale (EUA 2015; Cardoso, Tavares & Sin 2019). Ambitions of such programmes are to train future researchers in areas that are highly relevant to companies, foster mobility of people and ideas across boundaries, and develop relevant professional skills among PhD graduates (Assbring & Nuur 2017).

Collaborative doctoral programmes were first developed in technology and engineering disciplines, such as the Industry PhD schemes operating in several countries. More recently, programmes have broadened to encompass a wider set of fields including health and biomedical sciences, humanities and social sciences (EUA 2015). Thew latter scientific fields may however have other interests and opportunities and may be more oriented towards collaboration with public sector and non-profit sectors (Olmos-Penuela, Castro-Martinez & D'Este 2014).

There is a variety of models for collaborative doctoral education (Bao, Kehm e Ma 2018). Arrangements include formal models, such as the creation of joint doctoral programmes and internships for doctoral students, and informal models that include collaboration connected to data collection and use of facilities, supervision and teaching, and collaboration connected to communication and sharing of knowledge generated by doctoral students with companies (Santos, Veloso & Urze 2020).

In this paper, we emphasise that collaboration in doctoral programs consist of different forms of interactions. They include both formal and informal forms of collaboration between academic and business actors in the doctoral programs. Most prior studies have focused on formal collaborations, such as industry PhD programmes, with less emphasis on informal modes of collaboration. This study broadens the scope to a wider set of collaboration models.

Moreover, we emphasise that different models of collaboration are not exclusive and are often combined (Santos, Veloso & Urze 2020). Collaborations also evolve over time, and informal connections tend to be a stepping-stone towards more formal, long-term collaboration (Thune 2009; Gustavsson, Nuur & Soderlind 2016). Studies have found that university-company collaboration frequently begins by personal initiatives and are often based on previous personal relationships (Malfroy 2011; Paier & Scherngell 2011). Previous research has also found that individuals and personal connections play an important role in the establishment of collaborative doctoral education (Butcher & Jeffrey 2007; Borell-Damian 2009; Thune 2010). This also implies that it is important to understand the roles of individuals in university-business collaboration (Bercovitz & Feldman 2008; Al-Tabbaa & Ankrah 2018).

Drawing on research on university-business collaboration and social capital theory, this article addresses whether the «social capital» (Bourdieu 2006 [2000]) of individuals influences university-business collaboration in doctoral education. In particular, we are interested in

understanding whether the social capital of individuals – in this case of academics – accrued from personal experience and past connections, influences collaboration intensity and partnership continuity in doctoral education.

The empirical context of the study is collaborative doctoral programmes in Portuguese universities. Portugal has a 'developing scientific system' where university-business collaboration is at an early stage (Santos, Horta & Heitor 2016). The Portuguese economy is mainly composed of small and medium-sized companies, specialized in low or medium-low-technology economic activities, with only 5.7% of doctorate holders working in the business sector (DGEEC 2017). It is interesting to analyse whether the social capital of individuals is more important in empirical settings where university-business collaboration is less developed.

This article begins with a short review of the literature on social capital and collaboration in general and in university-business collaborations in particular, and based on this we formulate a set of hypotheses. Then, it presents empirical data on collaborations in doctoral programmes to shed light on the importance of social capital for the successful development of collaboration, particularly addressing collaboration intensity and continuity. The last part of the article discusses the findings in light of the existing research, outlines our main contributions and the implications for future studies and public policies.

Theoretical framework

Social capital and collaboration

By now there is a significant research tradition on social capital and collaboration (Kwon & Adler 2014). Social capital is a concept with multiple intellectual roots and interpretations, that has entered mainstream thinking in many research fields. The concept originally emerged within community studies (neighbourhoods, facilities, informal social networks, social clubs, etc.) and pointed to elements of the social structure that influence behaviours and actions of individuals without clear economic incentives or command and control-like mechanisms (Kwon & Adler 2014). As such, it is often compared with market relations and hierarchical relations, with attention placed on the value that social ties facilitate in different respects.

A common distinction in the literature is social capital understood in terms of its structural properties of social networks, and research that focuses on the resources that spring from social ties and the benefits these might have for actors (individuals or organizations) (Kwon & Adler 2014). The assumption is that these resources can be appropriated (i.e., becoming a form of capital) and are convertible, in that they can be transferred into other forms of capital (Kwon & Adler 2014). The latter has been an important point of study in management

research, that tends to explore the economic value of network ties for companies (Nahapiet & Ghosal 1998), but studies of individual benefits (human capital) have also addressed economic values of social ties (e.g., Granovetter 1973; Coleman 1990). Research has also entwined these two strands to consider how different network structures are carriers of different kinds of resources that are important for different kinds of outcomes (Nooteboom 2000; Inkpen & Tsang 2005). In both instances, social capital resides in relationships and is created through exchange between actors (Bourdieu, 2006 [2000]). Hence, social capital develops in relationships, but is also a precondition for further exchanges in relationships.

As social capital is a broad concept, much thought has gone into discussing different dimensions of social capital – essentially a discussion about the different resources comprising social capital. Nahapiet & Ghosal (1998, p. 243) define social capital as "the sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual or social unit". They identify three dimensions of social capital that have frequently been used in empirical research: structural, relational and cognitive dimensions. Structural dimensions concern having access to, and a position within, a social network that may give participants access to information, resources and opportunities. Structural dimensions of social capital are preconditions to the formation of collaboration, and hence the precondition to the other two aspects of social capital – relational and cognitive resources.

Relational dimensions, on the other hand, stem from experiences in a specific set of social ties. Through repeated interactions in a specific social setting, individuals develop resources that are beneficial for collaboration, such as mutual trust, norms of reciprocity, obligations and expectations. Such resources are beneficial to collaboration because they achieve coordination, facilitate exchange of knowledge and restrict opportunistic behaviour (Coleman 1990; Granovetter 1973; Ring, Doz & Olk 2005). Such resources reduce potential friction in collaboration and make coordination more efficient (Nahapiet & Ghosal 1998).

Social capital also has a cognitive dimension (Nahapiet & Ghosal 1998), associated with development of knowledge, perspectives and understandings. An important aspect of this are common language and codes, and these in turn lead to the development of a common "system of meaning" among social actors. Another concept for this is "cultural capital" (Bourdieu, 1986). Cognitive resources may not only develop in specific relationships, but also through experience of collaboration with multiple others in a specific field – i.e., cognitive resources are also related to structural dimensions of social capital, and are transferable across contexts. However, while "weak ties" or more generic relationships in a network are good for transfer of information and codified knowledge, research has found that closer relationships between specific partners that are characterized by repeated interaction are necessary for developing and sharing tacit knowledge (Nooteboom 2000; Inkpen & Tsang 2005). As such, cognitive

dimensions of social capital are also related to relational dimensions (Nahapiet & Ghosal 1998; Claridge 2018).

Social capital and university-business collaboration

Considerable research has been published on the topic of social capital and university-business relationships (Thune 2007; Al-Tabbaa & Ankrah 2016; Steinmo & Rasmussen 2018; Robertson et al. 2019). A lot of research has addressed structural properties of university-business networks in the context of e.g., high tech clusters (Walker, Kogut & Shan 1997). Social capital in a structural sense creates opportunities to connect, and as such has been found to be important for the formation of more formal types of university-business collaboration, such as joint projects, research centres, educational programmes, etc. (Thune 2007; Balland 2012; Gordon 2016; Al-Tabbaa & Ankrah 2018).

Research has focused on how social capital reduces barriers to collaboration, and here the attention has been placed on relational and cognitive dimensions of social capital. As universities and companies belong to different societal fields and are seen to embody different institutional logics (Bjerregard 2010; Sauermann & Stephan 2013), collaboration is seen as inherently difficult. Studies have shown that prior collaboration between academic and business actors leads to more successful partnerships (as perceived by the participants), as they develop routines, common knowledge resources and expectations that facilitate knowledge exchange and reduce possible friction (Mora-Valentin, Montoro-Sanchez & Guerras-Martin 2004; Butcher & Jeffrey 2007; D'Este, Guy & Iammarino 2013; Steinmo & Rasmussen 2018). Prior collaboration experiences can lead to greater convergence of understanding (cognitive resources), making it easier to reach a common perception of the different aspects of the process (Thune 2009; Bruneel, D'Este & Salter 2010).

In these cases, social capital is hence seen as something that "lubricates" such relationships and reduces barriers to collaboration (Nahapiet & Ghosal 1998), particularly when focusing on participant perception of quality or success. It is more unclear whether social capital is important for other measures of success, such as the intensity or frequency of interaction or the achieved results. Muscio & Pozzali (2013) for instance find that cognitive distance (limited social capital cognitive dimensions) between universities and companies does not prevent the possibility of establishing collaboration, but hinders its intensity of interaction (measured in frequency). There are also interesting studies illustrating that relational and cognitive sources do not always have to work in tandem. Steinmo & Rasmussen (2018) find that companies that had been involved in repeated interactions with universities relied more on cognitive resources, whereas new collaborators stressed direct, personal interactions as important for successful collaboration.

Another issue that has been investigated is the relationship between social capital and continuity of partnerships over time. A study by Salimi, Bekkers and Frenken (2016) argues that continuity is more likely if joint projects were preceded by another collaboration, indicating that social capital also motivates the continuation of collaboration. Thus, the authors note evidence of "chains" of collaborations indicative of long-term collaboration. They also state that a collaboration is more likely to be continued if the business partner funded the project, which is indicative of trust and commitment.

These findings illustrate that social capital is an antecedent to university-business relationships but that it also influences collaboration intensity and duration. According to Ring and colleagues (2005), social capital and collaboration tend to develop in cyclical ways where different dimensions of social capital exist in dynamic relations. For instance, structural capital is important for the formation of a relationship. Relational capital is crucial for experiencing successful and meaningful relationships, and relational resources are necessary for developing cognitive resources, which in turn are necessary for developing long-lasting relationships.

Hypotheses

In this study, we focus on the development of university-business collaborations, and not the formation of such collaboration. As seen above, relational and cognitive dimensions of social capital are both relevant to understand barriers to collaboration. However, we turn our attention to whether social capital resources are also relevant in explaining the success of these partnerships. We consider collaboration intensity (how frequently actors interact) and continuity (repeated interactions) as indicators of a positive development of partnerships, and investigate the effect of social capital on these dimensions of collaboration in particular.

The insights derived from literature on social capital and collaboration are used to develop a set of propositions to guide the empirical research:

H1: The stronger the relational dimensions of social capital of academics involved in the collaboration, the greater the collaboration intensity.

H2: The stronger the cognitive aspects of social capital of academics involved in the collaboration, the greater the continuity of collaboration.

H3: The stronger the intensity of collaboration, the greater the possibility of continuity of collaboration.

Methods and data

To test these hypotheses, we draw on a survey of the directors of doctoral programmes in Portugal, who were active in the academic year 2016–2017. The objective was to map university-business collaborations in doctoral education and discover trends and practices. The identification and definition of variables and indicators used in the survey were based on theoretical considerations drawn from analysing the literature on university–business collaborations, doctoral education and doctoral education in collaboration with companies.

The questionnaire used was applied to directors based on the consideration that they are in a privileged position regarding information about the doctoral programme, including collaboration processes with companies. However, we are aware of the limitations of using one source of data. Therefore, the questionnaire was tested with doctoral directors from different scientific fields and, based on the feedback, the instrument was improved in terms of perceived ambiguity, vague concepts and representative response options.

The final version of the survey was divided into eight sections with 51 questions in total: i) general characterization of the doctoral programme; ii) collaboration between doctoral programmes and companies; iii) characteristics of collaboration; iv) effects of collaboration; v) facilitating factors and obstacles in collaboration; vi) continuity of collaboration; vii) data on the company; viii) data on the doctoral programme director. The questions in sections i), ii), iii), v), vi) and viii) are analysed in this article.

The questionnaire was available online (*Limesurvey*) between November 2017 and January 2018. Each director was invited to participate by e-mail. To minimize non-response situations, as Dillman suggests (2000), two reminders were sent to nonrespondents. All Portuguese universities were included in the sample[30], in all scientific domains (total of 592 doctoral programmes), covering fields that are not normally included in studies on university-business collaboration.

The sample consists of 244 directors, corresponding to a final response rate of 42.9%. The scientific areas of the doctoral programme in the sample are well representative of the overall distribution of doctoral programmes in Portuguese universities: programmes in social sciences and arts and humanities are the most frequent, while programmes in medical and health sciences and agricultural and veterinary sciences represent a smaller percentage, both in the population and in the sample (Table 3.1). Also, the distribution of doctoral programs by university in the sample are representative of the offer of Portuguese universities.

[30] Polytechnic institutes in Portugal, despite being higher education institutions, are not authorized to promote doctoral courses. Thus, these higher education institutions are not part of the sample.

In this article, only the doctoral programs that integrated collaborative processes with companies were selected, which corresponds to 130 programs of the sample (53.3%). Its characterization by type of university and scientific domain is also found in Table 3.1.

Table 3. 1. Population and sample

	Population	**Sample**	**Sample with collaboration**
Universities			
Public	N = 532; 90.3%	n = 220; 90.2%	n = 14; 77.8%
Private	N = 57; 9.7%	n = 24; 9.8%	n = 4; 22.2%
Scientific areas			
Social Sciences	N = 149; 25.3%	n = 61; 25.0%	n = 21; 16.2%
Humanities and Arts	N = 126; 21.4%	n = 55; 22.5%	n = 16; 12.3%
Sciences	N = 113; 19.2%	n = 51; 20.9%	n = 34; 26.2%
Engineering and Technology	N = 103; 17.5%	n = 40; 16.4%	n = 38; 29.2%
Medical and Health Sciences	N = 67; 11.4%	n = 29; 11.9%	n = 14; 10.8%
Agricultural and Veterinary Sciences	N = 17; 2.9%	n = 8; 3.3%	n = 7; 5.4%
Without identification	N = 14; 2.4%	n = 0; 0%	n = 0; 0%

Variables

There are two dependent variables in the study. The first - collaboration intensity - is used to test hypothesis 1 and 3, and is adapted from the proposal of Bozeman & Gaughan (2007). This variable was created from the response items to the following questions in the questionnaire: “During the academic year 2016/2017, did any of the following collaboration activities with companies take place in the doctoral programme?” The question had a total of 18 items, adapted from the European Commission study ‘Assessing the state of university-business collaboration’ (2016), ranging from the “dissemination of R&D results produced by doctoral students in companies" to "offer doctoral programme together with companies". Based on the response items, an “intensity scale” was developed to represent the frequency of involvement between universities and companies, with a minimum value of 1 (one collaborative activity) up to a maximum value of 18 (all collaborative activities). In order for the results to be clearer, we divided the scale between weak intensity (1 and 2 activities), low-

moderate (3 and 4 activities), moderate-medium (5 and 6 activities) moderate-strong (7 and 8 activities), strong (more than 9 activities).

The second dependent variable is collaboration continuity, used to test hypothesis 2. This binary variable (yes/no) represents the expectations and plans for continuing the collaboration beyond the present time (at the time of the survey). It was created from the answers to the question "Did the collaboration in the doctoral programme continue in the academic year 2017/2018 [the year after the survey was administered]?" The construction of this variable was based on the study of Salimi, Bekkers and Frenken (2016), who used a similar question to measure continuation of collaboration.

The main explanatory variables are measures of the social capital dimensions described above. Relational capital is a binary variable (yes/no) based on answers to the following question "Before this collaboration, did you collaborate with the company in other activities?" The variable is meant to capture the specific experience that the programme director has from previous relationships with a specific company.

Cognitive capital is intended to measure general experience in collaboration with companies that provide the director with business knowledge. This variable was created from the items that make up the variable "previous experience of working with companies" and result from the answer to the following question "In what activities with companies were you involved in the academic year 2016/2017?". This question had a total of 7 items, also adapted from the European Commission study (2016): "research and development projects involving companies", "research projects contracted by companies", "registered patents", "licensing contracts", "spin-offs created", "start-ups created", "working in a company (for example, sabbatical or internship)". This scale represents the frequency of the director's involvement with companies in general, assuming a minimum value of 0 (no collaborative activity) or 7 (all collaborative activities). Based on descriptive analysis, the scale was divided as follows: no capital (0 activities), minimum capital (1 activity), medium capital (2 to 4 activities), maximum capital (more than 5 activities).

As there may be alternative explanations, we add two control variables to the analysis. The first is the field of science of the doctoral programme. Differences related to the scientific domain and, in particular, its importance with regard to university-business collaborations have been established in different studies (O'Shea et al. 2005; Belkhodja & Landry 2007; Bozeman & Gaughan 2007; Borell-Damian 2009). For simplicity, and following other studies, we compare responses from programme chairs in engineering and technology (1) to all other scientific domains (0).

The second control variable is the number of years the respondent has acted as the director of the programme, as prior research has indicated that it is more common to be

involved in external collaboration among academics with more years of service (e.g., Gulbrandsen & Thune 2017).

The variables, measures and descriptive data are presented in Table 3.2.

Table 3. 2. Dependent, independent and control variables

Variables	Measures	Descriptive results
Dependent		
Collaboration intensity	Scale ranged from 1 (one collaborative activity) to 18 (all collaborative activities).	The maximum frequency in the sample is 12. 64.3% indicated two activities in collaboration with companies. In 52.3% of the cases the doctoral students carried out part or all of their research projects in the company, and in 40% of the cases the doctoral students worked on projects whose problem was defined by companies. The least significant activities are those offering joint doctoral programmes (3.8%), the direct participation of companies in the programme management (6.2%) and financial support from companies (11.5%).
Collaboration continuity	Frequency; binary variable (yes/no)	83.0% of collaborations continued in the following academic year.
Independent		
Relational capital	Frequency; binary variable (yes/no)	73.2% had previously collaborated with the company in other activities.
Cognitive capital	Scale ranged from 1 (one collaborative activity) to 7 (all collaborative activities) with companies in general	60.2% indicated no prior collaborative activity (60.2%). 23.8% of the directors indicated that they had been involved in

		one activity in the previous academic year; none indicated 6 or 7 experiences. For those who had had experience with companies, 56.3% indicated having experience in R&D projects involving companies and 24.6% having been involved in research projects contracted by companies, while only 2.4% indicated having spent a period working in a company and 1.6% have been involved in licensing contracts.
	Control	
Scientific field	Dummy - engineering and technology (1), all other scientific domains (0)	29.2% of collaborations ate in engineering and technology programmes.
Number of years as director	Mean	The average is 12 years.

Analysis

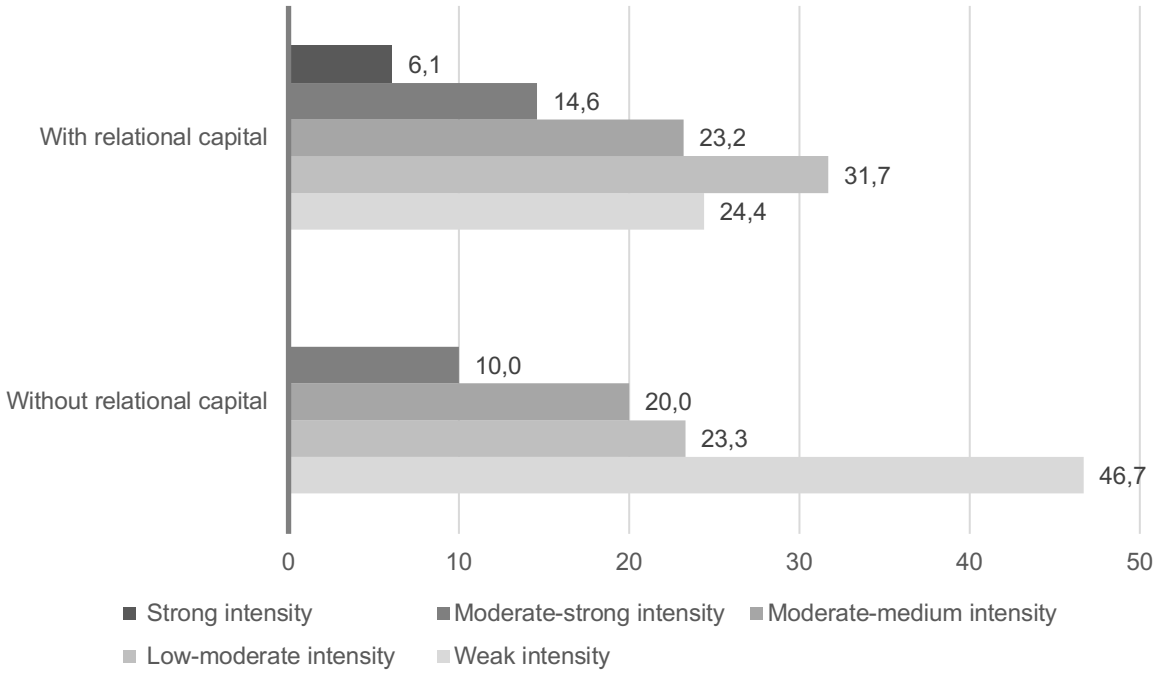
The analysis of the results was divided into three parts: i) the influence of social capital on the intensity of collaboration; ii) the influence of social capital on the continuity of the collaboration; and iii) the connections between relationship intensity and continuity of the collaboration.

Influence of social capital on the intensity of collaboration

The results show that the relational capital of the director of the doctoral programme is related to the intensity of collaboration, explaining 10.4% of the intensity (Eta = 0.322; Eta^2=0,104). More specifically, a significant percentage of cases where the director has no prior experience with the company are located in “weak intensity” category (46.7% of the cases); most of the cases where this capital exists are “moderate intensity” collaborations (69.5%) (Figure 3.1). Although few, there are also doctoral programmes whose directors have relational capital and have “strong intensity” collaborations (6.1%), indicating that prior knowledge can be an

important factor to promote greater diversity of collaborative activities within the doctoral programme.

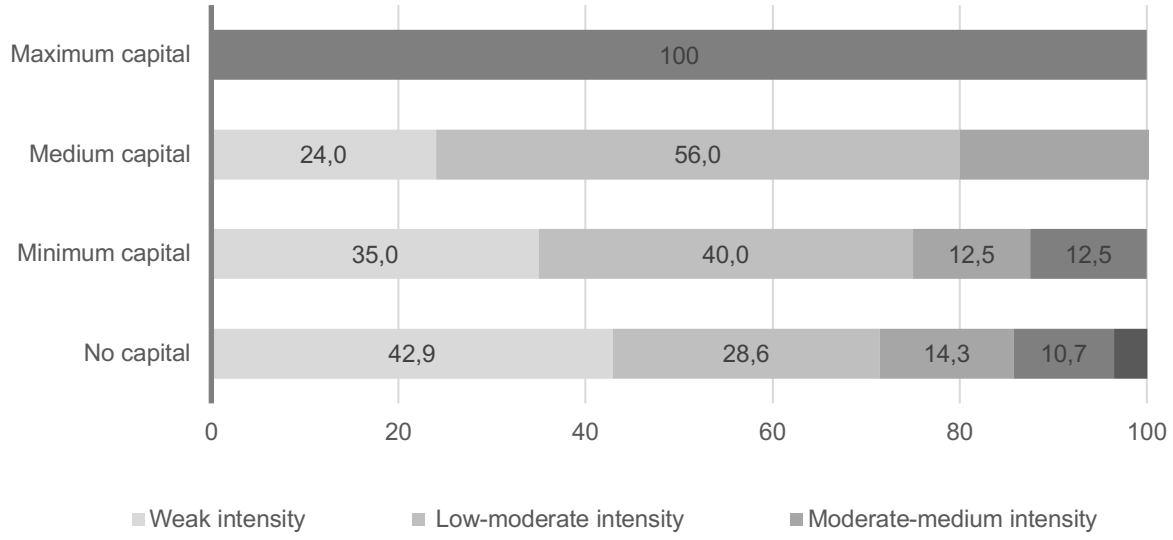
Figure 3. 1. Relational capital and intensity of collaboration (%)



The director's cognitive capital is also, and more strongly, related to the intensity of the collaboration (Pearson = 0.479, p <0.001), implying that the greater the academic experience with companies, the greater the intensity of collaboration (Figure 3.2). 42.9% of the cases in which there is no cognitive capital are “weak intensity”. This means that collaboration processes are restricted to one or two activities. For cases in which the director has “minimum cognitive capital” the collaboration is, above all, “moderate intensity” and “weak intensity”; while 100% of the cases in which the director's capital is maximum show “strong intensity”.

We can say that the experience with companies enables academics to have acquired important tools that help promote a more diverse collaboration. This can be a factor valued also by business actors. To support this idea, the results indicate that the more experience the directors have with companies the less “divergent communication and language modes between universities and companies” is considered a barrier (Eta = 0.438); just as, to a lesser extent, “divergent motivations/values between universities and companies” are considered barriers (Eta = 0.275).

Figure 3. 2. Cognitive capital and intensity of collaboration (%)



To confirm this influence on the intensity of collaboration, we used four linear regression models: i) uses only relational capital; ii) uses only cognitive capital; iii) uses both capitals (complete model 1); iv) uses both capitals and control variables (complete model 2). The four models are significant (Table 3.3). The relational capital and the cognitive capital of the directors seems to positively influence the intensity of the collaboration between the doctoral programme and the company (B = 1.258 for relational capital; B = 1.357 for cognitive capital).

The complete model with the control variables (model 2) is significant, and in this model the control variables – years of programme director and being a programme in the field of engineering and technology sciences – do not explain the intensity of the collaboration. Despite this, in bivariate analysis cognitive capital seems to influence the intensity of collaboration in almost all scientific domains (with Pearson's coefficient varying from 0.894 to 0.378, $p < 0.05$), but less for the sciences, engineering and technology. This may indicate that close languages and cultures between the academic and companies is a more important factor for the intensity of collaboration in the in the scientific domains that are more distant from business culture. The same does not happen with relational capital, whose relevance does not seem to depend on the cultural proximity between scientific domain and companies.

It is also worth mentioning that the director's professional experiences that are strongly related to the intensity of the collaboration are, in order of importance: licensing contracts, research projects contracted by companies, research and development projects involving companies and registered patents. Only 1.6% of the directors have been involved in licensing contracts and 4.1% were involved in the registration of patents, suggesting that cognitive

capital acquired in less common activities in the Portuguese panorama of university-business collaboration can promote more intense collaboration.

Table 3. 3. Effects of relational capital, cognitive capital and types of director's experiences with companies in intensity of collaboration

Variables	**Intensity (R^2)**
Relational capital	.049*
Cognitive capital	.229***
Complete model 1	.172***
Complete model 2	.208***
Director's professional experiences	*Eta (Eta^2)*
Licensing contracts	.573 (.328)
R&D projects contracted by companies	.477 (.228)
R&D projects involving companies	.428 (.183)
Registered patents	.405 (.164)
Spin-offs created	.399 (.159)
Start-ups created	.342 (.117)
Working in a company	.177 (.031)

**p<.05 **p<.01 ***p<.001*

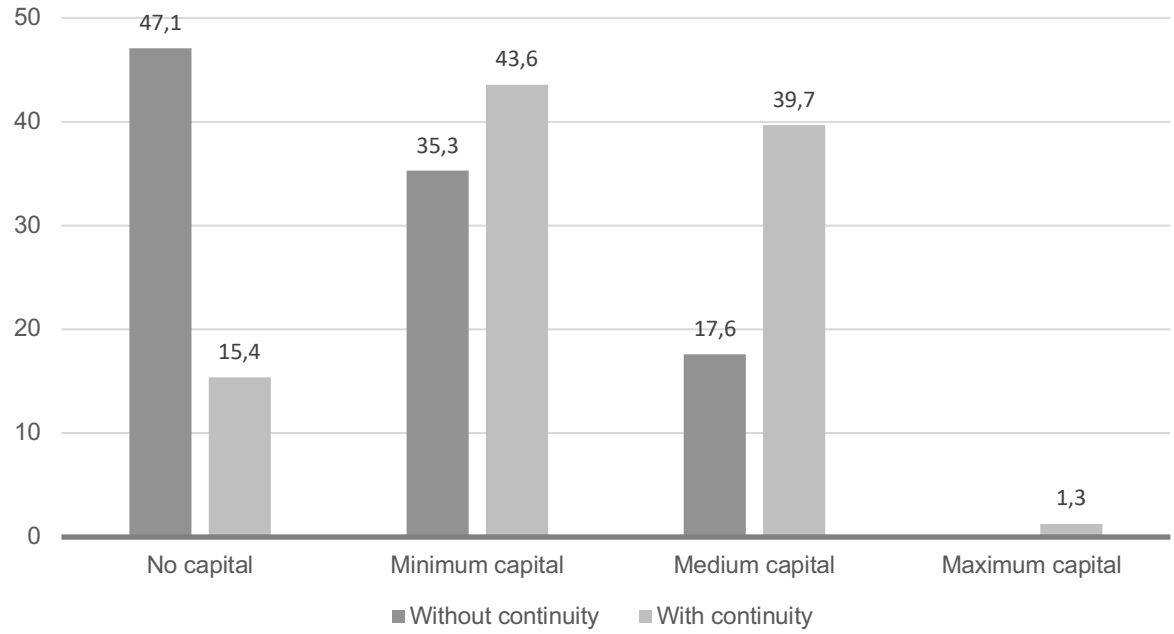
Influence of social capital on the continuity of the collaboration

The director's relational capital is weakly related to the continuity of the collaboration (Cramer's V = 0.254, p < 0.05). In cases of prior collaboration between director and company, 88.2% of collaborations were maintained after the academic year, compared to 66.7% of the programmes whose directors had no prior collaboration with the companies. Those with prior collaboration are also more satisfied with the collaboration than those without prior collaboration (Cramer's V = 0.366, p <0.05).

Also, the director's cognitive capital with companies is related to the continuity of the collaboration, explaining 10.2% of the dependent variable (Eta = 0.319, Eta^2 = 0.102). In 47.1% of the cases where the director has no experience with companies the collaboration does not continue, compared with 15.4% of collaborations that do not continue when the director has experience working with companies (Figure 3.3). If the analysis is done in terms of the different levels of cognitive capital, 83.3% of cases with continuity are in programmes

whose directors have “minimal capital” (43.6%) or “medium capital” (39.7%); and when the director has the “maximum cognitive capital” all collaborations continue.

Figure 3. 3. Cognitive capital and continuity of collaboration (%)



Once again, we developed four models of logistic regression to test whether relational capital and cognitive capital conditioned the continuity of collaboration. The results indicate that the relational and cognitive capital of the directors have a positive effect on continuity. The control variables, again, are not significant in the complete model (Table 3.4). The bivariate analysis revealed that cognitive capital is more strongly related to continuity in agricultural, veterinary, medical and health sciences, humanities and arts and social sciences (Eta ranging from 1.000 to 0.431) than in sciences, engineering and technology. This reinforces the fact that the closest scientific domains closest to the companies already have meeting points; contrary to what happens with the social sciences and the humanities and arts, which need this greater cognitive proximity on the part of the director.

While the professional experiences of directors in less common university-company collaboration activities in the Portuguese context seem to promote greater intensification in collaboration in doctoral programmes, continuity seems to be associated with the most common professional experience of directors (R&D projects involving companies 36.9%). The director's experience in R&D projects with companies is the most relevant experience in this case: 88.7% of the directors with experiences declared that the collaboration continued.

Table 3. 4. Effects of relational capital, cognitive capital and types of director's experiences with companies on the continuity of collaboration

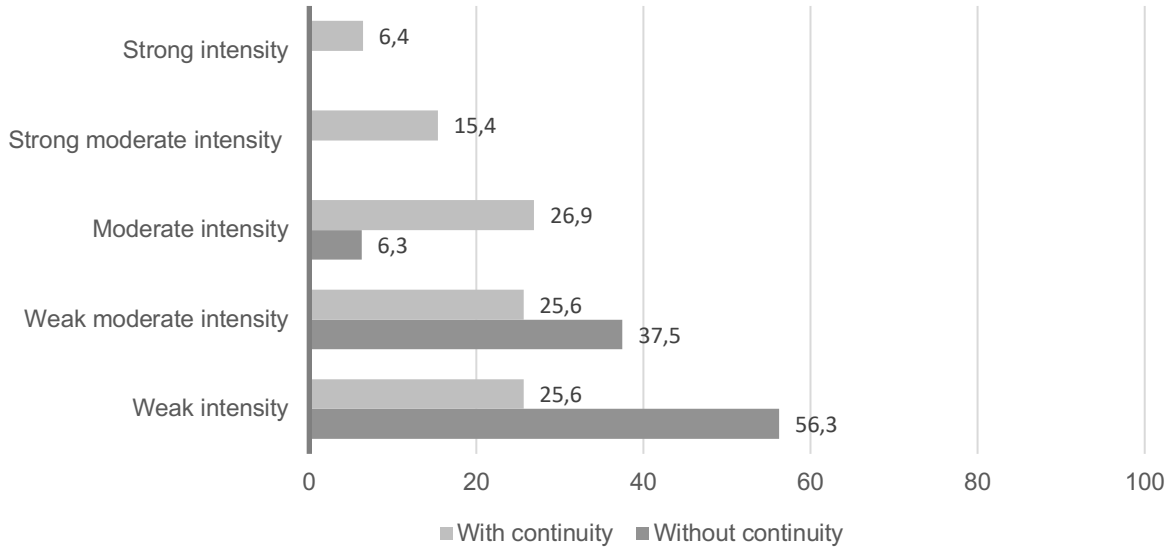
Variables	Logistic regression coefficients
Relational capital	3.750*
Cognitive capital	2.306*
Complete model 1 R^2 (Nagelkerke)	.157
Complete model 2 R^2 (Nagelkerke)	.199
Types of director's experiences	**Cramer's V**
R&D projects involving companies	.297**
Research projects contracted by companies	.149
Registered patents	.142
Spin-offs created	.084
Licensing contracts	.068
Working in a company	.073
Start-ups created	.043

**p<.05 **p<.01 ***p<.001*

Relation between intensity and continuity of the collaboration

The intensity of the collaboration is related to its continuity, explaining 20.7% of continuity (Eta = 0.455; Eta^2 = 0.207). The data also show that the increase in intensity means greater continuity. While the majority of "weak intensity" cases lack continuity (56.3%), the "moderate intensity" cases are, above all, characterized by collaboration continued into the following academic year (Figure 3.4).

Figure 3. 4. Intensity and continuity of collaboration (%)



The linear regression model to confirm this result shows that the intensity of the collaboration has an effect on the continuity of the collaboration (R^2 = 0.116, p <0.001). This result remains significant after adding control variables that show the robustness of the model (R^2 = 0.126, p <0.01). The bivariate analysis shows that in all scientific domains the relationship is strong (Eta ranging between 0.999 for the social sciences and 0.769 for the natural sciences). However, the results show that the more culturally distant the scientific domains are from the companies, the more important is the intensity for the continuity of the collaboration. For programmes in the fields of sciences, engineering and technology and medical sciences and health, the association between intensity and continuity are strong, but less strong than in social sciences and humanities and arts. This result confirms that social capital is more important in scientific fields that are less connected to business and industry in general.

Discussion

The results show that collaboration with companies in doctoral programmes is often initiated by individuals – academics, business actors or the doctoral students themselves (72.3%). This underlines the importance of individual in understanding the formation and development of university-industry collaboration. This paper focused on the role of academics as program directors, and to which extent their experiences and resources (i.e. their social capital) are instrumental for the set-up and development of collaborative doctoral programs. The results

confirm the three hypotheses, and indicates that academics play an important role in collaborative processes.

The social capital held by the directors, both the relationship specific (relational capital) and the generic experience from university-industry collaboration (cognitive capital) are positively related to the *intensity* of the collaboration.

This finding supports prior research that indicates that the existence of previous relationships (relational capital) between academic and business actors promotes trust and confidence (Ring, Doz & Olk 2005). In this case, social capital helps to diversify the range of collaborative activities and increase the frequency of interactions. This study also showed that through repeated interactions, academic actors and business actors become engaged in activities that are stronger in terms of company commitment, such as providing company funding for programmes and doctoral students. This is also in line with previous studies which highlight that repeated interactions are helpful in building trust, joint understanding and commitment (Ring, Doz & Olk 2005) and help to reduce friction (Thune 2009; D'Este, Guy & Iammarino 2013).

The results also show that academics with more diverse experience of working with companies (cognitive capital) are able to foster more frequent or more intense forms of collaboration in doctoral programmes. This result underscores the result that prior collaboration experiences can lead to greater convergence of understanding (cognitive resources), making it easier to reach a common perception of the different aspects of the process (Bruneel, D'Este & Salter 2010; Thune 2009).

The *continuity* of collaboration is also an important, but less studied topic, in the literature on university-business collaboration. The results show that both the relational capital and cognitive capital of programme chairs matter for the continuation of partnerships over time (confirming hypotheses 2). Having been involved in previous collaboration seems to increase, although to a small extent, the possibility of continuity of the collaboration.

This result may be related to the conclusions of previous studies that show that prior collaboration between academic and business actors leads to a greater identification between partners (Al-Tabbaa & Ankrah, 2018) and more satisfaction with the partnerships (Bruneel, D'Este & Salter 2010; Thune, 2009). This may also have an effect on the motivation to continue collaboration with a particular company (Salimi, Bekkers & Frenken 2016).

However, in this study, cognitive capital seems to be even more important in promoting continuity than relational capital. This indicates that cognitive capital reduces the friction resulting from organizational and cultural differences (as evidenced by Mora-Valentin, Montoro-Sanchez & Guerras-Martin 2004; Butcher & Jeffrey 2007; Salimi, Bekkers & Frenken 2016). This also resonates with the findings made by Steinmo & Rasmussen (2018) who highlight that cognitive capital is more important for long-term collaborations, and relational

resources are most important for set-up of new partnerships. In our study, we also see that cognitive resources are especially important in scientific fields that traditionally have had more limited connections to firms and industries. We see in our results that cognitive capital is particularly important for intensity and continuity of collaboration in fields such as the social sciences, humanities and arts.

Finally, the intensity of the collaboration strengthens the possibility of continuing the collaboration between the doctoral programme and the company in the following year (*confirming hypothesis 3*). This leads to positive cycles of collaboration (Ring & Van de Ven 1994), especially in scientific fields traditionally more distant from companies and industries (Steimo & Rasmussen 2018). The findings support the idea that there are "chains" of collaborative processes in which proximity generates trust and commitment between actors, which in turn enables the development of a more intense model of collaboration. Networks established between academic and business actors can create a solid foundation for this type of collaboration, resulting in continued exchange of knowledge (as highlighted by Gustavsson, Nuur & Soderlind 2016).

Overall, the results confirm the general pattern established in previous studies on university-business collaborations, indicating that proximity in the form of relationships established between academic and business actors (relational capital) and more general experience from collaboration with the business sector (cognitive capital) are vital for the intensity and continuity of university-business collaboration.

In general, these results underscore that collaboration is a social process that requires careful consideration of the social actors involved (Comacchio, Bonesso & Pizzi 2012), emphasizing in particular that particular academics who possess considerable social capital can be important promoters of stronger and more intense connection with the business sector. These academics are probably more valued as partners by companies because their expertise and knowledge. It is also possible that they are more oriented towards the commercial value of scientific research. These actors are likely to be academics who assume a "dual life" (Etzkowitz 2008) or act as "boundary spanners" (Parker & Crona 2012). They gain experience and knowledge of both sectors, and this reduces difficulties in translating knowledge from one sector to the other, reduces frictions and makes different interests and demands more easily compatible. When academics also involve doctoral students in collaboration with industry and companies over time this reinforces these networks and essentially trains a new generation of "boundary spanners" (Kunttu, Huttu & Neuvo 2018; Nielsen, Poulfelt & Buono 2018).

Conclusions and implications

The study has two important limitations that must be considered in future research. The first is that it only takes into account the point of view of the academic programme directors. This could be a limitation as other actors in the programme may have been the promoters of collaborations and the director's knowledge of these collaborations may be limited. Future research may opt for case studies including different actors in the analysis or even analyse the importance of the social capital of academics perceived by companies. On the other hand, directors may have had a need to ensure a more positive or successful image of the collaborations. However, we believe that this conflict of interest may have been minimized by ensuring the anonymity and confidentiality of the data.

Another area that needs further investigation concerns the operationalization of the dimensions of social capital, which may not capture all the factors that influence the development of social capital in the relationship between academic and business actors. It could be useful to add other variables, enriching the analysis, for example including institutional differences.

Moreover, this paper addresses doctoral programs that collaborate with the business sector. Doctoral programs in humanities and social sciences often have limited interests or opportunities to collaborate with companies, but they interact with a diverse range of groups, including government agencies and non-profit organizations, promoting multidisciplinary and applied knowledge (Hall & Tandon 2014). In some countries, collaborative doctoral programs have been extended to formal arrangements with the non-business sector, such as in Norway where there is now a “Public sector PhD programme”, in addition to industry PhD schemes. Whether or not the same dynamics that we observe in this paper for business–university collaborations apply in such programmes is however an open question. Such arrangements are relatively recent phenomena and warrant further research.

This study may also have useful implications for policies to promote university-business collaboration in doctoral education and for managers of such programmes. In contexts that are not characterized by high levels of collaboration between companies and universities, the results suggest the need to take into account the academics’ social capital, their ability to connect academia with the business world. The policy implication overall is that paying attention to individuals is important and that it is important to build on and strengthen existing relationships, especially in the scientific domains that are more distant from the business culture.

Universities or policy organizations that want to extend collaborations in doctoral education must take into account experiences of the academic actors involved. The mobility of academics, and potentially entrepreneurs, between universities and companies is an important vehicle for collaboration and one that is particularly useful for developing competencies and skills that are relevant both in the academic and companies domain. Policy

instruments that support mobility of people across the university-business interface are therefore useful for support to collaborative doctoral programmes too.

Finally, as this study highlights the dynamic nature of collaboration and that actors over time develop resources that benefit doctoral programmes, policy should also support and reinforce established collaborations and through this increase the continuity and degree of interaction. More “intense” partnerships likely lead to more learning opportunities for doctoral students, and hence to better learning outcomes.

CAPÍTULO 4. Students matter: the role of doctoral students in university–industry collaborations[31]

31 Santos, P., Veloso, L. & Urze, P. (2020). Students matter: the role of doctoral students in university–industry collaborations, Higher Education Research & Development, DOI: 10.1080/07294360.2020.1814702.

Abstract

Universities are the main knowledge-producing institutions, combining learning and research activities. Companies, in turn, play a role in the application of knowledge. In between, we find university–industry collaborations assuming various forms and stretching across different areas. One of the areas in which this cooperation takes place is doctoral education. The aim of this article is to discuss the role played by doctoral students, through their research, in the enhancement of university–industry collaborations, as they can be a vehicle of connection between academia and companies, but also because they can positively influence knowledge transfer and knowledge sharing. The discussion is framed by public policy initiatives formally promoting relationships between universities and companies in Portugal. We analyse the factors that contribute to make doctoral students important actors in creating and strengthening the colaboration between universities and companies and assess how their role varies between the scientific and economic environments. Our analysis is based on a survey conducted with doctoral programme directors in Portugal during the 2016/2017 academic year. From the main findings of the research, we highlight that doctoral students' research is a central element in university–industry collaboration, including in knowledge transfer, and that the more diverse the role of universities and companies, the more heterogeneous and important is the role of doctoral students.

Keywords: Doctoral students; university–industry collaborations; doctoral programmes; public policy; knowledge transfer

Introduction

In recent decades, we have witnessed important changes in economic and social structures connected to the rise of the so-called knowledge society, where universities and their impact on society have become critical issues on the global agenda. Universities are the main institutions responsible for knowledge production, by combining learning and research, and one of the areas of this interplay being doctoral education.

Doctoral education has been at the centre of a political and scientific debate to redefine it: to train, not only a community of scholars, but also human resources in a knowledge society (Bleiklie & Hstaker 2004; Nerad & Heggelund 2008). The prominence of knowledge and highly qualified people has brought to the agenda of European policy the need to upgrade science and higher education systems so as to cope with new challenges facing society and science. Since the foundation of the European Higher Education Area (2010) and the European Research Area (EU 2020), the European Union has been determined to establish itself as a

knowledge society, where the education of highly qualified people is critical. This, in turn, has led to an extension of this level of education in OECD countries. A rise of 69% is reported from 158,000 doctoral equivalent degrees having been awarded in 2000 to 266,881 in 2016 (OECD 2014, 2016).

In the European arena, doctoral education is increasingly looked upon as a strategic requirement to strengthen economic competitiveness. There is a drive towards doctoral programmes establishing a relationship with various stakeholders comprising each side of the 'knowledge triangle' (Borrell-Damian 2009): education, research and innovation.

According to the European Community, economic growth is increasingly dependent on this new model of knowledge production ('mode 2'; Gibbons et al. 1994) and the capacity of companies, universities, government and civil society to work together in the development of new products, productive processes and services ('quadruple helix') (Carayannis et al. 2017).

From being traditional suppliers of human resources, universities have become suppliers of knowledge production and transfer, including doctoral education. It is assumed that enhancing doctoral education boosts knowledge-sharing practices, as well as the circulation of Research & Development (R&D) outcomes in other economic sectors (Auriol, Félix & Schaaper 2010). Hence, doctoral students can become a cornerstone of the knowledge production and sharing network. Since they are in contact with companies, they can be a crucial element in starting and/or nurturing university–industry collaborations.

This debate has given rise to new doctoral programmes in Europe, which include professional and collaborative programmes with companies, among various public policy measures designed to foster university–company relationships. In Portugal, particularly between 2006 and 2013, science and technology (S&T) policy included funding to encourage the integration of doctoral students in companies ('PhD Studentships in Industry') and the co-creation of doctoral programmes with companies ('PhD Programmes with Industry').

The FCT Doctoral Programmes were promoted by the Foundation for Science and Technology (FCT) between 2011 and 2017, going against the traditional focus of doctoral training in Portugal, that is, individual research. This measure also led to the FCT Programmes in articulation with companies, that is, 'PhD Studentships in Industry' and 'PhD Programmes with Industry' mainly aimed at adapting the training of new researchers to business needs and contexts, with companies funding at least 25% of the programmes. In 2012 and 2013, seven of these programmes were approved.

There are few empirical studies focusing on the role of students involved in this type of collaboration. Thune (2009) emphasises that studies on university–industry collaborations in the framework of doctoral programmes focus on the areas of engineering and life sciences, in which there is a high degree of interaction with companies. Therefore, it is important to understand if and how the role of doctoral students can change according to scientific fields.

The aim of this article is to discuss the role played by doctoral students, through their research, in the enhancement of university–industry collaborations. This discussion is framed by public policy initiatives formally promoting relationships between universities and companies, through doctoral programmes and the integration of doctoral students.

The article is based on the principle that institutional – political, academic and economic – contexts are crucial in understanding the role of doctoral students in enhancing collaboration between companies and universities.

Doctoral programmes as arenas for developing university–industry relationships

The European University Association (EUA) has played a major role in bringing doctoral education and doctoral programmes into closer contact with the economic sector. In its first report in 2005 – 'European Doctoral Programmes for the Knowledge Society' – the EUA described the landscape of doctoral programmes in Europe and, among other topics, emphasised the collaboration with companies. The Marie Skłodowska-Curie Actions include research grants in industrial settings as important ways of establishing cooperation between companies and universities through doctoral education. In Portugal, the challenges posed by attempting to integrate doctoral students in companies led to the creation of 133 government grants for doctoral programmes to be carried out with companies between 2010 and 2013 (FCT 2013). The relationship between doctoral students and employers is thought to bring universities and companies closer together and to increase opportunities for highly qualified jobs based on learning and innovation, which is essential for societal development (Santos 2016).

The endeavour to build a European area of knowledge, innovation and competitiveness, based on an increasing number of PhD holders in OECD countries, has given rise to an agenda dedicated to the employability of highly qualified people in companies. The need to invest in the skillset of doctoral students with the aim of improving their employment opportunities, both in academia and in the labour market, is often highlighted.

The OECD, in partnership with UNESCO and Eurostat, drew recommendations supporting and guiding the employability of PhD holders in non-academic sectors (Auriol, Félix & Schaaper 2010). This is of paramount importance considering that academic positions have not grown proportionally to the number of doctorates (De Grande et al. 2014). As a result, new programmes have been defined to ensure the relevance of research topics and enable doctoral students to acquire transferable skills in addition to academic skills (Harman 2008; Nerad & Evans 2014). Many doctoral programmes are now geared towards the development

of specific workplace skills deemed desirable by employers, rather than focusing solely on knowledge-production skills. Others focus on entrepreneurship, knowledge-transfer skills and specific skills for the creation of science and technology-based start-ups (Breschi et al. 2014). Professional doctoral programmes, aimed at providing graduates who intend to work in non-academic sectors (Santos 2016), have gained greater relevance in this context. Conventional doctoral programmes are now giving way to other forms of producing knowledge and training students, since conventional doctoral programmes, associated with "mode 1" Nowotny, Scott & Gibbons 2001), are not flexible enough to fit the notion of usable knowledge produced collaboratively.

Hughes and Tight (2013) point out that this debate does not seem to consider the flexibility associated with the "traditional way". Models are presented in binary form, without considering the possible variants or more nuanced forms. Contemporary universities should be able to accommodate the full spectrum of doctoral programmes within this continuum: the doctoral programme as a job (mainly a product) and as a journey (mainly a process).

Several studies have shown that there are differences between scientific areas in terms of the transfer of knowledge to the economy (Bozeman & Gaughan 2007; O'Shea et al. 2005) and that the values and norms of scientific areas lead to different priorities and strategic options – differences also pointed out in studies on doctoral education. Borrell-Damian (2009) notes that the role of companies in doctoral programmes varies according to the scientific area. In areas such as engineering, technology, biotechnology, medicine and life sciences, companies tend to be more involved, whereas doctoral students in social sciences have limited opportunities to participate in collaborative doctoral programmes.

The interaction between universities and companies through doctoral education has also been viewed critically. McArthur (2011) points out that discourses conceptualise doctoral candidates as human capital. Frick, McKenna & Muthama (2017) take McArthur's (2011) criticisms further, arguing that these discourses tend to ignore the role played by higher education and academic research as public goods, and question what will happen to the original contribution expected as part of the production of knowledge if partner companies can decide what is appropriate, relevant and timely for research.

The mediating role of doctoral students in university–industry relationships

Various authors argue that doctoral students play a central role in university–industry collaborations (Slaughter et al. 2002; Mangematin & Robin 2003) and knowledge sharing between universities, companies and government (Mangematin 2000; Mougerou 2001).

Research carried out by Siegel et al. (2003) showed that hiring graduate students and fellows was an extremely efficient way of transferring technology, even if its benefits are not

apparent in the short term. A study by Salimi, Bekkers and Frenken (2016) concluded that doctoral students are the main channels of knowledge transfer between academia and partner companies.

Other studies indicate that doctoral students could be 'bridge builders' (Thune 2010) between universities and companies. In this line, Thune (2009) argues that doctoral students play a role in maintaining collaborative links between academia and the economic field. Powel, Koput and Smith-Doerr (1996) and Slaughter et al. (2002) concluded that doctoral students are crucial to the formation and maintenance of networks involving companies and universities. Both studies claim that the role of doctoral students in networking focuses on the relationship between students and their supervisors, who provide them with the opportunity to establish new connections.

A small range of articles highlights the conflicts and contradictions experienced by doctoral students who collaborate in research projects sponsored by companies or participate in doctoral programmes with companies. Harman (2008) examines how the training culture of doctoral students in Australia, whose main emphasis is on an experience aligned with economic needs, differs from a traditional science-based training culture. Harman finds that this 'new' training culture integrates concerns from universities and companies, although the emphasis has shifted from research driven by curiosity to research geared towards producing knowledge and technology that can be immediately applied. Slaughter et al.'s (2002) study highlights differences between the scientific and corporate cultures, and the way students are positioned in this context. According to these authors, academic partnerships with companies in doctoral education can be affected by cultural differences in research approaches, the nature and scope of projects, and deadlines for producing results, which poses problems for students. In Borrell-Damian's (2009) study, doctoral students involved in partnership programmes between universities and companies reported the need to deal with the differing dynamics and pressures of the academic and non-academic worlds, where foci, expectations and deadlines can be conflicting.

Salminen-Karlsson and Wallgren (2008) found that in collaborations deemed to be successful, academic advisors appear to have developed a good learning environment and have been able to identify research projects that are suitable for attaining a doctoral degree. In Thune's study (2010), students generally had more freedom to develop and design research projects when these were fully funded by companies.

The different studies mentioned and the variety of empirical data lead us to conclude that doctoral students and their research activities play a role in promoting and strengthening university–industry relationships. Our article discusses this issue within the Portuguese reality. It examines to what extent doctoral students play a part in shaping the university–industry

relations and in what ways this particular area within doctoral education should be considered crucial by public policy.

Materials and methods

The analysis is based on a survey carried out with Portuguese universities concerning trends and practices of university–industry collaboration in the country and focusing on all doctoral programmes that were active in the 2016–2017 academic year. The questionnaire was sent out to the doctoral programme directors.

The construction of the survey and the identification and definition of variables and indicators were mainly based on theoretical considerations drawn from analysing the literature on university–industry collaborations, doctoral education and doctoral education in collaboration with companies (Santos 2017). The survey also made use of European documents, such as the EUA study conducted by Borrell-Damian (2009) and the European Commission study 'Assessing the state of university-business collaboration' (2016). The final version of the survey was divided into eight sections with 51 questions in total: general characterisation of the doctoral programme; collaboration between doctoral programmes and companies; characteristics of collaboration or desirability of collaboration; effects of collaboration; facilitating factors and obstacles in collaboration; sustainability of collaboration; data on the company; data on the doctoral programme director.

In total, 592 programmes were identified; the sample only contained 568 (96% of the total) as, in some cases, the director's name or contact were incorrect or unavailable.

The survey was shared on the LimeSurvey platform between November 2017 and January 2018 and each director was invited to participate by e-mail. To minimise non-response situations, as Dillman suggests (2000/2007), two reminders were sent to nonrespondents.

A total of 251 questionnaires were received and 244 questionnaires were validated (response rate of 42.9%). The scientific areas of the doctoral programmes in the sample are statistically well represented: programmes in Social Sciences and Arts and Humanities are the most frequent, while programmes in Exact Sciences and Agricultural and Veterinary Sciences represent a smaller percentage, both in reality and in the sample. Moreover, the most represented universities in the sample are also the most represented universities in Portugal.

The analysis was conducted using the IBM SPSS Statistics 23 software. Data analysis combined descriptive analysis with multivariate analysis. Through a Principal Component Analysis (PCA), it was possible to reduce the information and characterise the existing

collaborations. Linear and logistic regression analyses were also performed, which allowed data to support the causal argumentation in greater depth (Hair et al. 2006).

Results and discussion

Public policy and doctoral programmes in collaboration with industry

The establishment of doctoral programmes in the 2001–2010 decade, both with and without the collaboration of companies, reflects public policies put in place to promote education at doctoral level. During this period, a number of public policy initiatives aimed at increasing the number of PhD holders were implemented, as well as initiatives focused on modernising doctoral education, such as the 'Technology Plan' and the 'International Partnership Programme', both implemented in 2006.

The Technology Plan consists in a set of transversal measures to: 'transform Portugal into a modern knowledge society', by stimulating the creation 'of a new economic model, (…) fostering competition based on qualified human resources, R&D and innovation'; and 'to invest in strengthening national scientific and technological skills, both in the private and public sectors' (Grandes Opções do Plano 2005–2009). One of the measures was to encourage the employment of PhD holders in companies and the public sector.

The Partnership Programme is a collaborative programme with US research universities (MIT, Carnegie Mellon and UTA in Texas). Other measures include the creation of doctoral programmes in the areas of science, technology, engineering and mathematics (Horta & Patrício 2016). These programmes highlight the importance of innovation and economic productivity, promote interdisciplinary work and are often run in collaboration with companies.

Analysis of the doctoral programmes based on the survey data shows that 130 programmes (53.3% of the sample) involve collaboration with companies, whereas 114 (46.7%) do not. While, overall, the scientific areas of Social Sciences (25.4%), Arts and Humanities (22.5%) and Engineering Sciences and Technology (16.4%) predominate, the doctoral programmes involving collaboration with companies are mainly found in Engineering Sciences and Technology, Agricultural and Veterinary Sciences, Natural Sciences and Exact Sciences.

By considering that doctoral programmes could explain the existence of collaboration using a simple logistic regression model, given the dichotomous nature of the dependent variable (dichotomous variable with a value of 1 for the existence of collaboration and 0 for absence of collaboration), we can conclude that the scientific area has an impact on whether or not collaboration takes place: programmes in Engineering Sciences and Technologyare more likely to involve collaboration, explaining 20.4% of total variance and increasing the

likelihood of collaboration by 3.14 times (B = 3.141, p < .001). Programmes in the Social Sciences have the opposite effect on collaboration, reducing its likelihood by 0.99 times (B = −0.976, p < .05).

Of the 244 doctoral programmes analysed, 45 (18.4%) are funded by a specific government scheme (in particular, the FCT Programmes – 14.6%), while only a few are funded by the Partnership Programme (1.6%). 57.8% of these programmes involve collaboration with companies, which seems to indicate that this funding promotes collaboration with companies.

Programme directors were asked about the type of collaborative companies' activities that had been carried out. Based on a multivariate analysis of the 13 types of collaborative activities, five components of collaboration were identified, comprising more than half of the total variation (59.14%). Factorial scores (relative coefficients) were calculated for the five components that characterise university–business collaboration activities to be used as dependent variables in subsequent analyses. The first component – involvement of the company in doctoral student research – is the most important and accounts for 20.7% of variance; it includes the most significant activities in the sample and is linked to the development of doctoral student research. The second component – company's funding of the programme and doctoral student – 12.0% of total variance. The third component – sharing doctoral students' results with companies – accounts for 9.5%. The fourth component – direct participation of the company in the programme – accounts for 8.8%. And finally, the fifth component – sharing the company's physical and human resources – accounts for 8% of total variance.

These results highlight the central role of doctoral research in most of the existing collaborations. A substantial part of universities' collaborative activities with companies in the framework of doctoral programmes in 2016–2017 was connected to doctoral students' research projects: in 52.3% of the cases students carried out part or all of their research projects with the company and in 40% of the cases they worked on projects defined by the companies.

While, on the one hand, company involvement in students' doctoral research is related to the programme goal of 'expanding the skills of doctoral students' (Spearman's rho = 0.20, p < .05), on the other hand, there is a moderate correlation between companies' definition of the topic of doctoral research projects and their funding of the same projects (Phi = 0.407). This may indicate that the funding provided by the company has a greater impact on the doctoral research undertaken. In this sense, it is important to consider, as some studies suggest, the impact of the company's funding of academic research by placing more emphasis on the choice of the research topic and the results (Barjak, 2006; Gulbrandsen & Smeby, 2005).

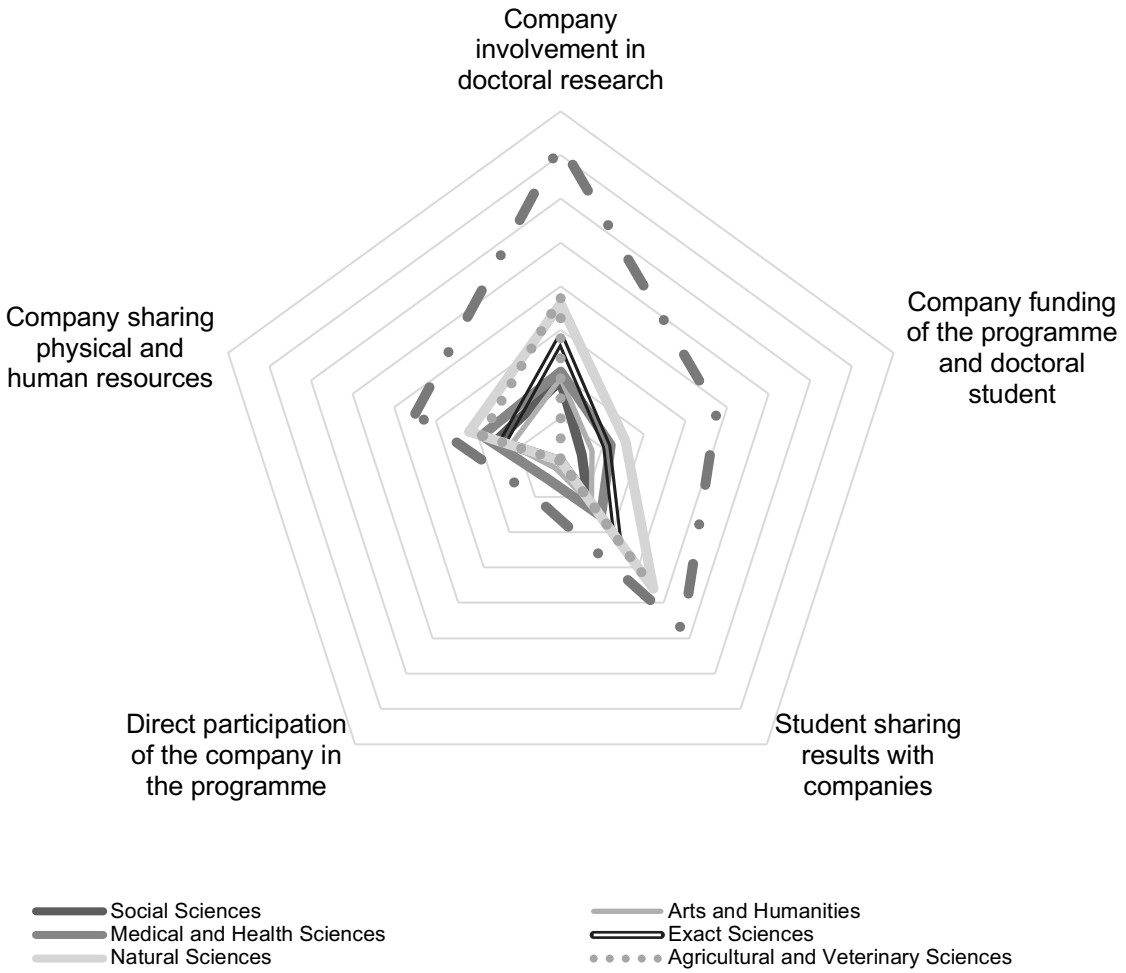
The least significant activities are the offer of joint doctoral programmes, direct participation of companies in the doctoral programme management and funding from

companies, which shows that companies play an indirect role and are less likely to provide financial and human resources. In addition, funding from the company is moderately correlated with the existence of previous relationships between partners (Spearman's rho = 0.361, $p < .02$), which indicates a continuous confidence building process that facilitates a financial commitment by the company.

The scientific area is a variable that allows us to portray important aspects of collaboration in doctoral programmes. The 'company involvement in doctoral research' is a collaborative component that exists primarily in the area of Engineering Sciences and Technology (EST) and is very low in the Social Sciences (SS) and Arts and Humanities (AH). This also happens with resource sharing by the company (whether physical, human or financial) and knowledge sharing by the students. Doctoral programmes in EST are the most diverse in terms of collaborative activities, probably due to their longer tradition of collaboration in this area (Figure 4.1).

Another noteworthy result is that 'direct participation of the company in the programme' – which can be understood as the strongest collaboration in terms of business partner involvement – corresponds to the doctoral programmes created within the scope of a government scheme and implemented by large public universities, by considering that the size of universities can be measured according to the number of students enrolled in the year in which data were obtained from the university websites (small sized universities – up to 9.999 students; medium-sized universities – between 10.000 and 20.000 students; large universities – more than 20.000 students).

Figure 4. 1. Components of collaboration by scientific area



Companies' characteristics are also a crucial factor for a more intense collaboration, namely size (Fontana, Geuna & Matt 2006). By adapting the categorisation of companies' size, adapted from 'The state of university-business cooperation in Europe' (2016) – micro and small companies: 1–49 employees; midsize companies: 50–250 employees; large companies: more than 250 employees – it was concluded that many companies involved in the creation of doctoral programmes are large, totalling 25.5% of the companies in the sample.

However, most of the companies in the sample, as in Portugal itself, are medium-sized (39.6%) or small and micro companies (33%). A significant proportion of the companies collaborating with doctoral programmes have a R&D department (63.9%) and 48.1% have more than five employees working in it. As Wallgren and Dahlgren (2005) point out, the R&D activity of companies involved in partnerships with universities has an impact on how collaboration takes place.

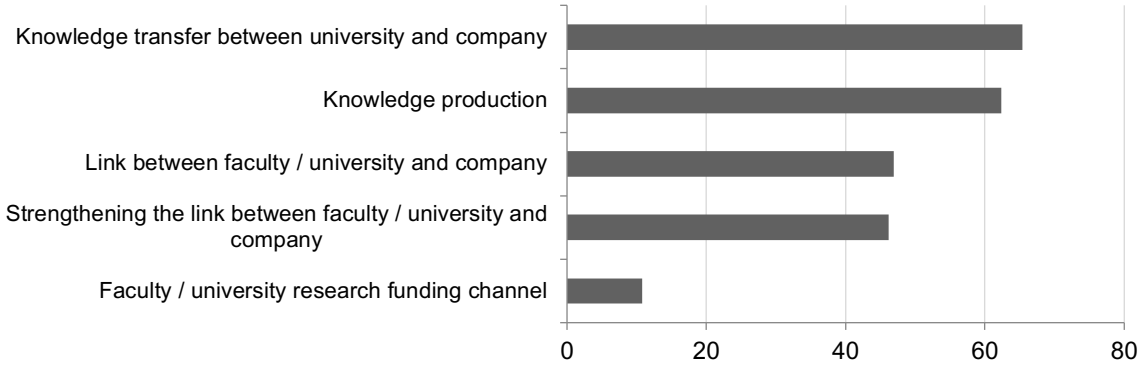
In the case of doctoral education, the existence of R&D activities is particularly relevant, since universities need to establish a collaborative network with companies that have favourable working and learning contexts for the integration of doctoral students. This type of collaboration is particularly valued by intensive R&D companies, as it gives them access to a highly skilled workforce and cutting-edge research (Borrell-Damian 2009).

The role of doctoral students and its underlying factors

It is central to the argument development to take the analysis further in order to understand the role they play and the variables that influence the different forms this role assumes.32

The role of students in doctoral programmes centres on: knowledge transfer between universities and companies (65.4%); knowledge production (62.3%); creating a bridge between the teaching staff/university and the company (46.9%); strengthening the link between the teaching staff/university and the company (46.2%); and being a channel for funding the research of the teaching staff/university (10.8%) (Figure 4.2).

Figure 4. 2. Role of doctoral students in the collaboration (%)



32 Eighteen variables were used to represent the roles of: the university (six variables); companies (seven variables); and doctoral students (five variables). Role of the university: provider of funding products and productive processes; supplier of facilities and equipment, specialized know-how, human resources, and research. Role of the company: provider of research, human resources, funding, facilities and equipment, doctoral work opportunities for PhD holders, specialised know-how and a context for developing doctoral projects. Role of doctoral students: channel for access to university research funding; strengthening the link between faculty, university and companies; liaison between faculty, university and companies; knowledge production; knowledge transfer.

By relating the role played by the doctoral students[33] in the collaboration to the different components of collaboration, it becomes clear that the more the company collaborates in different types of activity, the more pronounced and diverse the role of doctoral students.

To ascertain this hypothesis, five linear regression models were constructed to verify the effect of the characteristics of the programme and university (university type, university size, existence of specific public funding), the doctoral programme director (number of years supervising the programme and work experience with companies), the companies (size, existence of R&D department and number of employees engaged in R&D activities), the collaboration (existence of a contract, prior relationship and frequency of meetings between universities and companies) and, finally, the effect of the complete model on the diversity of students' roles (Table 4.1).

The characteristics of the doctoral programme have a positive effect on the diversity of roles played by doctoral students. The role of doctoral students in the collaboration is more diverse when it comes to a public university and when there is funding from a public policy measure. This result may be linked to the assumptions and guidelines of public programmes regarding the roles and responsibilities of universities. The size of the university has a negative effect on the diversity of roles played by doctoral students ($B = -0.045$): the larger the university, the less diverse the roles of students, which may indicate greater flexibility of the role of doctoral students in smaller teams.

The directors' experience of working with companies and supervising the doctoral programme are factors with a significant effect on increasing the diversity of roles assumed by doctoral students in the collaboration ($R2 = 0.322$, $p < 0.001$). The model built to find out the effect of company characteristics proved not to be significant for the roles played by doctoral students. The complete model, including all independent variables (except for company characteristics, which had not been significant for the roles of the different social actors), proved significant for the diversity of doctoral students' roles.

33 A new variable was created from the role played by the doctoral students. Since the answers concerning this role vary very little between cases, indicating a consensus about the roles assumed by these actors, the variable stems from the sum of the items corresponding to the answers to the five statements on the role of doctoral students. The index for the role of students varies between 1 and 5.

Table 4. 1. Effect of programme, director and collaboration characteristics on students' role

Independent variables	Student (R^2)
Doctoral programme characteristics	0.074**
Director's characteristics	0.322***
Company characteristics	0.38
Collaboration characteristics	0.096*
Complete model	0.174*

*p<0.05 **p<0.01 ***p<0.001

The diverse roles played by doctoral students are an effect of the characteristics of the doctoral programme, its director and the collaboration itself, though not of the company characteristics. It seemed important to test the effect of the company's role in the collaboration regarding the diversification of the role of the doctoral students. The PCA determined the existence of three components corresponding to three types of roles performed by the company and accounting for 60.2% of total variance. The company thus plays: a role as promoter of an environment and opportunities for doctoral students, as it provides them with a context for research and job opportunities (28.5% of total variance); an instrumental role as provider of facilities, equipment and funding (16.7% of total variance); and a role as provider of specialised know-how and highly qualified human resources (15.0% of total variance).

The role of the company as a provider of context and job opportunities for doctoral students is positively correlated with the involvement of the company in doctoral research (Pearson's r = 0.232, p = .01), the company's funding of the programme and doctoral student (Pearson's r = 0.178, p = .05), and the sharing of students' results with the company (Pearson's r = 0.180, p = .05). This seems to indicate a multifaceted relationship between companies and doctoral students. On the one hand, the company emerges as a context provider for doctoral research and is therefore more involved in the work of doctoral students, possibly funding their work, which may enhance their employability.

Borrell-Damian et al. (2015) state that a closer relationship will lead to greater employability of the doctoral student in the economic sector, mainly due to the transversal skills acquired while working on the doctoral thesis. On the other hand, doctoral students are more likely to share the results obtained.

It was also found that the role most frequently assumed by the company is as a provider of context for research and job opportunities for doctoral students, except in Medical and

Health Sciences, where the company becomes more of a provider of human resources. In all cases, the instrumental role is the least cited, except in the Arts and Humanities.

Through a linear regression, it was found that the diversification of the role of doctoral students in the collaboration (ranging from 1 to 5, as indicated above) is positively and significantly influenced by the three above-cited company roles, particularly their instrumental role ($B = 0.2691$, $p < .01$), which may indicate that the provision of conditions by companies is a non-negligible factor in this debate.

It is mainly the diversification of the role of universities that most influences the diversity of roles of doctoral students in the collaboration ($B = 0.416$, $p < .001$). The more diverse the role of the university in the collaboration and the more intense the instrumental role of the company, the more diverse the role of the doctoral student. This model explains 54.8% of total variation in students' role ($R2 = 0.548$, $p < .001$).

Knowledge produced by doctoral students as a key element of university–industry relationships

A collaborative relationship can increase knowledge transfer opportunities between the academic and economic sectors, mainly based on the research carried out by the doctoral student, as reported by 72% of the doctoral programme directors.

Knowledge transfer from doctoral students to the company is statistically related to the different roles assumed by the company: its role as a provider of context and employment opportunities for doctoral students represents 38.3% of total variance (Eta-squared (ES) = 0.619); its human resources role represents 29.2% of total variance (ES = 0.540); and its instrumental role represents 28.6% of total variance (ES = 0.535).

However, it is the diversity of roles assumed by doctoral students and universities that most contribute to knowledge transfer (ES = 0.756, representing 57.2% of total variance for the PhD student; ES = 0.707, representing 50.0% of total variance for the university).

These results are in line with those in the literature, which highlight the role of doctoral students in knowledge transfer from universities to companies (Mangematin 2000; Mougerou 2001; Salimi, Bekkers & Frenken 2016).

Knowledge transfer is supported by certain characteristics of the programmes, its directors, the companies and the collaboration and it is significantly related to the scientific areas of the programmes (Cramer's $V = 0.331$, $p < .001$). This transfer happens in all areas, especially in EST and, to a lesser extent, in the SS, AH and MHS. It is also related to the number of years that doctoral programme directors have been in this position, their experience working with companies and their previous relationship with the company (Cramer's $V = 0.415$, 0.578 and 0.237, respectively, $p < .001$). Finally, it is related to whether the company has a

R&D department (Cramer's V = 0.442, p < .001), whether a collaboration agreement is in place, and the number of meetings between the university and the company (Cramer's V = 0.199 and 0.433, p < .05).

Linking the collaboration components to knowledge transfer also provides a picture of the type of collaborative activity that best suits or promotes knowledge transfer from doctoral students to companies. The logistic regression model explains 49.1% of the variance in knowledge transfer (Nagelkerke R2 = 0.491) and shows that companies' sharing of physical and human resources has the greatest effect on knowledge transfer (Exp(B) = 3.559), followed by students' sharing of their results with companies (Exp(B) = 2.589) and the involvement of companies in doctoral research (Exp(B) = 2.317). The company's direct participation in the doctoral programme and its funding are the least contributing aspects in this model (Exp(B) = 1.675 and 0.678, respectively). Funding from the company has a negative effect on knowledge transfer (B = −0.389), suggesting that an instrumental role may not mean that knowledge circulation is needed or intended.

We also explored the possible obstacles to knowledge transfer with a logistic regression analysis using the dichotomous variable 'knowledge transfer' as the dependent variable. Knowledge transfer is negatively related to almost all factors considered as obstacles to collaboration between universities and companies (Nagelkerke R2 = 0.481), with the exception of diverging motivations or values, which have a positive effect on knowledge transfer (B = 0.024) (Table 4.2). It was found that the difficulty in attracting and retaining doctoral students able to work in both sectors, followed by the teaching staff's lack of interest in the collaboration and diverging modes of communication and language are the aspects that further block the transfer of knowledge.

Table 4. 2. Effect of obstacles to collaboration on knowledge transfer

Explanatory variables	Logistic regression coefficients
Lack of interest from the university/faculty	-0.142
Insufficient working time for collaboration	**-1.401****
Lack of company funding	**-1.537*****
Difficulty finding business partners	**-1.146****
Diverging motivations/values	0.024
Diverging modes of communication and language	-0.175

Limited ability of the company to absorb knowledge and Human Resources	-0.371
Confidentiality requirements	-0.482
Difficulty finding doctoral students able to work in both sectors	-0.339
Mismatch between research interests of doctoral students and companies	**-1.112***
R^2 (Nagelkerke)	0.481

*p<0.05 **p<0.01 ***p<0.001

Conclusion

A constellation of factors lends weight to the argument that, through their research, doctoral students contribute to enhance university–industry collaboration.

This is where the role of doctoral students comes into play, as the research they develop within the scope of their theses is a key element to initiate and/or strengthen relationships between companies and universities. Companies have a more noticeable influence on students' research topics, provide an environment and the conditions for them to carry out their research, and sometimes recruit students once they have completed their PhDs.

Therefore, knowledge, public policy guidelines and programmes allow companies to collaborate with universities, through their doctoral students, with the aim of achieving results that can potentially be applied in their business environment. However, analysis shows that the conventional division of labour between universities, as producers and suppliers of knowledge, and companies, as recipients and creators of conditions for the application and dissemination of specialised knowledge, remains in place.

In areas such as Engineering Sciences and Technology, the role of doctoral students is increasingly important, as they can contribute directly to business activities. However, there are signs of change in this pattern, since doctoral students are now carrying out research activities in combination with company activities, lending strength to their central role in deepening university–business relations. The empirical data show that the more heterogeneous the role of universities and companies in collaborative activities, the more diverse the role of doctoral programmes, as multipliers and two-way effects of networks and learning.

Doctoral students are a key factor in this collaboration and play a crucial role in university–business relations, mainly due to the importance of their research for the collaboration of, creating and strengthening bridges between teachers, universities and companies.

CAPÍTULO 5. Academic Culture in Doctoral Education: are Companies Making a Difference in the Experiences and Practices of Doctoral Students in Portugal?[34]

34 Santos, Patrícia & Patrício, M. T. (2020). Academic Culture in Doctoral Education: Are Companies Making a Difference in the Experiences and Practices of Doctoral Students in Portugal? International Journal of Doctoral Studies, 15, 685-704.

Abstract

This article examines the experience and practice of doctoral students by focusing on different dimensions of the PhD socialization process. It addresses the question of whether university collaborations with businesses influence the experience and practice of PhD students. The study explores the academic culture in the PhD process through the analysis of the experiences and practices of doctoral students in two groups – those without business collaborations (academic trajectories) and those with business collaborations (hybrid trajectories). Academic trajectories are seen as traditional academic disciplinary based doctoral education, while hybrid trajectories cross boundaries collaborating with companies in the production of new knowledge.

The article uses a qualitative methodology based on extensive interviews and analysis of the curriculum vitae of fourteen Portuguese PhD students in three scientific domains (engineering and technology sciences, exact sciences, and social sciences). The doctoral program profiles were defined according to a survey applied to the directors of all doctoral programs in Portugal.

The study contributes to the reflection on the effects of collaboration with companies, in particular on the trajectories and experiences of doctoral students. It contributes to the understanding of the challenges associated with business collaborations. Some differences were found between academic and hybrid trajectories of doctoral students. Traditional products such as scientific articles are the main objective of the PhD student, but scientific productivity is influenced by trajectory and ultimately by career prospects. The business culture influences the trajectories of doctoral students with regard to outputs such as publishing that may act as a barrier to academic culture. PhD students with academic trajectories seem to value international experiences and mobility. Minor differences were found in the choice of topic and type of research activity, revealing that these dimensions are indicative of the scientific domain. Both hybrid and academic students indicate that perceptions of basic and applied research are changing with borders increasingly blurred.

It is important for universities, department chairs, and PhD coordinators to be concerned with the organisation, structure, and success of doctoral programs. Therefore, it is useful to consider the experiences and trajectories of PhD students involved with the business sector and to monitor the relevance and results of such exchange. Key points of contact include identifying academic and business interests, cultures, and practices. A student-centred focus in university-business collaboration also can improve students' well-being in this process. Researchers should consider the processes of interaction and negotiation between

academic and business sectors and actors. It is important to understand and analyse the trajectories and experiences of PhD students in doctoral programs and in university-company collaborations, since they are the central actors.

This analysis is relevant to societies where policy incentives encourage doctoral programs to collaborate with companies. The PhD is an important period of socialization and identity formation for researchers, and in this sense the experiences of students in the context of collaboration with companies should be analyzed, including its implications for the professional identity of researchers and, consequently, for the future of science inside and outside universities.

More empirical studies need to explore these processes and relationships, including different national contexts and different scientific fields. Other aspects of the academic and business trajectory should be studied, such as the decision to pursue a PhD or the focus on perceptions about the future career. Another point that deserves to be studied is whether a broader set of experiences increases the recognition and appreciation of the doctoral degree by employers inside and outside the academy.

Keywords: Doctoral education, academic culture, university-business collaboration, PhD student's trajectory

Introduction

European higher education policies, public investments, and guidelines have encouraged a rapid expansion of doctoral education in most European countries. Over the last 20 years Portugal, similar to other countries, has seen a huge increase in student enrollment in PhD programs. The number of PhD enrollments in Portugal surged from 638 in 1998 to 5277 in 2018 and the number of PhD graduates increased dramatically from 375 in 1998 to 2,266 in 2018 (Directorate-General of Statistics in Education and Science - DGEEC 2019). Doctoral programs and doctoral degrees are increasingly recognized for their strategic importance in the knowledge society (Bin et al., 2016; Jones, 2018). Doctoral education is now seen for its wider benefits to society and requested to respond to needs from different sectors of society, especially from companies (see Van Deynze & Santos 2020).

Universities in general and doctoral programs in particular are increasingly encouraged to act like firms by capitalizing knowledge and becoming more entrepreneurial by training students for careers outside academia (Thune 2010). And yet, university-business relations remain tenuous and employment of doctoral holders in companies low (around 6%) (DGEEC 2015). Recent policy measures have sought to reverse these trends by encouraging intersectoral collaborations between universities and companies and reduce the gap between

academic and business cultures. The Ministry of Science and Higher Education introduced specific measures to promote university-company collaboration in doctoral education in an attempt to break down existing barriers and to promote PhD employment. Some doctoral programs were created with companies ("PhD Program with Industry") and others offer scholarships in companies ("PhD Scholarship with Companies"). In the first case, the programs are financed by the Foundation for Science and Technology (FCT), the public organization that manages funding for science in Portugal, and by industry (with cost sharing of 75 and 25%, respectively). These are often referred to as "industrial doctorate" to highlight the university-industry collaboration and exposure to the dual culture (Carvalho & Cardoso 2020; Tavares, Sin & Soares 2020).

Both these programs encourage doctoral students to undertake research activities in companies. The programs have the same duration as traditional programs (four academic years). Some include a course period (usually one year), in addition to the period spent on research, which culminates in the public defence of the thesis (monograph or articles) before a jury (Cardoso, Tavares & Sin 2019).

Universities also promote other forms of collaboration in doctoral education such as internships and work-study programs. Analysis of the doctoral programs based on a survey data to all directors of doctoral programs in Portugal, in 2016-2017, showed that 130 programs (53.3% of the sample) involve some type of collaboration with companies. A substantial part of collaboration between universities and companies in doctoral programmes was connected to the students' research projects: 52.3% of the students carried out part or all of their research projects with a company and 40% worked on projects defined by the companies (Santos, Veloso & Urze 2020).

In summary, new initiatives emerged to support university-business interaction in doctoral education, and yet little is known about the effects of these interactions on the trajectories of the PhD students. This article analyses how university collaborations with businesses influence the trajectories of PhD students. The main research question is what are the main differences between PhD students with and without ties to companies in terms of their doctoral trajectory?

The experience of PhD students with companies, referred to here as hybrid trajectories, is compared to that of PhD students without company involvement. The latter are considered as following a traditional academic trajectory. The comparative focus emphasizes elements that characterize and structure a PhD (see Yazdani & Shokooh 2018). We will look at (1) the core structure of the research, namely the choice of the topic and the type of investigation, (2) the research process such as the type of activities developed, and (3) the outputs including publications and product results.

Previous studies focus mainly on science and engineering doctorates, we, however, opted to include different fields: these are engineering and technology, exact sciences, and social sciences. These fields were selected to widen the range of possible interactions with businesses as well as the result of a cluster analysis of a questionnaire sent to all doctoral program directors in Portugal. These fields correspond to three profiles of collaboration with companies, described in the methodology.

This analysis includes aspects of academic culture, understood here as a socialization process in which the student learns scientific conventions, including research values and norms (Malfroy 2005; Merton 1973[1942]). Academic culture finds its roots in Merton's classic formulation of an 'ethos of science' (Merton 1973[1942]).

The trajectories of PhD students are viewed as constructed in a dynamic and plural process of interaction and negotiation with other actors (Mantai 2017). In university-business collaborations companies become key actors in the socialization process of doctoral students, that is, in the process by which doctoral students learn and acquire knowledge, culture, rules, and values, as well as the necessary skills to work as researchers (Levinthal & March 1993). These different pathways and experiences are associated with the "reasonable aspirations" (Bourdieu 1976/1983) of academic success or integration in the business sector. Thus, the expectation is that PhD students with hybrid trajectories will differ from those with traditional academic trajectories.

The article starts with a review of universities-industry collaborations focused on those in doctoral programs. The second section describes the methodology used to obtain the graduate students' experience. The third section characterizes the programs and the types of collaboration. The fourth section analyses the students' perceptions and experiences. The final section presents a discussion of the results, the policy implications, and suggestions for future research.

Cultures in University-Business Collaborations in Doctoral Education

This study contributes to the general reflection on the effects of university collaboration with companies, in particular, its effects on doctoral education. Therefore, the literature reviews the influence of university-business collaborations on academic culture, particularly with regard to doctoral education.

Several studies on collaborative doctoral education highlight the distinction between the business and the academic culture (Campbell & Slaughter 1999; Y. Lee 2000; Slaughter et al 2002). Some identify a confrontation between the two cultures. Slaughter and colleagues (2002) bring to light "cultural" differences in research approaches, the nature and scope of projects, the timelines for producing results, and the identification of problems. The differences accentuate the distortions of research agendas and restriction on the disclosure of results,

questioning the norm of open science for research in general. Some studies, as Y. Lee (2000), suggest that universities-companies collaborations involve contracts that often require confidentiality agreements, limiting publication and/or placing restrictions on communication. Campbell and Slaughter (1999) constructed a typology of university-industry interaction conflicts for academics in general. The authors distinguish between conflicts of interest (with public service or funding), commitment (with the academic organization), and equity (academic promotion based on relationships with companies). Boardman and Ponomariov (2009) found that identifying with Merton's norm of general disinterest prevented researchers from collaborating with companies, indicating the presence of a cultural barrier. The Akay study (2008) found that businesses claim that doctoral holders are overly restrictive and lack professional, organizational, and managerial skills such as teamwork, appreciation of applied problems, and knowledge of other fields.

Other authors find the two cultures are complementary. Harman (2008) notes that doctoral education programs in collaboration with companies integrate academic and business norms, but finds a shift from curiosity-driven research to research oriented to more practical knowledge and technology. Bin et al. (2016) speak of a "cross-pollination" between academia and business and Lee, Miozzo & Laredo (2010) note that pressures on funding in academia have led to greater commercialization with companies, as companies adopt some elements of academia, such as scientific publications.

Other studies indicate that academic-industrial collaborations can have positive effects on researchers' productivity. Gulbrandsen and Smeby (2005) found that enterprise-funded researchers reported higher levels of publication as well as higher levels of commercial output (including patents) than their peers. Also, Barjak (2006) analyzed academic life sciences research teams and showed that those who published together with co-authors of companies published significantly more articles in total and per member, although their impact was smaller and less recognized in the scientific community.

Some studies indicate that collaborations between the two sectors vary according to scientific domain. For example, the study by Belkhodja and Landry (2007), based on data from 1,554 researchers in the natural sciences and engineering, found that academic researchers are influenced by values promoted by their scientific field - and their recognition mechanisms - which shape their perception and appreciation of collaboration with companies. These authors also found that companies are less willing to fund projects that are driven by cultural values and research norms opposed to their own. Borrell-Damian (2009) undertook a comparative analysis of 33 doctoral programs with companies in various European countries and found that companies' roles vary according to scientific field. In general, companies tend to be more involved in engineering, technology, biotechnology, medicine, and life sciences;

while social science students have limited opportunities to participate in collaborative doctoral programs.

Collaboration can lead to the exchange of ideas that can become a source of innovation and creativity in new and diverse sources of knowledge (Carlsson et al. 2002). Collaboration also has the effect of “connecting” with a broad network of contacts in the scientific and business community (Tijssen 2018), especially through the hiring of doctoral holders (Slaughter et al., 2002). Approaches that underline the benefits of collaboration from a business perspective indicate increasing the economic relevance of the scientific knowledge produced and the technical skills and access to new technologies and processes (Guerrero, Urbano & Herrera 2019; Maietta 2015). However, at the company level, some studies indicate that the relationship between cooperation with public research organizations and innovation remains ambiguous (Guzzini & Iacobucci 2017; Pennacchio, Piroli & Ardovino 2018).

The European University Association study (EUA 2015) on doctoral education finds that the main benefits in strengthening the interest and involvement of companies in university research is to raise awareness of the technical challenges facing companies, to promote innovation, and to broaden the applicability of results. Overall, university-business collaboration provides an opportunity to change perceptions about forms of cooperation. The same study (EUA 2015) also identified the challenge of identifying a research project that met both business needs and academic standards with an academic supervisor that understands the objectives and constraints of the business sector and a business supervisor understanding the academic standards of a PhD.

Enders (2005) speaks of “hybrid trajectories” for higher education as a new mode of knowledge production that crosses disciplinary and organizational boundaries, as opposed to the academic-disciplinary model of training. For other authors, there has been a shift from a “traditional doctorate” – with a focus on preparing specialists for a discipline – to a “modern doctorate”, in which knowledge transfer is one of the main objectives (A. Lee 2018; Muller 2009). This is the case of professional doctoral programs, defined as the result of a relationship between university, company, doctoral student (Tiraboschi 2018). For Jones (2018) the traditional doctoral programs remain largely “mode 1”, while the professional doctoral programs – that ensure greater exposure to other sectors of the economy - is “mode 2”, where research is conducted in an application context.

In summary, studies on university-business interaction provide many examples of advantages, but also of conflicts of interest and cultural distinctiveness. Some of the examples include the commercial influence on the definition of research agendas and restrictions on the publication. The literature review suggests an ambiguous picture of positive and negative effects of university-business collaborations. Some authors emphasized that the benefits and costs of university-industry interaction are undeniable, so the question is how to overcome the

barriers that prevent a successful interaction (Bjursell & Engström 2019; Bruneel, D'Este & Salter 2010). Therefore, further analysis is necessary to understand the effects of the approach to companies in doctoral education.

Effects of University-Business Collaborations on the Trajectory and Experience of PhD Students

Studies that look at the effects of collaboration with companies on the trajectories of PhD students are particularly relevant for our analysis. We will present and discuss some of them in this section.

In a synthesis work, Thune (2009) highlights the varying exposure of PhD students that work with companies in terms of the physical environment in which they work, the forms of supervision, the research projects, and the rules of conduct. The author notes that, based on different studies, compared to non-collaborating students, the effects of collaboration with companies, while positive, are weak in terms of experience and results. The explanation for this "limited impact" has to do with the fact that most studies focus on engineering and life sciences, where university-business collaboration represents a more standardized practice, with greater familiarity of cultures and practices between sectors. Salminen-Karlsson and Wallgren (2008) verified that supervisors facilitate the "translation" of different requirements and generate research projects that are both academically and business relevant. The role of the supervisor assumes key relevance, above all, starting from his/her university-business experience - which tends to be more prevalent in these scientific areas.

Other authors pay more attention to the conflicts and contradictions experienced by students working on business-sponsored projects. Lyon (1995) argues that the dynamics of business collaboration fosters unequal power relations between the different stakeholders. Students, professors, supervisors, and funders need to overcome obstacles so as to enhance independent and academic learning. Blumenthal et al. (1996) also considered students to be particularly affected by industrial confidentiality policies restricting the publication of results. About 88% of companies in the study reported that the agreements required students to keep some data and results confidential. However, Thune's study (2010) found that in general PhD students were allowed to publish their work after approval of "clean" trade secrets from industrial partners. None of the students experienced delays or impediments in publication. Furthermore, in scientific areas with less tradition of collaboration, such as economics, property rights issues are rarely a concern.

Another set of studies reveals the latitude of PhD students' experience with collaboration. In the study by De Grande et al. (2014), PhD students who collaborate with companies

perceive collaboration as very positive: 83% said they had improved their skills and 81% thought that this contact could open career opportunities outside the academy. Tavares, Sin and Soares (2020) examine the profiles of industrial doctoral students and, like Thune (2009), find them motivated by employability and career prospects. However, more importantly, industrial doctoral students develop a broader set of skills and competencies to deal with industrial activities of commercialization and application of knowledge. Tavares, Sin and Soares (2020) also found that doctoral students in Portugal understand the learning process in a double context (academic and business) as positive, especially if it leads to the possibility of employment outside academia. These PhD students are motivated by extrinsic means (labor market opportunities in the period after obtaining the degree), given their field of research to constitute a marketable product.

Some studies seek to understand the outcomes of the collaborations. The outputs of PhD students with and without collaboration also reveal mixed and varied results. Lin and Bozeman (2006) verified the negative impact of the business's participation on the scientific productivity of PhD students, with influence on later career throughout. In contrast, Salimi, Bekkers and Frenken (2015) found that project outcomes and impacts were greater for PhD students involved in collaborative projects compared to university-only projects.

The literature review presents different components of the trajectory of PhD students that seem to be important to analyze in an integrated way: purpose (definition of the theme and type of investigation), process (activities developed), and products (type and number of academic results). There is also a lack of an overview of these aspects from the perspective of PhD students. The literature on university-business collaborations involving PhD students is often ambiguous, especially in terms of forms of confidentiality and the possibility of sharing results and scientific outputs.

It is possible to identify important gaps in the literature on this topic. First, as mentioned above, research tends to focus on doctoral education in engineering and life sciences, two fields with the highest degree of interaction with companies, neglecting fields such as the social sciences and humanities. Collaborations with companies in the social sciences and humanities tend to be informal (Santos, Veloso & Urze 2020) and, therefore, often ignored by studies that focus on collaborative doctoral programs. However, we know that, whether formal or informal, students' socialization processes are structured within doctoral programs (Gardner, 2008). Second, in most cases, studies on doctoral education focus on countries with a "developed scientific system" (as referred to by European Commission 2019) such as USA, Australia, United Kingdom, and Canada (Jones 2013; Carvalho & Cardoso 2020).

Few studies consider these effects in scientifically less developed countries, which involve differences in resources available for training and opportunities for integration doctorate holders (Santos, Horta & Heitor 2016). The Portuguese case can shed a different light on what

occurs in a “developing scientific system” where university-company relations are still quite tenuous and employability of doctoral holders in companies is uncharacteristically low.

The result of these two factors is limited knowledge about collaborative processes of different natures and in different scientific areas. The research question on the influence of the collaborative processes with companies on the trajectories of doctoral students remained largely unanswered. The questions of the definition and characterization of the types of university-business collaboration in doctoral programs still needs to be addressed. The different types of collaborations are likely to affect the perceptions and experiences of doctoral students and to influence the academic culture of doctoral programs. That is to say, the business collaboration within academic culture needs to be looked at more closely.

Methodology and characterization of the students

This study aims to examine the trajectories of doctoral students and to identify the academic experience of students engaged with companies through a qualitative methodology. This approach gives voice to those with first-hand experience. Qualitative research methods also allows a more in-depth analysis of the issues that affected PhD students’ experience (see Corbin & Strauss 2008) and a greater wealth in the description of the trajectories of PhD students, taking into account the specific context of decisions related to the choice of topic, type of research, research activities, and types of outputs. This is also the trend in most studies on doctoral students. Sverdlik and colleagues (2018) found that more than 50% used qualitative methods (for example, interviews, focus groups and case studies).

The methodology is based on extensive interviews with open-ended questions to explore students’ perspectives and practices. The structure of the interview script was based on a review of the relevant literature on the topic, but without restricting the PhD students’ respondes. General evaluative questions such as “how was your PhD?” and “what were the most positive and negative aspects of doing a PhD?” were asked. Other questions attempted to acquire information about the doctoral program and the process of collaboration, such as “how did you decide to do research with/in a company?” and “what does involvement with a company mean to you?”

It is worth mentioning that some studies on the relationship between university and companies in doctoral programs show different views of the different actors involved in the process. For example, Powles (1994), based on interviews with students, academic advisors, and industry advisers, verified the existence of different views regarding confidentiality requirements. Doctoral students assumed the confidentiality restrictions as more difficult than their advisors did. Thus, students’ perspectives are relevant.

The interviews took place from December 2018 to February 2019 in the greater Lisbon region. Fourteen PhD students were interviewed from different scientific fields in different PhD programs. Our sample included six interviewees from Engineering and Technology Science (ETS), three female and three male respondents, aged between 28 and 37 years old; four respondents from Exact Science (ES), three female and one male, between 24 and 36 years old; and four respondents from Social Sciences (SS), three male and one female respondents, aged between 30 and 45 years old. The social science students were slightly older with more previous professional experience.

Half of the sample participated in doctoral programs in collaboration with companies and half attended traditional academic programs with no company collaboration. The traditional academic group with no business collaboration served as a control group (in the same scientific area and region), following the line of a substantial part of the studies on this theme (see Thune 2009). The collaboration with companies took different forms. Some included research activities within the physical installation of a business including a period of immersion in the business; others involved integrating students from companies into graduate programs. Still others involved a specific doctoral grant with business support or doctoral work undertaken with business data or material. All these possible exchanges or routes of collaboration with companies are referred to as “hybrid trajectories”.

The interviews were recorded, transcribed, coded, and analysed with the MAXQDA program. The analysis used thematic analysis to capture the doctorate’s trajectory (before, during, and after the PhD, in those cases where the student had recently defended his/her thesis), with and without collaboration. The data generated in relation to questions involved an evaluation of the doctoral process at different phases. This led to the construction of nine subthemes that structured the narrative. The different subthemes included the following: 1) PhD motivations, 2) choice of the advisor, 3) thesis topic, 4) research activities, 5) international experiences, 6) type of knowledge produced, 7) skills acquired, 8) outputs and results, and lastly 9) difficulties experienced. This article focused on subthemes 3), 4), 5), 6), 7) 8) and 9), since they contribute more strongly to the empirical exploration of the theme under analysis.

In parallel, the curriculum vitae of 12 of the PhD students were analysed to determine their respective outputs. (Two of the interviewees never sent their CV). Following Lin and Bozeman (2006) we count the numbers of publications in the CVs. In the analysis we took into account the type of academic product (conferences, articles, book chapters), commercial products (patents and products) authorship (authors or co-authors), and scope (national or international) as reported by the interviewees. Lastly, we triangulate this information with the interview data for each student.

Characterization of the doctoral programs and the type of collaboration

The doctoral program profiles in which the students were enrolled were defined based on a survey applied to the directors of doctoral programs in Portugal, with a response rate of 42.9% (244 cases). The collaboration profiles were defined from a cluster analysis and the three scientific fields of study used in this article fit each of the profiles. The areas within each profile for the analysis described in this article were selected based on the availability of the directors of the doctoral programs to provide contact with PhD students. Below we specify the collaboration profiles of each of the three doctoral fields involved with companies that make up the sample.

The engineering and technology sciences profile is one of continuous and strategic collaboration, and there may be a mix of fundamental research and applied research, as in doctoral scholarships and internship in companies. There is a previous relationship that translates, mainly, into research projects and circulation of doctoral students. There is greater mutual knowledge: the company knows and values the university's research capabilities; the university understands the company's procedures, priorities and capabilities. There tends to be active involvement of business partners – at one or several moments – in the scientific work process, such as structuring the research project, guiding doctoral students, or setting objectives to ensure that knowledge translates into creation of new products, technologies, or services. The particularity of a doctoral scholarship in companies, for example, imposes a set of expectations and mutual obligations between the actors involved for the realization of these collaborations. In these cases, business actors redefine the "quality" and "relevance" of the doctoral students' projects. It is the closest model to the co-creation of knowledge.

The exact sciences profile of the collaboration can be characterized as an episodic collaboration. Despite the fact that companies assume a different role, they mainly maintain an external relationship in relation to scientific production processes. There is a proliferation of collaborative activities but none marked by their intensity.

The social sciences profile of collaboration tends to be a relatively less implicated relationship. It is characterised as involving a material or an instrumental collaboration. It is a more traditional exchange whereby the university shares knowledge and the company shares data and resources to enable or optimize the doctoral research project. The scientific results or outputs of the work will be assessed accordingly.

Results and discussion

In the next section, we describe how PhD students reflected on the motive, process, and product of their research. Three main themes emerged with the consolidation of the

subthemes defined above. We have identified these categories by their apparent contradictory nature, indicating the process of choice that students must often navigate through in doctoral education. These processes are i) between negotiation and independence of the choice of topic and the research activities; ii) between fundamental and applied knowledge production; and iii) between academic outputs and commercial productivity. Throughout the discussion we integrate quotes that exemplify students' perceptions and attitudes towards these themes. These quotes illustrate the interviewees' prevailing ideas.

Between the processes of negotiation and independence

The doctoral thesis implies the capacity to define a research topic, determine a research design, and make theoretical and methodological decisions throughout the research process. Roach and Sauermann (2010) consider that what distinguishes an academically oriented PhD student from an industrially oriented one is the capacity to determine the research topic.

In our study the PhD students in engineering and technology sciences and in exact sciences, in both trajectories, negotiated the doctoral research topic with different actors. In most cases these negotiations took place with the academic advisors, as expressed in the quote of a female PhD student in exact sciences. Even when a project is previously defined students find some opportunities to negotiate and contribute to the outline of their theses.

> The projects were already written and we had to register, apply for the project that ... we were most interested in. ... Within the bases that they gave us, the history of the project, afterwards I had to define a little what was going to happen. Although it is always with the advisor, but for some things I was free to say that I would like to do more. (E1, ES, academic trajectory)

In the hybrid trajectories a further set of negotiations occur with the business partners (especially in the field of ETS). Although academic advisors generally incorporate guidelines a priori, this model can create more tension by reducing or reorienting the student's research topic. The research topic is thus defined through a process of negotiation involving the needs and interests of the university department, the business partner, and the PhD student. The tri-level negotiation process requires the need to balance the various interests. An engineering student describes below the inherent tensions in the negotiation process. The PhD student highlights the added difficulty of adapting a topic of interest to companies to the conceptual and methodological requirements of a doctoral research.

> The research problem was provided by the project but it was insufficient; it was cool but not enough for a doctoral thesis. … For the business it worked, its fine, its perfect; but for me, no. This does not work for a PhD thesis. How do I know what's behind it? And this was difficult for them. I needed to generate data that theoretically was not an added value for the business, but that I needed for the PhD. Later on they came to realize that it was important. But during the initial phase it was quite difficult for them to realize that. (E14, ETS, hybrid trajectory)

In both hybrid and academic trajectories, the negotiation process may imply acceptance of a theme proposed by the supervisor, the project coordinator, or business supervisor and direct it towards the student's own interests or towards existing opportunities (for example, complementarity with another research project) or future opportunities (for example, a "fashion" sub-theme where funding possibilities are greater). It seems that, in both trajectories, students are prepared to negotiate and direct their efforts towards available opportunities, in so far as their own interests are safeguarded.

The overlap between doctoral research and the supervisor's research is recognized as beneficial for the students interviewed. In the literature this strong interconnection can create a strong field of knowledge and help build a robust research profile for the research unit. PhD students can also acquire access to laboratories, equipment, and other materials, and most importantly ensure professional support (Patrício & Santos 2019; Pilbeam, Lloyd-Jones & Denyer 2013). But it can also lead to what Ziman (1987) called the "problem of problem choice" – when the topic is defined by other actors and students lose some "distinct value of their products and originality" (Bourdieu 1976/1983, p. 10), which is an important social capital for these actors and a central value in science (Merton 1973[1942]).

Research activities and practices are also an important aspect in the students' learning trajectories. Students in both trajectories described their main research practices to include laboratory work, data collection, data analysis, communication, and writing. PhD students generally account for these tasks as well as more conceptual tasks, such as theoretical reflection and definition, hypothesis building and planning.

However, the research experience of PhD students in this study varies considerably by scientific domains. There is a heterogeneity of situations between scientific fields and even within the same field (as McAlpine & Mitra 2015, also found). The students interviewed in the exact sciences conduct research in laboratories, primarily in teams meeting with their supervisor regularly. These students frequently express feelings of being members of a research unit. However, a common feature of this type of laboratory work is the functional division of labour (e.g., Latour & Woolgar 2013). In our sample the supervisor is frequently responsible for upstream tasks, while students are more involved in the technical tasks such

as collecting and analysing data. In social sciences, the PhD students described working alone with infrequent meetings with their supervisors. It is more common for PhD students in social sciences to work on their thesis outside the university. This means that they are far from the research environment and, therefore, experience greater difficulty in building scientific and professional networks (see Calmand 2016).

In general, students in all scientific fields and in both trajectories value autonomy and express independence as something desirable, considering the passage from student to researcher or, as Dalton, Thompson and Price (1977) refer to, the transition from “apprentices” to “colleagues”. The following quote from a male student in ETS illustrates the idea that freedom is necessary condition for the development of a researcher:

> [The supervisors] gave me a lot of space, I think that’s very important. I do not know if I would like to have a supervisor on my back every week asking what I did. Because I can’t do much in a week, that is, I can and not get anywhere, have nothing to show, and in the following week I will soon have material for the two or three papers during the year. But I feel that I have gained a lot in having people ... who gave me a lot of freedom. (E6, ETS, academic trajectory)

The publication patterns of students reflect the importance of navigating between the patterns of autonomy and collaboration. In the social sciences, single authorship is more common (21.5% of all publications and communications indicated in the CVs). This may be associated with their ability to conduct more autonomous research (Laudel & Gläser 2008). In engineering and technology sciences and in exact sciences, publication through joint authorship is the common practice (only 11.5% of ES products and 19.3% of ETS products are single authored). In these cases, the PhD students seem to rely on their supervisors and their publishing experience.

The type of trajectory of the PhD students in this study does not predetermine the capacity to negotiate the research topic and to explore autonomous research paths. Doctoral education should provide a path to scientific autonomy (Laudel & Gläser 2008; Shibayama 2019), but it is obtained in different quantities throughout the trajectories of these PhD students. The freedom and autonomy to investigate, contrary to what might be expected, is not determined by the type of trajectory or by the pressure of business actors. This autonomy seems to be more conditioned by disciplinary traditions. The overall research experience occurs in a context of multiple influences within academic traditions largely consequential of the scientific field.

Between fundamental and applied knowledge production

All the students in the study expressed a high degree of recognition and appreciation for "applied knowledge". This occurred regardless of scientific field or business collaboration. Although the boundaries between basic and applied science are often unclear or blurred, applied knowledge was generally referred by respondents as a more short-term or immediate response to a particular problem and can imply a practical intervention. The quote below from a student in SS and a student in ETS, with and without collaboration with companies, illustrated the relevance of research to a practical result or output and the gratification they feel when the results of their investigation are used by different types of organizations or actors.

> I always prefer a little more applied. A scientific question of course, but that has some practical application that result of my work some knowledge that is practical. It's in logic that there are these results, based on these results, new knowledge is produced that can be useful for someone, even if it's for public bodies, for the university, for other researchers. It can be results, methodologies, but knowledge has some practical component, so it's not too theoretical. (E3, SS, academic trajectory)
>
> It is so good to do science as a practical thing, that is, you see a product grow, you see a product that you created, with the help of the team, but you created and that is being used. It's gratifying. I think it's more rewarding than, say, science is now too oriented to 'let's publish'; the goal is to publish. It is often forgotten a bit of the importance of what one is doing. ... You're ... helping the company, you're seeing something created and that's rewarding. ... For a person who wants only to do science is probably limiting, but if you want to combine science with a practical objective it is perfect. (E12, ETS, hybrid trajectory)

For students with hybrid trajectories solving a practical problem meant an extension in the range of their research. The focus on solving problems in real-time situations is seen as having a positive impact on the quality of their projects and on the type of knowledge produced. The experience of working in a company, in a business environment, was in itself a learning opportunity. Developing research within a business environment meant adapting to short-term results, often thinking commercially in an applied context (as observed by De Grande et al. 2014). It also implied developing more technical and business-specific knowledge. They also perceived this as a way to aid future employment prospects, with skills and work experience valued by employers. The PhD students' quotes below help to illustrate the gains in terms of increasing the quality of research in terms of data collected, working methods, well-defined

objectives, and acquisition of industrial experience and knowledge, with repercussions on employability outside academia:

> For me it was great, because it gave me the opportunity to have data and information, to have goals. … These projects forced me to have deadlines and to be really focused, something that when a person has a scholarship, and in my case I had a lot of freedom, sometimes you can lose your thread a little. … Probably, if I had not had the opportunity to work with companies, perhaps my PhD would not have been so efficient. (E11, SS, hybrid trajectory)
>
> Over these five years, in addition to doing my PhD, I gained a lot of experience and a lot of background in the industrial area. ... A doctorate in business gives you that advantage, because when you go looking for something, you will already look for it with an industrial background. You won't be wasting time training someone if you have someone with a PhD there who already knows how it works. (E4, ECT, hybrid trajectory)

We also find that students in both academic and in hybrid trajectories recognize the use, value and importance of science contributing to society; both assume the multiple purposes of research from fundamental to applied. The main difference is that the students with hybrid trajectories have experienced the context and constraints of a business. Students with hybrid trajectories view the collaboration with companies as an additional opportunity provided to an academic trajectory; a contact with the "real world". In practical terms, this means that they have a better understanding of business culture. The quote below illustrates the corporate culture more related to the emphasis on short-term results and less opportunity for exploration:

> They have some difficulty in realizing that maybe there are things that do not have great applicability or knowing at the outset that they may be useless, let alone to prove that it is not there. We have to explore. Therefore, explaining that I had to make molecules in order to be able to bridge the gap with my PhD was thus my biggest challenge. (E13, ES, hybrid trajectory).

Integration in companies was not always easy, in particular, adapting to the business culture of hierarchy, priorities and timings. Business and academic culture differ in values and interests and PhD students recognized this. Many students considered dealing with the business culture as an obstacle to be overcome. Some even considered that their role in the company was seen in a negative light, due to a lack of understanding of the importance of

academic research and a PhD degree. This is the case of an ES doctoral student that found it necessary to assert her contribution and value to the company.

> Integration was not the easiest, because ... there is still a lot of the stigma associated with the doctorate and research that is done in the academy, 'this has no interest'. ... And they did not value my experience either. (E8, ES, hybrid trajectory)

Students in both academic and hybrid trajectories identified the added value of increased specialization, the knowledge-production approach, and the relevance of acquiring "scientific maturity". Scientific maturity is composed, according to the interviewees, of autonomy, independence, and ability to solve problems. For the PhD students these skills and competencies are relevant academic skills suitable for a variety of employment sectors. The skills acquired can be part of professional practice, regardless of the sector of work. In essence, they refer to the transferability of their capabilities and skills beyond the PhD.

> The scientific maturity that is gained by the doctoral degree is most important and I think that is what a company seeks, the ability to solve problems, the ability to put ideas into practice, to have ideas. This is something that is very developed in us. ... I think scientific maturity has been building for a long time; it's not something a person learns to do a job here, a job there... I think it's a very important competency that I acquired during my PhD and I do not think I had it before that. (E13, ES, hybrid trajectory)

In sum, the distinction between basic and applied research have been recognized as important for PhD students but its significance is clearly changing (as Henkel pointed out in 2004). Students with academic trajectories and students with hybrid trajectories value basic and applied research and consider that knowledge production can be both basic and applied. But students recognize a gap between the knowledge produced in the "real world" and knowledge produced in the "academic world". Those with academic trajectories expect, above all, that their research to have meaning for peers, while those with hybrid trajectories expect to produce practical results. Also, while the differences between basic and applied research are often fuzzy, the practical side of company integration is seen as an added value in terms of experience and know-how. Sometimes the experience of working in or with a company implies overcoming obstacles and barriers imposed by the different cultures.

Between academic outputs and commercial productivity

The differences between academic and business cultures are most revealing in the outputs or results of the research. Both academic and hybrid trajectories value academic outputs, but the type of productivity can vary significantly.

All PhD students consider academic outputs – understood here as scientific publications and participation in scientific events – as an important component of the doctorate. However, the analysis of the CVs reveals differences between academic and hybrid trajectories. PhD students with hybrid trajectories present a wider range of scientific outputs than the students with academic trajectories. Students with hybrid trajectories reveal more involvement in different types of national and international conferences and in commercial results such as registering patents and producing new products or services. Students with an academic trajectory reveal a more focused path concentrating on scientific articles in international well-ranked journals. In other words, pressure for scientific publications in the pursuit of an academic career leads to more instrumental productivity (Henkel, 2000), making PhD students less inclined to engage in devalued outputs such as conferences and articles in national journals. In constructing their space in the scientific field (Bourdieu 1976/1983) students with an academic trajectory expect their academic performance, in the form of international scientific publications, to positively influence career advancement. This is illustrated in the discourse of a student in social sciences with an academic trajectory:

> Nowadays I go less and less to conferences, I go to the ones that really interest me. Now I'm not going to any conference just to go, even if it's in Lisbon. It's not an extra line in the curriculum that will do better, it's a waste of time. (E5, SS, academic trajectory)

In general, students attribute great significance to these events and value publications. The social and professional function of conferences and congresses provide an opportunity to network, to engage, and to feel part of the scientific community. Students thus attribute a meaning of validation, visibility, and peer recognition to these moments, but also point to their potential to develop networking and career opportunities.

By publishing scientific articles students are exposed to scientific dynamics, develop relevant skills, and contribute to knowledge production. However, this issue is associated with the intense pressure to publish, the 'publish or perish' syndrome effecting academia in general, and not only senior academics and researchers (Jones 2013). The publication becomes a "convertible currency" (Abbott 2019) in job security, finance, higher salaries, and career success (Merton 1973[1942]; Laurance et al. 2013). A student in exact sciences, without collaboration, expressed this. However, it is important to note that the number of post-

doctorates in Portugal has been increasing, making these career goals even more difficult to achieve in academia, giving rise to increasingly unpredictable careers (Santos, Horta & Heitor 2016).

> The motto of my advisor is 'publish or perish', it has to be. Because otherwise, this is a very ... harsh competition nowadays. ... We have to publish more, more, and more to be competitive. (E6, ETS, academic trajectory)

Scientific publications – articles and chapters – are essential achievements for doctoral students in this study while product development is considered less relevant for those who want to continue in academia after the graduation. The CV analysis revealed the publication track of the students, evidencing that a doctoral degree involves more than writing a thesis, it involves writing scientific articles, book chapters, often co-authored with supervisors.

Academic culture also contains an important international component. Students expressed the widely accepted idea that mobility is a prerequisite for successful academic careers, as well as important to obtain some international experience along the way. But the type of experience varied. The students with academic trajectories were more involved in international internships or summer schools. While the most common form of international experience for students with hybrid trajectories was in conferences and seminars, also due to the lower possibility of reconciling with collaboration or integration in the company. That is, the additional experience of PhD students with academic trajectories seems to involve more international collaboration and integration in scientific networks, while PhD students with hybrid trajectories are more involved in tasks and activities with the companies. This is not to say that students collaborating with companies are not international but that the cross-border mobility is usually embedded in company interests. These differences are illustrated in the two following quotes:

> During the doctorate they gave us funding for three months to a year to do internships abroad. And I took advantage of the challenge. Because there were collaborations, because I knew people outside, there were collaborations between the laboratory and other laboratories. (E7, ES, academic trajectory)
>
> Usually when you do your PhD...you can have a period abroad. When you are doing a PhD in a company, forget it. It is very difficult for you to succeed. ... It happened because I went to develop work for my doctorate, but I took the company's work to develop as well. (E4, ETS, hybrid trajectory)

Students in academic and in hybrid trajectories were concerned with acquiring international experience as it is highly valued and considered to facilitate access to wider scientific networks. These experiences can result in collaborations with international teams and access to different scientific environments, which is relevant in an increasingly international and interdisciplinary research context. In addition, they considered working outside the university to acquire useful knowledge to advance their research, as they are exposed to different disciplines and to different methodological perspectives. This is reinforced in studies that indicate that that international experiences can increase the technical, scientific, and social capital of PhD students, as well as their international recognition (Recotillet 2007; Patrício & Santos 2019).

> I learned a lot, it was brutally productive from a professional and personal point of view. ... It has been months ... brutal, brutal experiences that I recommend it to everyone who goes for a doctorate, because I learned, I learned immensely during the times I was there. ... In fact, I ended up doing things that I was not expecting to do. ... I incorporated a series of case studies in my thesis because of this. (E5, SS, academic trajectory)

Students in both trajectories are aware of the need to expand the range of experiences beyond traditional academic learning and training. Thus, activities that promote additional skills and extend their networks are sought. Students actively seek experiences that will have important repercussions and strategic advantages (see also Jazvac-Martek, Chen & McAlpine 2011; McAlpine 2012). These parallel experiences are means for them to acquire technical, scientific, and cultural capital, regardless of involvement in collaborative processes with companies.

The interests that distinguish academic and business culture are different and recognized as such by the students. This has repercussions in the process and development of the PhD. The differences are predominantly evident in the outputs that are valued by the academy and by businesses. Students with an academic background considered it necessary to guarantee their involvement in a wide range of academic experiences, including international ones, and achievements more valued in academia, such as scientific articles published in international journals. As Acker & Haque (2017) define, they intend to try to build “academic capital” to have a greater possibility of integration in this field.

Conclusions

This article has examined the experiences and practices of PhD students in two groups – those with business collaborations and those without business collaborations. Academic

trajectories are seen as traditional academic disciplinary based doctoral education, while hybrid trajectories experience cross-organizational boundaries collaborating with companies in the production of new knowledge. This study concludes that the formal differences between an academic trajectory and a hybrid trajectory are minor. The academic culture and its values dominate in a context of tenuous links between universities and companies in doctoral programs. However, there are some differences worth noting.

The greatest difference lies in the types of scientific outputs. Traditional outputs such as scientific articles are the main objective of the PhD student, but scientific productivity is influenced by career prospects (in the same direction as the results of Mangematin 2000). In the case of academic trajectories, students can be guided by "succession strategies" to ensure "the profits promised to those who realize the official ideal of scientific excellence" (Bourdieu 1976/1983, pp. 17-18). In these cases, the objective is the scientific publication in a well-ranked international journal. Hybrid doctoral trajectories develop paths more directed to the business sector. Students with business experience are able to benefit from the "habitus", the shared understandings, perceptions, and orientations that they "internalize" during their doctorate. Such an environment leads to results and products, such as patents, prototypes, licenses, and other company-based outputs.

The types of collaboration with companies varied and vary the experiences of doctoral students. Those in hybrid trajectories experienced the most challenges, especially those with a more intense type of collaboration (such as students in the program of engineering sciences and technology). This path is more difficult to navigate, due to the diversity of cultures that shape the process. Socialization in a business environment, in some cases, leads to less freedom and tight deadlines and, consequently, limits the deepening of the questions to be studied (one of the traditional objectives of the doctoral degree) and the writing of articles (one of the most considered products in scientific culture).

This analysis seeks to understand the doctoral process as constructs that differ by type of trajectory, forms of collaboration, and scientific domains. Academic identity continues to be highly discernible by disciplinary field. The disciplinary tradition has implications that are often simultaneous with the different trajectories. In some cases, the dimensions of analysis - such as the choice of topic and the research design – and the scientific domain can be a more relevant and influential variable than the PhD trajectory.

Universities have become increasing attentive to market logics, introducing new public management and entrepreneurial practices. This has led some academics to refer to the phenomenon as academic capitalism (Slaughter & Rhoades 2004; Jessop 2018). The growing tendency is for universities and the academic culture to become increasingly attached to economic values such as commercialization, commodification, and marketization. While this seems to be the case for higher education institutions in general, academic culture remains

the core, the central focus, of doctoral education. The study compares the two trajectories by focusing on the academic culture and the academic process of obtaining a doctoral degree. Academic culture in doctoral education, while adjusting and adapting to external tendencies and forces, remains committed to the production of new knowledge and the transmission and diffusion of knowledge while accepting and encouraging diversified channels and circuits. Doctoral programs conserve academic culture as the dominant form.

This study contributes to the understanding of the influence of collaborations with companies on the trajectory of doctoral students, but it is possible to identify four main limitations. First, not all scientific fields were included. While we included fields that are not normally discussed in the literature on universities-business collaborations in doctoral education, other scientific areas, and their cultures were left out. Second, a limited number of doctoral students were interviewed. Third this study was carried out within a specific national context, limiting generalization. Although the study was located in Portugal, the stories resonate with the tendency reported in other European countries (De Grande et al. 2014, Van Deynze & Santos 2020). More comparative studies with countries similar to Portugal that reveal a diversity of programs and high rates of growth to qualify human resources may be appropriate. Finally, we must recognize that this study analysed only some of the components of the doctoral trajectory. Other aspects of the trajectory, such as the influence of the PhD trajectory in the future career, can offer interesting questions for further research.

Continuing to capture the representations of the experiences of doctoral students in the context of collaborations with companies is important since they are the central actors in both processes – doctoral program and university-company collaboration. The study provides important information for universities to monitor these processes and their influence on the path of new researchers. These results, complemented by other studies, may allow for more thoughtful decisions on the part of students when opting for a PhD in collaboration with companies. The study indicates that such university-company collaborations can be planned with care so that the scope of the research is not limited or side-tracked.

Research activities are an integral part of the trajectories of the doctoral students and are not hindered or diverged by collaborative processes with companies in the fields studied. Academic outputs, however, seem to be more influenced, in particular when related to expectations and perceptions concerning implications on the students' professional future. This leads to another point that deserves to be studied. Can a broader set of experiences and perspectives in the trajectories of doctoral students increase the recognition and appreciation of the doctoral degree by employers outside the academy? The answer to this question addresses one of the primary purposes of the introduction of the measure by the government to promote collaboration.

CONCLUSÕES GERAIS

1. Síntese e articulação dos resultados obtidos. Qual o presente das colaborações universidade-empresa no ensino doutoral?

Este estudo pretendeu fornecer uma compreensão aprofundada sobre os processos de colaboração universidade-empresa no ensino doutoral em Portugal. Em particular, a análise dos fatores políticos e sociais que impulsionam tais processos colaborativos, o papel de académicos e de doutorandos e os efeitos nos percursos formativos. Neste estudo foi possível reconstruir os processos que permitiram a criação, o desenvolvimento e a continuidade das colaborações universidade-empresa. Explorou-se a natureza compósita destes processos nos programas de doutoramento, as relações dinâmicas entre diferentes atores, as práticas e os resultados implicados, tanto apoiando como desafiando o conhecimento já existente.

Os resultados reforçam a ideia de que os processos colaborativos no ensino doutoral são um fenómeno complexo, interativo e dinâmico que ocorrem num espaço, marcado pela diversidade de atores e das suas características. Pode-se considerar quatro correntes, com dinâmicas próprias, que fluem nestes processos: o fluxo da política, o fluxo dos papéis, o fluxo do capital social e o fluxo da cultura. As colaborações universidade-empresa no ensino doutoral são, desta forma, resultado de uma cadeia de influência políticas, sociais e culturais de interações concretizadas num quadro estrutural e territorial específico. Em última instância, o ensino doutoral em colaborações com o tecido empresarial explora debates mais amplos sobre o papel da universidade na sociedade atual.

Tendo em consideração que os resultados foram apresentados nos capítulos empíricos anteriores, de forma independente, nesta seção o objetivo é destacar e articular as contribuições mais significativas, vinculadas às questões exploratórias traçadas no início do processo de investigação.

A política europeia como tendência não condicionadora de políticas nacionais descontínuas

Neste estudo desafiaram-se suposições sobre as pressões isomórficas europeias no campo do ensino doutoral. Embora tenha sido possível identificar, no sistema português, uma tendência de evolução comum aos restantes sistemas europeus, em particular ao contexto de Flandres, a análise permitiu afirmar que os processos envolvem recontextualizações nacionais, respondendo à Questão exploratória 1.

A interpretação das funções e a estrutura do ensino doutoral a nível europeu tem sofrido alterações significativas ao longo dos anos, com consequências nas políticas nacionais. As narrativas e orientações europeias têm vindo a proporcionar a emergência do “problema” da

empregabilidade dos doutorados e da relevância do ensino doutoral e/ou a contribuir para o agendamento de propostas neste sentido. Ambos os sistemas em análise – português e Flandres – "canalizaram" (segundo o modelo de Gornitzka 2013) normas europeias para legitimar maiores investimentos no ensino doutoral, procurando aumentar o número de doutorandos e reorientando a sua trajetória para carreiras não académicas. A regulação construída e/ou difundida a nível europeu, a partir da intensificação e sofisticação de indicadores estatísticos de desempenho comparativo, tal como o lugar modesto de Portugal em relação à média europeia, têm certamente contribuído para a promoção das colaborações universidade-empresa no ensino doutoral.

Porém, fica patente nos resultados que não existe uma homogeneização dos sistemas de ensino doutoral. O confronto entre os dois sistemas europeus e as políticas empreendidas permitem identificar elementos comuns, mas também traçar padrões de diversidade e singularidade dos caminhos adotados. Diferem, desde logo, em termos de justificações para as medidas implementadas, na combinação de medidas, bem como na especificidade do desenho e uso de determinados instrumentos. As pressões europeias foram também "filtradas" para o contexto nacional para legitimar iniciativas políticas e, em Portugal, "amortecidas" na sequência da crise financeira, por exemplo, reduzindo os investimentos em bolsas de doutoramento. Por outro lado, algumas medidas de política, legitimadas por referência a desenvolvimentos europeus, já se encontravam em vigor, sugerindo uso oportunista das mesma, como é o caso das medidas de promoção de uma empregabilidade ampliada para os doutorados.

Não sendo possível falar de relações causais, pode-se considerar que existe uma convergência parcial destes processos, sobretudo a nível das ideias e modelos, paralelamente a uma diversidade de caminhos adotados. Ou seja, considerando a abordagem de Jakobi e Teltemann (2011), as políticas dirigidas à implementação apresentam-se mais dependentes das tradições e circunstâncias nacionais, confirmando a importância dos governos nacionais na promoção de colaborações universidade-empresa no ensino doutoral.

Em Portugal, no período em análise (1994-2015), ocorreu um movimento em prol das colaborações universidade-empresa no ensino doutoral. O quadro político, nesse período, esteve submerso em narrativas cuja ênfase foi principalmente económica e cujos discursos são claramente reativos em resposta às necessidades e transformações da "sociedade do conhecimento", da economia e do mercado de trabalho. A imagem recorrente é que os méritos do ensino doutoral dependem, em grande medida, da sua utilidade social e económica. É, sobretudo, a adoção do pensamento teórico do capital humano que torna o ensino doutoral, os seus programas, doutorandos e doutorandos aspectos incontornáveis das políticas, justificando o investimento nessa área.

Embora a maior das narrativas políticas nacionais estabelecem, assim, uma necessidade de mudança ou uma mudança iminente que reforça o doutoramento como um prelúdio para uma ampla gama de carreiras, dentro e fora da academia, as medidas políticas em Portugal apresentam soluções (ou instrumentos) para problemas (ou objetivos) que variam ao longo do tempo e se concentram em diferentes atores, respondendo à Questão Exploratória 2.

A análise revela que alguns discursos enfatizam atores individuais (doutorandos e doutorandos), enquanto outros enfocam o papel das organizações (universidades e empresas). Partindo do pressuposto de que existe um fosso cultural entre universidades e empresas, os governos concentram-se em estruturas e instrumentos de financiamento que facilitam a transferência de conhecimento e inovação, enfatizando o papel do ensino doutoral enquanto campo de aproximação das duas culturas, nos últimos anos utilizando doutorandos e doutorados como "agentes de mudança" (Butcher e Jeffrey 2007). Além disso, a política governamental deixou de priorizar justificativas relacionadas à necessidade de massa crítica para as empresas, agregando justificativas voltadas para o lado da oferta, com questões que tocam os tipos de competências exigidas pela "sociedade do conhecimento" ou a adaptação do ensino doutoral às crescentes necessidades da mão-de-obra.

Importa salientar que, embora as medidas e instrumentos políticos variem, essa variação não parece transformar significativamente o papel tradicional dos parceiros empresariais e a abordagem tradicional do governo. Em geral, nas medidas e instrumentos criados a responsabilidade pela colaboração recai principalmente sobre os doutorandos e doutorandos, também sobre as universidades e, em menor medida, nas empresas. Já os governos ecoam um modelo de "tripla hélice", assumindo o papel de promotor, sobretudo, com base em incentivos financeiros. Contudo, os resultados evidenciam que a integração dos programas de doutoramento em medidas governamentais, mesmo que de forma instrumental, é importante na criação, aumentando a intensidade e a possibilidade de continuidade da colaboração nos programas de doutoramento.

Características e papel dos parceiros institucionais como promotores da constelação de modelos colaborativos e da diversidade no papel dos doutorandos

Os resultados apontam para a existência de uma variedade de modelos colaborativos entre universidade e empresa no ensino doutoral. Uma parte substancial das colaborações centra-se nos projetos de investigação dos doutorandos: os seus projetos de investigação são realizados na empresa e/ou os doutorandos trabalham em projetos cujo problema foi definido por empresas. Em menor escala, existem colaborações que integram a partilha e a comercialização de resultados com a empresa, a partilha de recursos físicos e humanos da empresa, o apoio financeiro da empresa ao programa e/ou doutorando e a participação direta

da empresa no programa (por exemplo, programas de doutoramento colaborativos). O licenciamento e o patenteamento estão entre as formas de colaboração menos frequentes.[35]

Tal diversidade de formas de colaboração expõe como as relações entre atores institucionais académicos e empresarias não operam num vácuo social. Os modelos colaborativos universidade-empresa nos programas de doutoramento constituem-se como processos situados no contexto social onde operam. São matizados de acordo com diferenças horizontais (na forma como Marginson e van der Wende 2006, concebem) que incluem variações de tamanhos, configurações e culturas institucionais de universidades e empresas; e diferenças em termos de tradições científicas, respondendo à Questão exploratória 3.

Os dados indicam a importância das características da empresa na colaboração. Ressalta-se que quanto maior for a empresa maior probabilidade de haver uma colaboração continuada e replicada a outros domínios de atuação. Estes resultados corroboram a ideia de que a "acumulação de conhecimento" no interior da empresa (Cohen e Levinthal 1990; Oliveira e Carvalho 2002) é condição necessária para as colaborações em programas de doutoramento. Também o capital científico das empresas, ilustrado pela existência de departamento de I&D, facilita os processos colaborativos desta natureza. As grandes ou médias empresas com departamento de I&D e um número considerável de pessoas dedicadas à I&D parecem garantir um maior envolvimento e um papel mais preponderante por parte do actor empresarial ou uma relação mais recíproca com as universidades, por exemplo, na criação e desenvolvimento de um programa de doutoramento.

A diferentes modelos de colaboração correspondem também papéis diferenciados dos atores institucionais envolvidos. Em geral, as colaborações universidade-empresa no ensino doutoral tendem a reproduzir formas tradicionais de colaboração universidade-empresa unilateral, em que a maior parte do ônus recai sobre as universidades e os académicos. A análise mostra a resistência de uma divisão convencional dos papéis distribuídos entre as universidades, como produtoras e fornecedoras de conhecimento, e as empresas, como destinatárias e criadoras de condições para a aplicação e disseminação de conhecimento especializado. A exceção a esta divisão convencional do trabalho é o domínio das ciências da engenharia e tecnologia com maior número de relações de reciprocidade (universidade<->empresa).

Contudo, há algumas nuances a ressaltar a este respeito. A universidade assume um papel mais diversificado quando há partilha de recursos físicos, humanos e financeiros por

[35] No Anexo C encontra-se uma caracterização detalhada das componentes de atividades em colaboração, ilustrando a elasticidade dos processos colaborativos.

parte da empresa, revelando que os papéis se reforçam mutuamente. As empresas assumem um papel importante para o desenvolvimento da investigação do doutorando, especialmente como fornecedor de contexto para a realização dos seus projetos nos diferentes domínios científicos. São as pequenas e microempresas que assumem em maior medida um papel instrumental, sendo que quanto mais pessoas trabalham em atividades de I&D na empresa menor este tipo de papel.

Os doutorandos contribuem para a criação e fortalecimento das colaborações universidade-empresa, mas também reforçam processos de transferência de conhecimento entre os dois setores. A investigação que desenvolvem no âmbito das suas teses é um elemento fundamental para iniciar e/ou estreitar as relações entre empresas e universidades. No entanto, o seu papel encontra-se, de certa forma, dependente da relação entre intervenientes, o que se traduz num maior ou menor protagonismo assumido pelos próprios no processo e nas maiores ou menos possibilidades de transferência de conhecimento, respondendo à Questão Exploratória 5. Os dados empíricos mostram, por exemplo, que quanto mais heterogéneo é o papel das universidades e empresas nas atividades colaborativas, mais diverso é o papel dos doutorandos no processo. Salientando-se ainda que um papel instrumental por parte da empresa leva um papel mais ativo por parte do doutorando, provavelmente no sentido de uma maior necessidade de prestar contas a um financiamento atribuído.

Em geral, os discursos políticos associados a modelos para a colaboração universidade-empresa em programas de doutoramento estão vinculados a paradigmas de conhecimento não lineares nos quais o conhecimento flui e as pessoas circulam em várias direções. Contudo, os dados empíricos revelam a prevalência de um modelo linear caracterizado pela transferência unidirecional do conhecimento. Também por isso, uma das atividades que proporciona formas mais substantivas de colaboração é a mobilidade de doutorandos e profissionais-doutorandos. Estas trajetórias são possivelmente a ponte mais eficaz para o estabelecimento e continuidade de relações entre universidade e empresa, numa matriz em que investigação, formação e atividade económica se cruzam e articulam, potenciando a incorporação de diferentes lógicas institucionais, interesses e linguagens. Desta forma, os doutorandos – sobretudo inseridos em processos de mobilidade - e os doutorados – sobretudo quando recursos humanos em empresas - são atores-chave na criação, manutenção, fortalecimento e multiplicação dos processos de colaboração universidade-empresa, podendo criar condições para uma crescente interpenetração cultural e uma colaboração contínua. Os doutorandos a trabalhar numa empresa não apenas desenvolvem o conhecimento científico da empresa, mas também aumentam a sua capacidade de absorção de conhecimento (Vinding 2004). Mais importante, criam um efeito de "transbordamento" (Jaffe at al. 1993; De Bondt 1997; Lynskey 2010) o que pode levar a uma

mudança na cultura científica da empresa de tal forma que se familiarize com a importância do grau de doutoramento e de recursos humanos altamente qualificados.

O capital social dos académicos enquanto motor de fortalecimento das colaborações

Os resultados mostram que a colaboração com empresas em programas de doutoramento é frequentemente iniciada por atores individuais e que muitos elementos da colaboração se desenvolvem de forma diferente de acordo com as suas características individuais. Em particular, é sublinhada a influência dos académicos, em específico os diretores de programas, e do seu capital social para o desenvolvimento de colaborações mais intensas e da forma como estas evoluem ao longo do tempo, respondendo à Questão Exploratória 4.

O capital social detido pelos académicos potencia, assim, a ampliação e longevidade da colaboração. As interações repetidas (capital relacional) são úteis na construção de confiança, compreensão conjunta e compromisso e ajudam a reduzir o atrito entre setores, tendo efeito na diversificação do leque de atividades colaborativas e no aumento da frequência das interações entre parceiros. Também os académicos com experiências mais diversificadas de trabalho com empresas (capital cognitivo) são capazes de promover formas mais frequentes ou intensas de colaboração em programas de doutoramento. As experiências anteriores de colaboração podem levar a uma maior convergência de entendimento (recursos cognitivos), tornando mais fácil chegar a uma percepção comum dos diferentes aspectos do processo.

Desta forma, as experiências anteriores de colaboração são identificadas como primordiais no sucesso e continuidade das colaborações universidade-empresa, interferindo nos resultados e efeitos para os atores envolvidos e ampliando as possibilidades de continuidade e de integração de novas colaborações. A experiência profissional dos diretores é também um fator que facilita o estabelecimento de colaborações e permite um entendimento comum e uma proximidade mais elevadas com o tecido empresarial. Também são os programas cujos diretores estiveram mais envolvidos em atividades com empresas aqueles onde ocorre um maior número de atividades em colaboração, tal como colaborações mais diversificadas, uma maior transferência de conhecimento para a empresa e uma maior diversidade de papéis assumidos pela universidade e pelos doutorandos na colaboração.

Tanto o capital relacional quanto o capital cognitivo dos académicos são importantes para a continuação das colaborações ao longo do tempo. Ter estado envolvido numa colaboração anterior parece aumentar, embora em pequena medida, a possibilidade de continuidade da colaboração. Esse resultado pode estar relacionado ao facto da colaboração prévia entre atores académicos e empresariais levar a uma maior identificação entre os parceiros e mais satisfação com os processos colaborativos. No entanto, é o capital cognitivo que surge como

mais importante na promoção da continuidade. Tal indica que o capital cognitivo reduz o atrito resultante das diferenças organizacionais e culturais. Também se verifica que os recursos cognitivos são especialmente importantes em campos científicos que tradicionalmente têm relações mais limitadas com empresas. Isto é, o capital cognitivo é particularmente importante para a intensidade e continuidade da colaboração em campos como as ciências sociais, humanas e artes.

As colaborações acabam por se inscrever em dinâmicas de continuidade, quer de colaborações prévias, quer de determinadas trajetórias académicas e profissionais comuns. Os resultados apoiam, então, a ideia de que existem ciclos positivos de colaboração, especialmente em campos científicos tradicionalmente mais distantes de empresas, em que a intensidade da colaboração. Pode-se falar, mais uma vez, de cadeias de processos colaborativos em que a proximidade gera confiança e compromisso entre os atores, o que por sua vez permite o desenvolvimento de um modelo de colaboração mais coeso e sustentável.

A cultura científica e académica como prevalecente nos modelos colaborativos e na trajetória dos doutorandos

As colaborações não são um fenómeno homogéneo, mas sim decorrentes e moldadas pelas características dos programas de doutoramento, sobretudo o seu domínio cientifico. Existem padrões e intensidades de colaboração com empresas diferenciados decorrentes dos campos científicos. As ciências da engenharia e da tecnologia ainda apresentam um perfil único relativamente aos restantes domínios. São estes os programas que mais apresentam colaborações com empresas, mas também colaborações mais diversificadas, contratualizadas, com maior nível de transferência de conhecimentos e mais sedimentadas. No sentido oposto e como seria de prever, encontram-se os programas no domínio das ciências sociais e das humanidades e artes. Tal é uma indicação da importância de culturas e normas disciplinares específicas e de uma maior ou menor tradição de investigação com o tecido empresarial, recorrentemente facilitada pelo capital social dos académicos como já salientado.

As trajetórias de formação “hibrida”, tal como acontece com as trajetórias unicamente académicas, são influenciadas pelos domínios científicos dos programas de doutoramento. Em geral, este estudo sugere que os programas de doutoramento continuam fortemente associada às comunidades disciplinares, mesmo quando integrados em processos de colaboração com atores exteriores. Mudar papéis, ambientes e redes entre universidades e empresas implica um jogo de interação entre fronteiras organizacionais por parte dos doutorandos, processo que molda as práticas e experiências dos futuros doutorados, mas de

forma mais ténue do que previsto à partida na Questão exploratória 6. Por outro lado, na perspetiva de doutorandos e doutorados não existe um descompasso entre as suas competências e capacidades e as necessidades das empresas onde estavam inseridos ou trabalhavam, rejeitando um discurso comum neta área. Os doutorandos acreditam que o valor agregado do seu doutoramento reside na sua especialização e na sua "maturidade científica", composta por autonomia, independência e capacidade de resolver problemas.

A maior diferença dos percursos híbridos, comparativamente a percursos académicos, está no tipo de produção científica que prevalece. No caso das trajetórias académicas, o objetivo é a publicação científica em revistas internacionais, já os doutorandos com trajetórias híbridas desenvolvem caminhos mais direcionados para o setor empresarial, como a produção de patentes, protótipos e licenças. Os processos de colaboração originam, então, diferenças nas escolhas estratégicas que levam a diferenças na produtividade dos doutorandos, mas que também traduzem o dinamismo das opções dos doutorandos e relevam que a sua agência individual deve ser tida em consideração na análise destes processos.

Contudo, as colaborações não são um espaço e experiência isentos de conflitos. Foi neste nível que se encontraram alguns resultados ilustrativos de que o processo construído por diversos setores e atores não se traduz necessariamente num sistema organizado. A colaboração com empresas, em alguns casos, leva a menos liberdade e prazos apertados ou uma panóplia de atividades não académicas que, consequentemente, limitam o aprofundamento das questões a serem estudadas no processo de investigação, sobretudo para os doutorandos envolvidos em tipos de colaboração mais intensas (como é o caso dos doutorandos de programas de ciências e tecnologia da engenharia). Os doutorandos envolvidos em trajetórias colaborativas também acabam por vivenciar conflitos relacionados com as suas opções em termos de produtividade que não se coadunam, muitas vezes, com os produtos científicos valorizados nos âmbitos dos próprios programas de doutoramento.

Em resumo, o ensino doutoral encontra-se numa fase de transição onde coexistem modelos "novos" e "tradicionais" de o conceber, avanços e recuos, retóricas e práticas que contribuem para a sua renovação ou reestruturação.

No sendo imune às dinâmicas sociais, económicas e políticas do tempo histórico em que se insere, revela-se um indicador sensível da mudança de padrões de produção e transferência de conhecimento nas universidades. O ensino doutoral é também motor de transformação e mudança académica. Os resultados revelam que os novos doutorados têm diferentes conceções do conhecimento e da sua aplicabilidade, da importância de novas vivências e transdisciplinaridades. Assim, a identidade e práticas profissionais dos futuros trabalhadores científicos podem moldar a natureza do conhecimento e os seus modos de

produção, com implicações naquilo que são os programas de doutoramento, o ensino doutoral e a investigação científica.

Contudo, o receio de que a mudança na dinâmica entre os atores possa desafiar a posição tradicional das universidades como guardiões dos programas de doutoramento ou ameaçar a cultura académica é, neste tempo e neste contexto, infundada. Em geral, a cultura académica e os seus valores continuam a ser o foco central num contexto formativo de interação entre universidades e empresas, também decorrente da informalidade e descontinuidade das colaborações existentes. Ao mesmo tempo em que os programas de doutoramento se ajustam e adaptam às tendências e forças externas, permanecem comprometidos com a produção de novos conhecimentos e com a transmissão e difusão de saberes. Tal adaptação do ensino doutoral e dos programas de doutoramento a um ambiente académico, social e económico, regional, nacional e europeu, em constante mudança, inevitavelmente continuará no futuro.

2. Balanço do percurso investigativo, limitações do estudo e abertura a outras linhas de investigação

O desenho teórico e metodológico escolhido permitiu uma investigação profunda e multifacetada de perceções, experiências e práticas. No entanto, existem contextos, aspetos e variáveis não considerados que devem ser salientados e que podem abrir caminhos de investigação no futuro.

O campo do ensino doutoral em Portugal é palco de processos de transformação que vão sucedendo à escala europeia, que ressoam com a tendência relatada em outros países europeus e suportam semelhanças com estudos existentes. Para além disso, os estudos sobre esta matéria têm estado centrados na análise das determinantes de sucesso de certas regiões, ficando de fora regiões onde o processo se encontra em fase embrionária ou onde ainda existem baixos níveis de financiamento público e privado, como acontece no sistema científico em Portugal. Nesse sentido, as conclusões retiradas do presente estudo podem ser relevantes para países que experienciam dinâmicas semelhantes, que pretendem aumentar as qualificações da população e contribuir para o desenvolvimento socioeconómico nacional.

Contudo, tal como os resultados salientam, as colaborações universidade-empresa enquanto política e prática têm uma configuração específica em Portugal. Trata-se de um "um caso que figura num universo finito de configurações possíveis", como alerta Bourdieu (2001, p. 4). Nesse sentido, é provável que existam diferenças relativamente a outros países com características e contextos semelhantes em termos de desenvolvimento e investimento em ciência e no ensino superior. Outros contextos nacionais e regionais com tais características

poderiam, assim, ser incluídos no sentido de ser possível compreender os resultados à luz de um número maior de países e regiões.

Em segundo lugar, a intenção foi desenvolver um estudo que garantisse que todos os tipos de colaboração universidade-empresa estariam representados, tal como a diversidade de domínios científicos dos programas de doutoramento. Tal foco, permitiu incluir campos que normalmente não são se encontram na literatura sobre colaborações universidades-empresas no ensino doutoral (como é o caso das ciências sociais), dando a oportunidade para estudar mais aprofundadamente este tema. Por outro lado, ao contrário de grande parte da investigação até à data, este estudo pretendeu analisar a realidade qualitativamente e em contexto, incluindo a perspetiva de doutorandos e doutorados. As opiniões e perceções destes atores têm sido sub-representadas na literatura e, como foi visto na componente quantitativa deste estudo, são um elo incontornável dos processos colaborativos. Embora se considere que os atores integrados nos processo de colaboração possam ter diferentes perceções, parte-se do pressuposto que a opinião e as experiências dos doutorandos dão acesso a informação sobre como as colaborações funcionam, o que funciona e o que não funciona.

No entanto, na componente qualitativa, os resultados devem ser generalizados para outros campos com cautela, devido às características distintivas dos domínios científicos incluídas e o limitado tamanho da amostra, tal como a prevalência dos atores académicos. Novos estudos devem incluir outros domínios e atores. “O contraste de diferentes intersubjetividades”, como refere Machado Pais (2003, pp. 242-243), em especial os atores empresariais, pode enriquecer o conhecimento sobre como as colaborações são desenvolvidas e realizadas, bem como o impacto que as colaborações têm nas universidades e nas empresas.

Em terceiro lugar, este estudo aborda programas de doutoramento que colaboram com o setor empresarial, deixando de fora outro tipo de colaborações, incluindo colaborações com agências governamentais e organizações sem fins lucrativos. Tal justifica pesquisas futuras que contribuam para o conhecimento da rede de relações e colaborações mais amplas e mostre a sua relevância e potencial no sentido de apoiar os propósitos formativos e de investigação no ensino doutoral, incluindo em domínios científicos menos propensos a colaborar com o setor empresarial.

Em quarto lugar, a natureza multidimensional do estudo levou a um conjunto de objetivos e fatores a considerar, mas não foi exaustiva. É necessário reconhecer que este estudo investigou apenas alguns dos elementos constituintes nos processos e efeitos de colaboração universidade-empresa no ensino doutoral. Outros estudos podem analisar a importância do capital social dos académicos percebido pelas empresas ou até que ponto os doutorados em posições que não são de investigação contribuem para o desempenho das

empresas. Para conhecer como as relações entre empresas e universidades surgem e se desenvolvem ao longo tempo, uma abordagem longitudinal também pode ser útil. Ou seja, um estudo qualitativo em que os casos são acompanhados tempo considerável pode permitir identificar e explicar padrões no processo de mudança. Reconhece-se também que este estudo analisou apenas algumas das componentes da trajetória doutoral. Outros aspetos da trajetória, como a influência da trajetória do doutorando na carreira futura, podem ser questões interessantes para pesquisas futuras.

Por fim, o modelo de análise desenvolvido não se focou na interação entre os três planos. Partindo deste modelo, pode-se avançar para estudos que privilegiem a articulação das diferentes componentes, considerando que os atores envolvidos influenciam-se e influenciam os processos. A título de exemplo, a análise política pode ser confrontada com o significado que adquire, tanto a nível dos processos colaborativos nos programas de doutoramento em concreto (nível meso), como nas trajetórias académicas e competências adquiridas pelos doutorandos (o nível micro). Pode, ainda, levar em consideração como as práticas se coadunam com os constrangimentos e oportunidades macroestruturais, admitindo discordâncias entre políticas e dinâmicas organizacionais.

3. Implicações para as políticas e para as organizações parceiras. Qual pode ser o futuro das colaborações universidade-empresa no ensino doutoral?

Acredita-se que os resultados deste estudo serão úteis para informar a política e a prática organizacional, numa área pouco estudada. Espera-se, ainda, que possam ser um recurso para despertar o interesse e estimular a discussão entre as comunidades académicas e empresariais na compreensão das relações existentes entre estes campos e os seus efeitos. Foi nesse sentido que, a partir dos resultados, foram formuladas recomendações para decisores políticos e organizações académicas.

Entende-se que os resultados podem ser úteis para informar os *decisores políticos* que desejam e/ou projetem o desenvolvimento de medidas de política para incentivar a colaboração universidade-empresa nos programas de doutoramento. Em particular, embora este tema desafie soluções simples, salientam-se cinco recomendações que se consideram fundamentais:

i. Monitorizar o progresso e os desenvolvimentos da implementação das medidas de política. O financiamento público foi considerado importante para ampliar a cultura de colaboração nos programas de doutoramento. No entanto, a forma como os processos de colaboração inseridos em programas do governo são desenvolvidos e a extensão dos seus efeitos são,

recorrentemente, aspetos inexplorados. Quais são as consequências pretendidas e não pretendidas desses programas e instrumentos? Nesse sentido, as colaborações financiadas poderiam ser sujeitas a uma monitorização específica a partir de indicadores construídos para o efeito, a fim de assegurar as condições propícias ao seu desenvolvimento, incluindo a auscultação dos atores envolvidos nesses processos. Também seria importante investigar como políticas dessa natureza, em particular os novos modelos de programas de doutoramento, são apropriados e transformados de acordo com as características institucionais, organizacionais e relacionais dos atores envolvidos.

ii. Encontrar formas de forjar relações mais significativas fortalecendo os relacionamentos existentes, especialmente nos domínios científicos mais distantes da cultura empresarial.
Este estudo confirma a visão de que a colaboração universidade-empresa no ensino doutoral é um fenómeno complexo, difícil de manipular, e que é necessário incorporar as particularidades do contexto de colaboração e a posição dos atores no mesmo. As colaborações emergem em função de uma trajetória prévia de experiências que potencia a colaboração nos programas de doutoramento, mais do que como algo passível de ser atingido através de medidas políticas diretas. Desta forma, o papel das medidas de política, pode não se tratar tanto da criação de novas colaborações, mas de um investimento no reforço das já existentes e, em alguns casos, da sua reorientação: de mais pontuais e menos intensas para mais continuas e integradas.

Fomentar a colaboração onde interesses mútuos já foram identificados parece ser um aspeto crucial para a intensidade e continuidade destes processos. As políticas devem também apoiar e reforçar as colaborações estabelecidas que, como visto, levam a mais oportunidades de transferência de conhecimento e mais probabilidade de processos de aprendizagem para os doutorandos.

iii. *Articular as medidas de política existentes, de forma a apoiar objetivos claros.*
A intersecção entre diferentes campos de política neste domínio - ensino superior, ciência, inovação e economia - conduz à coexistência de documentos e instrumentos centrados em diferentes processos e financiamentos. Neste contexto, seria benéfica uma melhor coordenação entre as duas principais agências neste domínio - a FCT e a ANI. O objetivo seria facilitar uma estratégia de longo prazo, promovendo a coordenação estratégica dos investimentos públicos.

iv. Utilizar a mobilidade intersectorial de doutorandos e doutorados numa via dupla.
A mobilidade intersectorial entre universidades e empresas é um importante veículo de colaboração e particularmente útil para o desenvolvimento de competências e aptidões

relevantes tanto no domínio académico como empresarial. Em particular, os fundos públicos para a mobilidade intersectorial podem ser considerados essenciais na construção da capacidade de investigação das empresas envolvidas e na ampliação da sua cultura de I&D, sobretudo tratando-se de pequenas e médias empresas.

Algumas medidas têm sido desenvolvidas para promover a mobilidade intersetorial, mas sobretudo na direção universidade-empresa em comparação com a direção empresa-universidade. A mobilidade intersectorial pode funcionar nos dois sentidos. As colaborações devem permitir um movimento bidirecional entre as universidades e as empresas e deve-se reconhecer o que impede que tal aconteça. Uma possibilidade seria a criação de apoio financeiro para a formação de recursos humanos de empresas em programas de doutoramento.

v. Promover oportunidades para a realização de doutoramentos em organizações do sector público ou organizações do terceiro setor enquanto ambientes apropriados para a formação de ensino doutoral.

O número limitado de empresas suscetíveis de acolher doutorandos a curto e médio prazo, tal como a pertinência ou não desta abordagem relativamente aos diferentes domínios científicas leva a repensar o modelo de bolsas e programas de doutoramento em contexto empresarial. É necessário valorizar políticas que potenciem o contributo (económico e social) de cada domínio na composição da economia portuguesa. Os esquemas de colaboração nos programas de doutoramento, incluindo as bolsas de doutoramento financiadas pela FCT, poderiam trazer benéficos também para estes setores, pois permitiram que organismos desta natureza tenham acesso a conhecimentos e capacidades de alto nível e se tornem mais sensibilizados para a importância dos recursos altamente qualificados.

Entende-se que os resultados do estudo oferecem ainda às *instituições académicas* a oportunidade de refletir sobre as diferentes abordagens e mecanismos de colaboração e os seus efeitos. Alguns dos fatores considerados com efeitos no sucesso da colaboração universidade-empresa, entendidas como inevitavelmente desafiantes, são fatores que estão sob o controle das universidades, em concreto destacam-se cinco:

i. Monitorizar a influência dos processos colaborativos nas experiências e trajetórias dos doutorandos.

A falta de conhecimento aumenta a probabilidade de que a colaboração possa mover a universidade em direções indesejáveis, por isso, é fundamental que se conheçam os processos colaborativos que são promovidos no seio dos programas de doutoramento. Uma maior e melhor recolha e análise de dados sobre estes processos apoiaria as orientações e

estratégias das universidades e ajudaria a estarem em posição de garantir que as colaborações em programas são relevantes para todos os atores envolvidos, incluindo para os doutorandos. Tais resultados podem permitir ainda decisões mais criteriosas por parte dos doutorandos ao optar por trajetórias híbridas de doutoramento.

ii. Apoiar os planos de carreira dos doutorandos.

As universidades têm um papel fundamental para apoiar os doutorandos e doutorados a alinharem os seus perfis, experiências e expectativas em relação ao futuro profissional desejado. Uma parte dos doutorandos e doutorados inscreveram-se num programa de doutoramento por falta de alternativas profissionais, como meio de "atrasar" a carreira propriamente dita e, muitas vezes, motivados por atores externos (Santos 2021). Acima de tudo, há uma visão pouco clara de carreira e a capacidade de antecipar o futuro profissional parece limitada, sobretudo no caso dos doutorandos em ciências sociais.

Nesse sentido, os doutorandos precisam de estar melhor informados sobre as suas opções de carreira, incluindo fora da academia, e ser encorajados a planeá-la. As práticas institucionais relativas à carreira podem ajudar os doutorandos a entender o doutoramento como "bilhete para viagens múltiplas" (Enders, 2005, p. 121). Um apoio e acompanhamento dos planos de carreira dos doutorandos requer disponibilização de informação em termos da capacidade de aspirar, ajuda no estabelecimento de metas e na identificação de caminhos possíveis.

iii. Promover discussões entre universidades e empresas que permitam diluir visões estereotipadas sobre o doutoramento e doutorandos.

A tradição de colaboração limitada entre universidades e o setor empresarial pode significar desconhecimento por parte dos empresários sobre a importância de colaborações com universidades ou da necessidade de contratar recursos altamente qualificados. Desta forma, informações claras e bem direcionadas podem ajudar a reverter pontos de vista estereotipados entre atores, incluindo relativamente às capacidades e competências desenvolvidas na trajetória de doutoramento.

As universidades poderiam, assim, desenvolver campanhas de sensibilização e informação para empresas, e outras organizações, alargando o reconhecimento externo do grau de doutoramento como uma formação adequada para uma carreira não académica e do valor agregado dos doutorados. Para superar alguma relutância, podiam ainda ser pensadas atividades "peer-to-peer" de empresa para empresa, facilitando o acesso a experiências, a discussão sobre o interesse em colaborações desta natureza e, quando pertinente e adequado, o envolvimento nestes processos.

iv. Promover relações colaborativas mais equilibradas em termos de papéis e responsabilidades.

A construção de colaborações eficazes exige capacidade e disposição para transcender o binário provedor de conhecimento – recetor de conhecimento e chegar a processos de integração e construção conjunta. Uma parceria mais profunda exigirá compromissos de ambas as partes, incluindo mudanças organizacionais, criação de estruturas e recursos adequados (como departamentos de I&D nas empresas e recursos humanos focados nestes processos na universidade), tal como maior disponibilidade no apoio da pesquisa dos doutorandos e horizontes de tempo convergentes.

v. Valorizar as trajetórias possíveis para o doutoramento.

As experiências adicionais durante a trajetória de doutoramento desempenham um papel crucial na preparação de doutorandos para uma carreira fora do contexto académico. Uma área que requer mais reflexão é o reconhecimento e valorização da contribuição científica dos doutorandos que participam nestes processos. O ponto-chave é que o ensino doutoral deve ser enraizado num contexto onde as experiências fora da academia são valorizadas e, nesse sentido, as restrições e obstáculos enfrentados pelos doutorandos envolvidos nestes processos devem ser reconhecidas (como é o caso da produtividade científica *versus* produtividade comercial).

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ANEXOS

ANEXO A: Documentos analisados

Os documentos consultados e analisados para o capítulo 1 e capítulo 2 estão organizados cronologicamente por ano de publicação.

Ano	Título
1991	Junta Nacional de Investigação Científica e Tecnológica (1991). Programa CIÊNCIA. Lisboa: JNICT.
1994	Junta Nacional de Investigação Científica e Tecnológica (1994). Programa PRAXIS XXI (2.º QCA). Lisboa: JNICT.
1996	Junta Nacional de Investigação Científica e Tecnológica (1996). Apoio à Inserção de doutorados e mestres em empresas - Programa PRAXIS XXI. Lisboa: JNICT. XII Governo Constitucional (1996). *Grandes Opções do Plano 1997. Diário da República, n.º 299*, 27-12-1996. Lisboa: Diário da República.
1997	XII Governo Constitucional (1997). *Grandes Opções do Plano 1998. Diário da República, n.º 293, 20-12-1997*. Lisboa: Diário da República.
1998	Fundação para a Ciência e a Tecnologia (1998). Base de dados de bolseiros de formação avançada da FCT. Lisboa: FCT. Fundação para a Ciência e a Tecnologia (1998). Relatório sobre Programa de Apoio à Reforma dos Laboratórios do Estado (ARIPIPI). Lisboa: FCT. OCT - Observatório das Ciências e das Tecnologias, (1998). Política Científica e Tecnológica: Diagnóstico e orientações de médio e de curto prazo. Livro Branco para o Desenvolvimento Científico e Tecnológico Português (1999-2006). Lisboa: Ministério da Ciência e da Tecnologia. XIV Governo Constitucional (1998). *Grandes Opções do Plano 1999. Diário da República, n.º 263, 07-01-1999*. Lisboa: Diário da República.
1999	XIV Governo Constitucional (1999). Quadro Normativo das Instituições de Investigação Científica e Desenvolvimento Tecnológico. Decreto-Lei 125/99. Lisboa: Diário da República.
2000	Fundação para a Ciência e a Tecnologia (2000). Programa Operacional Ciência, Tecnologia, Inovação (POCTI) 2000-2006 (3.º QCA). Lisboa: FCT. Fundação para a Ciência e a Tecnologia (2000). Regulamento de Apoio à Inserção de Doutores e Mestres nas Empresas e em Centros Tecnológicos - Programa POCTI. Lisboa: FCT. XIV Governo Constitucional (2000). *Grandes Opções do Plano 2001. Proposta de Lei 30-B/2000*. Lisboa: Diário da República.
2001	Conselho de Ministros (2001). Regulamento do Sitio de Emprego Cientifico e Tecnológico. Resolução do Conselho de Ministros n.º 24/2001, de 1 de Março. Lisboa: Diário da República.

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2002	XV Governo Constitucional (2002). *Grandes Opções do Plano 2003. Diário da República, n.º 301, 30-12-2002*. Lisboa: Diário da República.
2003	XV Governo Constitucional (2003). *Grandes Opções do Plano 2004. Diário da República, n.º 30, 30-12-2003.* Lisboa: Diário da República.
2004	Direcção-Geral do Desenvolvimento Regional (2004). Relatório Programa Operacional Ciência e Inovação (POCI) 2010 (3.º QCA). Comissão QCA III. Lisboa: MAOTDR. Fundação para a Ciência e a Tecnologia (2004). Regulamento deGrau Cientifico - Bolsa de emprego para Carreiras Pós-graduadas nas Empresas. Lisboa: FCT. Ministério da Ciência e do Ensino Superior (2004). Regulamento de bolsas de doutoramento em empresas. Despacho n.º 3037/2004. Lisboa: Diário da República. Ministério da Ciência e do Ensino Superior (2004). Iniciativa Estratégica - Conhecimento e Inovação. Lisboa: MCES.
2005	Conselho de Ministros (2005). *Grandes Opções do Plano 2005-2009. Aprovada 14 Julho 2005, Lisboa*. Lisboa: Diário da República.
2006	Conselho de Ministros (2006). Plano Tecnológico. *Lei n.º 137/2007*, 18 Setembro. Lisboa: Diário da República. Conselho de Ministros (2006). Programa de Parcerias Internacionais. Lei n.º 132/2006. Lisboa: Diário da República. Ministério da Ciência e do Ensino Superior (2006). Um compromisso para a ciência para o futuro de Portugal - vencer o atraso científico e tecnológico. Documento orientador. Lisboa: MCES.
2007	Conselho de Ministros (2007). QREN - Quadro de Referência Estratégico Nacional. Lei n.º 86/2007. Lisboa: Diário da República. Ministério da Ciência, Tecnologia e Ensino Superior (2007). Ciência 2007. Intervenção do Ministro da Ciência, Tecnologia e Ensino Superior, *José Mariano Gago,* Encontro Ciência em Portugal. 12 Abril 2007.

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2010	Gomes, José Ferreira Gomes (2010). (2010). Relatório "A Ciência em Portugal". Assembleia da República. Lisboa: Comissão de Educação e Ciência. Ministério das Finanças e Administração Pública (2010). *Grandes Opções do Plano 2010-2013*. Lisboa: Diário da República.
2011	XIX Governo Constitucional (2011). Programa Estratégico para o Empreendedorismo e a Inovação (+e+i). Diário da Republica, n.º 243, 21 Dezembro. Lisboa: Diário da República.
2012	Fundação para a Ciência e a Tecnologia (2012). Programa Investigador FCT. Lisboa: FCT. Fundação para a Ciência e a Tecnologia (2012). Programas de Doutoramento FCT. Lisboa: FCT. XIX Governo Constitucional (2012). *Grandes Opções do Plano 2013. Proposta de Lei n.º 100/XII.* Lisboa: Diário da República.
2013	Conselho de Ministros (2013). Estratégia de fomento industrial para o crescimento e o emprego 2014-2020. Lisboa: Diário da República. XIX Governo Constitucional (2013). Sistema de Incentivos Fiscais (SIFIDE). Proposta de Lei *n.º 83-C/2013, 31 de Dezembro*. Lisboa: Diário da República. XIX Governo Constitucional (2013). *Grandes Opções do Plano 2014. Proposta de Lei n.º 177/XII.* Lisboa: Diário da República.
2014	Fundação para a Ciência e a Tecnologia (2014). Relatório de análise do percurso dos investigadores contratados pelos Programas CIÊNCIA e Welcome II. Lisboa: FCT. Fundação para a Ciência e a Tecnologia (2014). Roteiro Nacional de Infraestruturas de Investigação de Interesse Estratégico. Lisboa: FCT. Fundação para a Ciência e a Tecnologia; National Innovation Agency (2014). Estratégia de Investigação e Inovação para uma Especialização Inteligente. Lisboa: FCT. XIX Governo Constitucional (2014). Programa Operacional ao abrigo do objetivo de investimento no crescimento e no emprego]. http://www.pofc.qren.pt/ResourcesUser/2015/PO_CI/20150205_POCI_vs_publica.pdf XIX Governo Constitucional (2014). *Grandes Opções do Plano 2015. Proposta de Lei n.º 253/XII.* Lisboa: Diário da República.
2015	Conselho de Ministros (2015). Regulamento Específico do Domínio do Capital Humano. *Portaria n.º 60-C/2015*. Lisboa: Diário da República.

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2016	Conselho de Ministros (2016). "Compromisso com a Ciência e Conhecimento". *Lei 32/2016.* Lisboa: Diário da República. Ministério da Ciência, Tecnologia e Ensino Superior (2016). Emprego Cientifico. Lei n.º 57/2016, 29 august. Lisboa: Diário da República. Agência Nacional de Inovação (2016). Sistema de incentivos à investigação e desenvolvimento tecnológico - Núcleos de I&D em copromoção. Lisboa: ANI. XXI Governo Constitucional (2016). *Grandes Opções do Plano 2016-2019. Proposta de Lei n.º 11/XIII.* Lisboa: Diário da República.
2017	Fundação para a Ciência e a Tecnologia (2017). Regulamento do Emprego Científico. Lisboa: FCT. Fundação para a Ciência e a Tecnologia (2017). Programa Interface. Lisboa: FCT. XXI Governo Constitucional (2017). *Grandes Opções do Plano 2018. Proposta de Lei n.º 99/XIII.* Lisboa: Diário da República.

ANEXO B: Inquérito aos diretores dos programas de doutoramento

COLABORAÇÃO UNIVERSIDADE-EMPRESA NOS PROGRAMAS DE DOUTORAMENTO EM PORTUGAL

O presente questionário integra-se num projecto de doutoramento que está a ser realizado no ISCTE-IUL, associado ao Centro de Investigação e Estudos de Sociologia do Instituto Universitário de Lisboa (CIES-IUL) e financiado pela Fundação para a Ciência e a Tecnologia.

O estudo ***procura conhecer e caracterizar as tendências de colaboração de universidades nos programas de doutoramento, em particular com empresas,*** a partir da percepção dos seus diretores***.***

O questionário aplica-se tanto a programas de doutoramento que tenham colaboração com empresas como a programas que não tenham. As questões dizem respeito ao programa que coordena no ano letivo 2016-2017 e as respostas são totalmente confidenciais e anónimas.

Após o preenchimento do questionário, pode optar por receber os artigos desenvolvidos no âmbito deste estudo e receber convites para apresentações baseadas nos dados recolhidos.

Se tiver alguma questão sobre o estudo ou sobre o questionário, por favor, contacte Patrícia Santos através do e-mail ana.patricia.santos@iscte-iul.pt

A sua colaboração é essencial. **Obrigado!**

Caracterização do Programa de Doutoramento

P1. Área científica:

_____

P2. Ano de criação: _____

P3. <u>No ano lectivo 2016-2017</u> havia elementos do corpo docente ou colaboradores externos do programa de doutoramento provenientes de:

Seleccione (X) todas as que se apliquem

a. Empresas.....

b. Outras instituições nacionais *(instituições de ensino superior, centros de investigação ou outros organismos de investigação).....*

c. Instituições internacionais *(centros de investigação, instituições de ensino superior ou outros organismos de investigação).....*

d. Não.....

P4. O financiamento está inserido em algum programa do governo? *(Por exemplo, Carnegie Mellon – Portugal, MIT-Portugal, Programas de Doutoramento FCT, ou outro)*

Selecione (X) uma opção

a. Sim..... b. Não..... ☐

P4.1. Se sim, qual?

P6. Indique se concorda ou discorda com as seguintes afirmações sobre o <u>programa de doutoramento</u>.

Classifique numa escala de "<u>Discordo totalmente</u>" a "<u>Concordo totalmente</u>"

	Discordo totalmente	**Discordo**	**Nem concordo nem discordo**	**Concordo**	**Concordo totalmente**	**Não se aplica**
a. Contempla na oferta/objetivos as soft skills	☐	☐	☐	☐	☐	☐
b. Promove conhecimento e competências necessários para o mercado de trabalho na academia.....	☐	☐	☐	☐	☐	☐
c. Promove o conhecimento e competências necessários para o mercado de trabalho fora da universidade.....	☐	☐	☐	☐	☐	☐
d. Encoraja os doutorandos a publicarem em revistas científicas.....	☐	☐	☐	☐	☐	☐
e. Encoraja os doutorandos/doutorados a patentear os seus resultados/produtos.....	☐	☐	☐	☐	☐	☐
f. Visa promover a transferência /partilha de conhecimentos e de tecnologia com empresas…….	☐	☐	☐	☐	☐	☐
g. Encoraja os doutorandos/doutorados a criaram *start-ups e/ou spin-offs*.....	☐	☐	☐	☐	☐	☐

P7. Indique as capacidades e competências promovidas pelo programa de doutoramento através das unidades curriculares, workshops ou seminários.

Seleccione (X) todas as que se apliquem

a. Trabalhar em equipa.....

b. Reconhecer e integrar ideias e recursos de um amplo conjunto de fontes.....

c. Liderança…….....

d. Originalidade e criatividade.....…….....

e. Comunicar com não especialistas.....

f. Nenhuma das acima indicadas.....

g. Outra. Por favor, especifique:.....

Colaboração entre Programa de Doutoramento e Empresas

P9. <u>Durante o ano lectivo 2016/2017</u>, ocorreu alguma das seguintes atividades de colaboração com empresas no programa de doutoramento?

Seleccione (X) todas as que se apliquem

a. Doutorandos a trabalhar num projeto de investigação que envolve empresas……..

b. Doutorandos a realizar em empresas parte/totalidade da sua investigação.....

c. Doutorandos a trabalhar em projetos de investigação cujo problema foi definido por empresas.....

d. Doutorandos a trabalhar em projetos de investigação financiados por empresas……

e. Estágio de doutorandos em empresas…….....

f. Orientação do trabalho dos doutorandos por parte de um membro de empresas.....

g. Divulgação dos resultados da I&D produzida pelos doutorandos em empresas *(por exemplo, encontros, seminários, conferências).....*

h. Publicações em co-autoria entre doutorandos e empresas.....

i. Comercialização a empresas dos resultados da I&D produzida pelos doutorandos *(por exemplo, licenciamento / registo de patentes).....*

j. Docentes convidados ou palestras de recursos humanos do setor empresarial…….

k. Recursos físicos partilhados com empresas para o desenvolvimento do programa *(por exemplo, infraestrutura, equipamentos).....*

l. Participação de empresas na gestão do programa *(por exemplo, na comissão científica).....*

m. Apoio financeiro de empresas *(por exemplo, patrocínio do programa e bolsas de estudo)*.....

n. Oferta de programa doutoral em conjunto com empresas.....

o. Outro. *Por favor, especifique:*

p. Nenhuma colaboração.....

SE NÃO HOUVE NENHUMA COLABORAÇÃO PASSAR PARA P24

SE m. PASSAR PARA P9.1

P9.1. Se houve financiamento direto por parte de empresas, indique a percentagem (%)?

_____ %

P10. Indique o número aproximado de empresas com que o programa teve colaborações durante o <u>ano letivo 2016/2017</u>: _____

Características da Colaboração
Caso o programa tenha tido mais de um parceiro empresarial, responda considerando apenas a colaboração com **uma das empresas**. A escolha dever recair na empresa mais participativa medido, por exemplo, em termos de estudantes envolvidos, número e duração de atividades desenvolvidas, efeitos das atividades envolvidas.

P11. Quais as motivações da parte do programa de doutoramento para colaborar com a empresa?

Classifique numa escala de "<u>Nada importante</u>" a "<u>Muito importante</u>"

	Nada importante	**Pouco importante**	**Nem muito nem pouco importante**	**Importante**	**Muito importante**
a. Contribuir para o desenvolvimento económico do país……	☐	☐	☐	☐	☐
b. Contribuir para a missão da universidade……..	☐	☐	☐	☐	☐
c. Estimular o diálogo universidade-empresa……	☐	☐	☐	☐	☐

d. Melhorar a reputação do programa.....	☐	☐	☐	☐	☐
e. Aceder a conhecimento especializado.....	☐	☐	☐	☐	☐
f. Incorporar o conhecimento produzido pelos doutorandos em produtos e processos……	☐	☐	☐	☐	☐
g. Comercializar os produtos desenvolvidos……..	☐	☐	☐	☐	☐
h. Aceder a financiamento.....	☐	☐	☐	☐	☐
i. Aceder a infraestruturas e equipamento….....	☐	☐	☐	☐	☐
j. Adquirir patentes e licenças.....	☐	☐	☐	☐	☐
k. Proporcionar aos doutorandos o contacto com novas perspetivas de investigação.....	☐	☐	☐	☐	☐
l. Melhorar a experiência de aprendizagem dos doutorandos.....	☐	☐	☐	☐	☐
m. Ampliar as competências dos doutorandos……..	☐	☐	☐	☐	☐
n. Aumentar as oportunidades de emprego dos doutorandos.....	☐	☐	☐	☐	☐
o. Ampliar a colaboração a outros âmbitos *(por exemplo, projectos de investigação)*……...	☐	☐	☐	☐	☐

P12. Antes desta colaboração, colaborou com a empresa noutras atividades?

Selecione (X) uma opção

a. Sim..... b. Não..... ☐

P12.1. Se sim, em:

a. Investigação e Desenvolvimento (I&D) ☐

b. Ensino ☐

c. Outra. *Por favor, especifique:* ☐

P13. Antes desta colaboração, a universidade e a empresa colaboraram noutras atividades?

Selecione (X) uma opção

a. Sim..... b. Não..... ☐

P13.1. Se sim, em:

a. Investigação e Desenvolvimento (I&D) ☐

b. Ensino ☐

c. Não sei ☐

d. Outra. *Por favor, especifique* ☐

P14. Quem tomou a iniciativa para a colaboração no programa de doutoramento?

Selecione (X) uma opção

a. Iniciativa individual *(por exemplo, professor da universidade).....*

b. Iniciativa da universidade *(por exemplo, grupo de professores, reitor, órgão de transferência de conhecimento, grupos de universidades).....*

c. Iniciativa da empresa.....

d. Iniciativa governamental *(por exemplo, organismos governamentais nacionais/da EU)*

P15. A colaboração com a empresa foi contratualizada?

Selecione (X) uma opção

a. Sim..... b. Não..... ☐

P16. Como caracteriza o papel da universidade na colaboração?

Seleccione (X) todas as que se apliquem

a. Fornecedora de recursos humanos altamente qualificados.....

b. Fornecedora de *know-how* especializado.....

c. Fornecedora de instalações e equipamentos laboratoriais para o desenvolvimento de atividades de I&D.....

d. Fornecedora de investigação.....

e. Fornecedora de financiamento.....

f. Fornecedora de produtos e processos comercializados à empresa.....

g. Outro. *Por favor, especifique:*

☐

P17. Como caracteriza o papel da empresa na colaboração?

Seleccione (X) todas as que se apliquem

a. Fornecedora de recursos humanos altamente qualificados.....

b. Fornecedora de *know-how* especializado.....

c. Fornecedora de instalações e equipamentos para o desenvolvimento de atividades de I&D.....

d. Fornecedora de investigação.....

e. Fornecedora de financiamento.....

f. Fornecedora do contexto para a realização dos projetos dos doutorandos.....

g. Fornecedora de oportunidades de trabalho para doutorados.....

h. Outro. *Por favor, especifique:* ☐

SE SELECIONOU APENAS A OPÇÃO e) VÁ PARA P18; CASO CONTRÁRIO VÁ PARA P19

P18. Houve interesse da parte do programa que a empresa tivesse um papel para além do financiamento?

Selecione (X) uma opção

a. Sim..... b. Não..... ☐

P19. Indique a frequência média de reuniões universidade-empresa no âmbito do programa doutoral.

Seleccione (X) uma opção

a. Mais de uma vez por semana	☐	e. Uma vez por trimestre	☐
b. Uma vez por semana	☐	f. Uma vez por semestre	☐
c. Uma vez de duas em duas semanas	☐	g. Uma vez por ano lectivo	☐
d. Uma vez por mês	☐	h. Nenhuma	☐

SE RESPONDEU NENHUMA VEZ PASSAR PARA P21

P21. Classifique a importância dos seguintes fatores na gestão da colaboração com a empresa.

Numa escala de "Nada importante" a "Muito importante"

	Nada importante	**Pouco importante**	**Nem muito nem pouco importante**	**Importante**	**Muito importante**
a. Desenvolver relações sustentadas entre organizações.....	☐	☐	☐	☐	☐
b. Gerir as expectativas dos intervenientes	☐	☐	☐	☐	☐
c. Ultrapassar as diferenças culturais.....	☐	☐	☐	☐	☐
d. Desenvolver modelos de comunicação frequente……	☐	☐	☐	☐	☐
e. Explorar formas de minimizar os riscos associados à colaboração *(como a restrição na comunicação de resultados)*…	☐	☐	☐	☐	☐
f. Explorar a sustentabilidade das relações	☐	☐	☐	☐	☐

P22. Classifique o papel dos doutorandos na colaboração com a empresa.

Seleccione (X) todas as que se apliquem

a. Elo de ligação entre corpo docente / universidade e empresa.....

b. Reforço da ligação entre corpo docente / universidade e empresa.....

c. Produção de conhecimento.....

d. Transferência de conhecimentos entre universidade e empresa .....

e. Canal de acesso a financiamento para investigação do corpo docente /universidade

f. Nenhum papel.....

g. Outro. *Por favor, especifique:*

P23. Quanto ao conhecimento que os doutorandos produziram, selecione os itens apropriados.

Seleccione (X) todas as que se apliquem

a. O conhecimento não foi transferido para a empresa.....

b. O conhecimento foi transferido pela empresa.....

c. Não se sei / Não se aplica.....

SALTAR PARA P25

Desejabilidade da Colaboração com Empresas

P24. Consideraria desejável iniciar/aumentar a colaboração com empresas no programa de doutoramento que coordena?

Selecione (X) uma opção

a. Sim..... b. Não..... ☐

Efeitos da Colaboração com Empresas

P25.1/2 Em geral/No caso do programa de doutoramento que coordena, até que ponto acha que os seguintes intervenientes beneficiam de uma colaboração com empresas.

Classifique numa escala de 1 "Nada" a "Extremamente"

	Nada	Pouco	Moderadamente	Muito	Extremamente
a. Doutorandos.....	☐	☐	☐	☐	☐
b. Professores/Investigadores da universidade	☐	☐	☐	☐	☐
c. Universidade.....	☐	☐	☐	☐	☐
d. Empresa.....	☐	☐	☐	☐	☐

SE NÃO HOUVE NENHUMA COLABORAÇÃO PASSAR PARA P27.2

P26. Indique se concorda ou discorda, em geral, das possíveis mais-valias do envolvimento da empresa para o programa de doutoramento.

Classifique numa escala de "Discordo plenamente" a "Concordo plenamente"

	Discordo totalmente	Discordo	Nem concordo nem discordo	Concordo	Concordo totalmente
a. Alinhamento do programa com as necessidades da empresa.....	☐	☐	☐	☐	☐
b. Distinção do programa de outros na mesma área científica.....	☐	☐	☐	☐	☐
c. Integração de uma cultura de formação que integra a cultura académica e a cultura empresarial	☐	☐	☐	☐	☐
d. Captação de alunos internacionais.....	☐	☐	☐	☐	☐
e. Desenvolvimento de novas vias de investigação / formação / consultoria do corpo docente.....	☐	☐	☐	☐	☐

P27.1/2 Indique se concorda ou discorda dos possíveis efeitos <u>para os doutorandos</u> com o envolvimento da empresa no programa de doutoramento.

Classifique numa escala de "Discordo plenamente" a "Concordo plenamente"

	Discordo totalmente	Discordo	Nem concordo nem discordo	Concordo	Concordo totalmente
a. Desenvolvimento de capacidades e competências transferíveis……	☐	☐	☐	☐	☐
b. Aplicação das capacidades e conhecimentos adquiridos ……..	☐	☐	☐	☐	☐
c. Aumento da relevância do conhecimento produzido	☐	☐	☐	☐	☐
d. Limitação ao desenvolvimento de ideias por parte dos doutorandos.....……	☐	☐	☐	☐	☐
e. Publicação em co-autoria com empresas.....	☐	☐	☐	☐	☐
f. Restrição na divulgação e publicação de resultados.....	☐	☐	☐	☐	☐

g. Aumento da motivação dos doutorandos para concluir o grau……	☐	☐	☐	☐	☐
h. Aumento de desistências por parte dos doutorandos…….	☐	☐	☐	☐	☐
i. Extensão do tempo normal para a conclusão do grau de doutoramento.....	☐	☐	☐	☐	☐
j. Aumento da empregabilidade no setor público.....	☐	☐	☐	☐	☐
k. Aumento da empregabilidade no setor privado……..	☐	☐	☐	☐	☐
l. Acesso a suporte técnico e instalações adequado para as atividades de investigação do doutorando….....	☐	☐	☐	☐	☐
m. Apoio financeiro adequado para atividades de investigação…….....	☐	☐	☐	☐	☐

SE NÃO HOUVE NENHUMA COLABORAÇÃO PASSAR PARA P31.2

P29. Avalie a colaboração com a empresa no programa de doutoramento em termos de:

Classifique numa escala de "Nada satisfeito" a "Muito satisfeito"

	Nada satisfeito	**Pouco satisfeito**	**Indiferente**	**Satisfeito**	**Muito satisfeito**	**Não se aplica**
a. Financiamento.....	☐	☐	☐	☐	☐	☐
b. Qualidade do ensino.....	☐	☐	☐	☐	☐	☐
c. Integração dos doutorandos em atividades de investigação.....	☐	☐	☐	☐	☐	☐
d. Ambiente de investigação para doutorandos *(know-how disponível, dados e equipamento)*……..	☐	☐	☐	☐	☐	☐
e. Qualidade dos orientadores.....	☐	☐	☐	☐	☐	☐
f. Competências promovidas.....	☐	☐	☐	☐	☐	☐

g. Competências adquiridas pelos doutorandos.....	☐	☐	☐	☐	☐	☐
h. Produtividade dos doutorandos.....	☐	☐	☐	☐	☐	☐
i. Empregabilidade dos doutorados.....	☐	☐	☐	☐	☐	☐

P30. Avaliação geral da colaboração com a empresa no programa de doutoramento

Classifique numa escala de "Nada satisfeito" a "Muito satisfeito"

Nada satisfeito	Pouco satisfeito	Indiferente	Satisfeito	Muito satisfeito
☐	☐	☐	☐	☐

Fatores Facilitadores e Obstáculos da Colaboração com Empresas

P31.1/2 Em geral/No caso do programa de doutoramento que coordena, classifique o grau de importância dos seguintes fatores na facilitação da colaboração do programa doutoral com empresas.

Classifique numa escala de "Nada importante" a "Muito importante"

	Nada importante	Pouco importante	Nem muito nem pouco importante	Importante	Muito importante
a. Orientação da universidade para colaborações com empresas.....…	☐	☐	☐	☐	☐
b. Interesse da I&D para as empresas.....	☐	☐	☐	☐	☐
c. Curta distância geográfica entre organizações.....	☐	☐	☐	☐	☐
d. Confiança mútua.....	☐	☐	☐	☐	☐
e. Compromisso mútuo.....	☐	☐	☐	☐	☐
f. Objetivo partilhado.....	☐	☐	☐	☐	☐
g. Financiamento para colaboração.....	☐	☐	☐	☐	☐

h. Relação prévia com o parceiro empresarial……..	☐	☐	☐	☐	☐
i. Interesse da universidade no acesso a instalações/ equipamentos/ dados do sector empresarial.....	☐	☐	☐	☐	☐

P32. Que mecanismos de apoio à colaboração com empresas dispõe a sua universidade?

Selecione (X) todas as que se apliquem

	Sim	Não	Não sei
a. Planos e estratégias de comunicação com empresa……..……..			
b. Incentivos à colaboração na avaliação do trabalho docente.....			
c. Recursos *(por exemplo, financiamento, equipamentos).....*			
d. Gabinetes e pessoal dedicado à colaboração *(por exemplo, gabinete de transferência de tecnologia, incubadoras, gabinete de orientação profissional).....*			
e. Atividades de interação com empresários destinadas ao corpo docente/ investigadores……...			
f. Atividades de interação com empresários destinadas a doutorandos.....			
g. Outro. *Por favor, especifique:*			

☐

P33.1/2 Em geral/No caso do programa de doutoramento que coordena, quais as <u>três principais barreiras</u> à colaboração com as empresas em programas de doutoramento?

Seleccione (X) todas as que se apliquem

a. Falta de interesse por parte do corpo docente do programa de doutoramento.....

b. Tempo de trabalho insuficiente para atividades de colaboração com empresas para investigadores / docentes.....

c. Falta de financiamento por parte da empresa.....

d. Dificuldade em encontrar parceiros empresariais que valorizem a I&D da universidade.....

e. Motivações / valores divergentes entre universidades e empresas.....

f. Modos de comunicação e linguagem divergentes entre universidades e empresas.....

g. Limitada capacidade de absorção de conhecimento e recursos humanos das empresas.....

h. Requisito de confidencialidade empresarial.....

i. Dificuldade em atrair e reter doutorandos capazes de trabalhar simultaneamente em ambientes empresariais e universitários.....

j. Interesses descoincidentes de investigação de doutorandos e de parceiros empresariais.....

SE NÃO HOUVE NENHUMA COLABORAÇÃO PASSAR PARA P43

Sustentabilidade da Colaboração com Empresas

P34. A colaboração no programa de doutoramento manteve-se no ano lectivo 2017-2018?

Selecione (X) uma opção

a. Sim..... b. Não..... ☐

P35. A colaboração no programa de doutoramento criou oportunidades para desenvolver outras iniciativas conjuntas?

Selecione (X) uma opção

a. Sim..... b. Não..... ☐

P35.1. Se sim, em:

a. Investigação e Desenvolvimento (I&D)…. ☐

b. Ensino…… ☐

c. Outra. *Por favor, especifique:* ☐

Dados sobre a Empresa Colaboradora

P36. Dimensão:

Selecione (X) uma opção

a. Pequenas e micro-empresas *(1 a 49 funcionários*) ☐

b. Médias empresas *(50 a 250 funcionários)……* ☐

c. Grandes empresas *(mais de 250 funcionários)…..* ☐

P37. Atividade económica da empresa: _____

P38. Pais-sede: _____

P39. Distrito (Portugal):_____

P40. A empresa tem um departamento de I&D?

Selecione (X) uma opção

a. Sim..... b. Não..... ☐

c. Não sabe.....

P41. Número de pessoas dedicadas às atividades de I&D:

Selecione (X) uma opção

a. 1 funcionário……..…. ☐

b. 2 a 5 funcionários……. ☐

c. Mais de 5 funcionários… ☐

d. Não sabe……... ☐

P42. Investimento médio em atividades de I&D: _____€

Dados sobre Diretor

P43. Área de doutoramento:_____

P44. Número de anos que dirige o programa:_____

P45. Atividades em que esteve envolvido <u>no ano lectivo 2016/2017</u>.

Selecione (X) uma opção

a. Projetos de investigação e desenvolvimento que envolvem empresas.....

b. Projetos de investigação contratados por empresas…….....

c. Patentes registadas.....…….....

d. Contratos de licenciamento.....…….....

e. *Spin-offs* criados.....…….....…….....

f. *Start-ups* criadas.....

g. Período tempo passado a trabalhar numa empresa *(por exemplo, licença sabática ou estágio).....*

Agradecemos a sua colaboração!

Gostaria de ter uma cópia dos resultados do estudo. **Por favor, insira o seu e-mail:_____**

Gostaria de participar em eventos de apresentação dos resultados do estudo. **Por favor, insira o seu e-mail:_____**

Gostaria de participar nas fases seguintes do estudo (estudos de caso qualitativos que incluem entrevistas a doutorandos, doutorados, empresas envolvidas). **Por favor, insira o seu e-mail:_____**

ANEXO C: Resumo da caracterização das cinco componentes de colaboração entre programas de doutoramento e empresas

Envolvimento da empresa na investigação do doutorando. Descreve as atividades mais recorrentes no conjunto da amostra que estão relacionadas com o desenvolvimento da investigação do doutorando (investigação na empresa, com orientação da empresa, cujo tema foi selecionado pela empresa). Existe sobretudo no domínio das Ciências da Engenharia e Tecnologia e das Ciências da Agricultura e Veterinária. Está relacionada com a confiança mútua entre atores, com o compromisso mútuo e com a existência de um objetivo partilhado, mas os programas onde houve contratualização com a empresa têm menos probabilidade de terem a empresa envolvida na investigação do doutorando. Encontra-se relacionada com a motivação de ampliar as competências dos doutorandos e o papel do doutorando é mais central do que o da universidade. O alinhamento do programa com as necessidades das empresas e a aquisição e relevância dos conhecimentos adquiridos pelos doutorandos são efeitos relevantes e esta componente explica uma percentagem importante da transferência de conhecimentos para a empresa. Está também relacionada com a maior sustentabilidade da colaboração.

Apoio financeiro de empresas ao programa e ao doutorando. É a segunda componente mais predominante e inclui o doutorando a trabalhar num projeto financiado pela empresa e o apoio financeiro da empresa ao doutorando e/ou programa. É uma componente de colaboração existente sobretudo no domínio das Ciências da Engenharia e Tecnologia e Ciências Naturais e é explicada pelas características da empresa. Está relacionado negativamente com a motivação para aceder a infraestruturas e equipamento por parte da universidade e com a transferência de conhecimento, mas positivamente relacionada com a existência de uma colaboração contratualizada. Quanto maior for a divergência em termos de motivações e valores entre a universidade e a empresa menor é o apoio financeiro da empresa. A universidade assume um papel mais diversificado do que o doutorando nesta componente.

Partilha de resultados dos doutorandos com empresas. Inclui a divulgação de resultados, copublicação e comercialização de produtos. É uma componente de colaboração existente sobretudo no domínio das Ciências da Engenharia e Tecnologia e Ciências Naturais. Quanto menor a distância geográfica entre universidade e empresa maior a partilha de resultados. O tempo de trabalho insuficiente para atividades de colaboração por parte de investigadores e docentes e a maior descoincidência de interesses dos doutorandos e empresas condiciona esta componente. Esta componente contribui para a distinção do programa de outros na mesma área científica e para a publicação em coautoria com elementos da empresa. Explica também uma parte da

transferência de conhecimentos para a empresa e do alargamento da colaboração a outros âmbitos.

Participação direta da empresa no programa. Inclui oferta conjunta do programa de doutoramento ou a participação na gestão de um programa já existente. Só se verifica em três domínios – Ciências da Engenharia e Tecnologia, Ciências Médicas e da Saúde e Humanidades e Artes – com programas integrados em universidades públicas, de grande dimensão e pertencentes aos "Programas de Doutoramento FCT". É uma componente também explicada pelas características da empresa. Trata-se de grandes empresas, sediadas em Portugal, com departamento de I&D com mais de cinco funcionários. Existiam previamente relações entre universidade, diretor e empresa. Está positivamente relacionada com o interesse da universidade no acesso a instalações, equipamentos e dados do setor empresarial e negativamente relacionada com a dificuldade de encontrar parceiros empresariais que valorizem a I&D desenvolvida na universidade. O papel do doutorando é mais diversificado do que o da universidade e esta contribui para o aumento da motivação dos doutorados para concluir o grau. Proporciona um melhor alinhamento do programa com as necessidades das empresas e a integração de uma cultura académica e empresarial no programa.

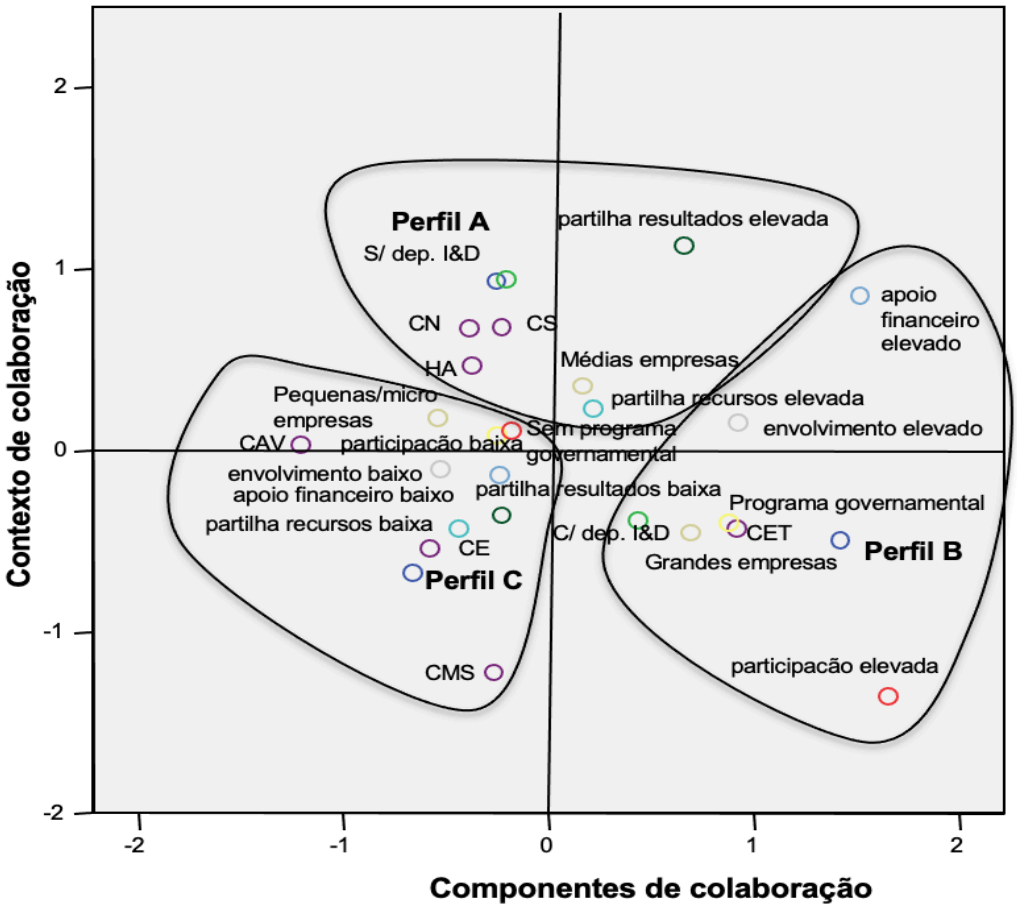
Partilha de recursos físicos e humanos da empresa com o programa. É uma componente de colaboração existente sobretudo no domínio das Ciências da Engenharia e Ciências Naturais. Está negativamente relacionada com modos de comunicação e linguagem divergentes entre empresas e universidades. A universidade assume um papel mais diversificado do que o doutorando nesta componente. Esta partilha explica uma percentagem importante da transferência de conhecimentos para a empresa.

ANEXO D: Perfis de colaboração – análise de clusters

Em sequência das análises descritas em cima, procedeu-se a uma Análise de Correspondências Múltiplas a partir das variáveis mais significativas relacionadas com as componentes de colaboração e o contexto de colaboração. Esta técnica permitiu uma configuração de categorias no espaço suficientemente diferenciadora de perfis relativos à colaboração entre programas de doutoramento e empresas.

Depois de consideradas as medidas de discriminação das variáveis e a quantificação e contribuição das suas categorias, duas dimensões foram retidas para a definição do plano que permite identificar diferentes perfis da colaboração entre programas de doutoramento e empresas. A primeira dimensão opõe categorias relativamente ao contexto, mais ou menos propicio, à colaboração, relacionado as variáveis caracterizadoras do programa (domínio científico e integração numa medida específica do governo) e da empresa (dimensão e existência de departamento de I&D). A segunda dimensão centra-se nas componentes de colaboração que correspondem a uma tendência de mais ou menos intensidade na participação do ator empresarial.

Posteriormente, uma análise de *cluster* foi útil para ao desenvolvimento de perfis de colaboração com empresas em programas de doutoramento. O critério de agregação utilizado foi o *k-means* que produziu uma solução de três clusters. Os perfis A, B e C consistem em 50, 30 e 50 programas de doutoramento. A Figura 18 permite observar os três perfis no espaço bidimensional.



O *Perfil A* – situado no primeiro e no segundo quadrantes - contém programas nos domínios das Ciências Naturais, Humanidades e Artes e Ciências Sociais. É definido pela não existência de financiamento enquadrado num programa específico do governo. Por outro lado, as empresas colaboradoras são sobretudo médias empresas, sem departamento de I&D, e cuja atividade é predominantemente atividades de informação e comunicação (23,7%), atividades de consultoria, científicas e técnicas (15,8%) e atividades de saúde humana e apoio social (10,5%). Apesar das condições pouco propícias à colaboração, este perfil caracteriza-se pela forte partilha de resultados para as empresas e partilha de recursos físicos e humanos da empresa para o programa, sendo o papel instrumental da empresa mais acentuado do que no restantes perfis. As colaborações aqui situadas são, na sua maioria, não contratualizadas (64,4%)

O *Perfil B* – situado no segundo e quarto quadrantes - concentra os programas dos domínios das Ciências da Engenharia e Tecnologia e um conjunto de categorias ligadas a um contexto propício à colaboração. São programas integrados em linhas de apoio do governo. As

empresas colaboradoras são sobretudo indústrias transformadoras (43,5%), caracterizadas como grandes empresas, com departamento de I&D. As parcerias são contratualizadas (65,4%), havendo um envolvimento da empresa na investigação dos doutorandos elevado. Assinala-se ainda que, apesar de pouco frequente, é o perfil onde existe maior apoio financeiro das empresas e também maior participação directa das empresas nos programas, seja na sua criação ou gestão. O papel de promoção de oportunidades de investigação e de emprego para os doutorandos é aqui mais saliente do que nos três outros perfis.

No *Perfil C* - situado no terceiro quadrante e em parte do primeiro quadrante - encontram-se os programas de Ciências Exatas, Ciências da Agricultura e Veterinária e Ciências Médicas e da Saúde. É de notar que as Ciências Médicas e da Saúde estão mais distantes das características que definem este perfil, provavelmente pelas particularidades que este domínio apresenta e que foram sendo elencadas nos pontos anteriores (por exemplo, direcção da colaboração e existência de casos onde a empresa participação na criação ou gestão do programa). As empresas colaboradoras nos programas destes domínios científicos são pequenas e micro-empresas, cuja atividade se centra na indústria transformadora (21,2%), agricultura, produção animal, caça, floresta e pescas (15,2%) e atividades de informação e comunicação (12,1%). São empresas que na sua maior apresentam departamento de I&D, podendo indicar que este perfil integra *start-ups* e *spin-offs* muitas vezes de dimensão reduzida mas com uma componente de investigação embutida. Estes programas não estão inseridos em medidas governamentais específicas para o ensino doutoral ou investigação científica. Existe uma proliferação de atividades em colaboração mas nenhuma demarcada pela sua intensidade. Tal vai ao encontro do resultado que indica que é neste perfil que os diferentes atores – universidade, doutorando e empresa - assumem um papel menos diversificado ou intenso. A da colaboração neste casos é vincadamente não contratualizada (82,1%).

ANEXO E: Guião de entrevista a doutorandos e doutorados com colaboração

---------- **DOUTORANDOS** ----------

MÓDULO I – Trajetória e experiência de doutoramento

1. Qual foi a sua trajectória académica e profissional antes de iniciar o doutoramento?

2. Qual foi a sua motivação para fazer um doutoramento?

3. Qual foi a sua motivação para se inscrever neste programa de doutoramento?

4. Que tipo de atividades de cariz académico e profissional tem desenvolvido desde que iniciou o programa de doutoramento?

5. Como está a ser feita a sua investigação? (onde, apoio financeiro, orientação, etc.)

6. Tem tomado decisões independentes em termos de escolha de problema, metodologia, planeamento e organização do trabalho, resultados?

7. Tem criado ou reforçado redes de contacto e de trabalho durante o doutoramento, dentro e fora da universidade? Como?

MÓDULO II – Programa de doutoramento

8. Quais os principais contributos do programa de doutoramento até agora face ao seu percurso académico e profissional anterior?

9. Como descreve o tipo de conhecimento que é privilegiado no seu programa de doutoramento? Básico, aplicado, interdisciplinar, etc.?

10. Que conhecimentos e competências tem desenvolvido durante o seu doutoramento? (conhecimento científico; pensamento analítico; trabalho de equipa; independência; competências de comunicação e de apresentação; capacidades de escrita; gestão de projetos; etc.)

11. Quais os aspectos do seu programa de doutoramento que destaca como aspectos positivos?

12. Quais os aspectos que destaca como aspectos negativos?

13. Que dificuldades tem enfrentado ao longo do seu percurso de doutoramento? Alguma relacionada com a colaboração com a empresa? (por exemplo, satisfazer simultaneamente as necessidades e expectativas da universidade e da empresa; lidar com dinâmicas e

pressões diferentes; lidar com diferentes níveis de interesse dos parceiros; ter que "duplicar" relatórios de resultados de pesquisa; etc.)

MÓDULO III – Colaboração com empresas e seus efeitos

14. Por favor, descreva a sua experiência com empresas no programa de doutoramento: com quantas empresas teve contacto desde que iniciou o doutoramento? O que fez? Quanto tempo fez?

15. Como são/foram as suas relações com a empresa?

16. Quais considera ser os aspectos positivos da colaboração com empresas no seu programa? (por exemplo, obter *insights* do setor não académico, outras capacidades de pesquisa, competências transferíveis, enfrentar problemas de pesquisa da "vida real", aumentar as oportunidades de empregabilidade, oportunidade de construir uma rede de contatos fora da academia; etc.)

17. Considera que o trabalho que faz/fez com a empresa beneficia a empresa? Ou a universidade? Ou a sua tese?

18. Quais considera ser os aspectos negativos dessa colaboração?

19. Para si, quais as principais diferenças e semelhanças entre a investigação que se faz na universidade e a investigação que se faz em empresas?

20. Quais pensa ser os efeitos da colaboração com empresas na sua trajetória até ao momento? E no futuro? (foco de pesquisa, mobilidade intersectorial, competências adquiridas, produtividade científica, redes criadas/desenvolvidas, etc.)

MÓDULO IV – Papel do doutorando e doutorado

21. Que tipo de atividades é que tem desenvolvido na universidade e na empresa?

22. Sentiu ou teve algum conflito entre estar entre a universidade e numa empresa (valores, perspectivas, objetivos, divulgação de resultados, financiamento)? Se sim, como foi resolvido?

23. Para si, qual é o papel que os doutorandos devem assumir nas universidades? E nas empresas?

24. Qual considera ser o papel dos doutorados na sociedade?

MÓDULO V – Expectativas e ambições de carreira

25. O que pretende fazer em termos de carreira depois de concluir o doutoramento? (por exemplo, pós-doc, fora da academia, etc.)

26. Considera que o programa de doutoramento o tem preparado para uma inserção no mercado de trabalho?

MÓDULO VI – Balanço

27. Que experiências ou que factores mais influenciaram o seu caminho durante o doutoramento?

28. Se pudesse voltar no tempo até ao momento da inscrição no programa de doutoramento, o que mudaria? (por exemplo, orientador diferente, tópico diferente, campo ou subcampo diferente, universidade diferente, não fazer o doutoramento)

---------- **DOUTORADOS** ----------

MÓDULO I – Trajetória e experiência de doutoramento

1. Qual foi a sua trajectória académica e profissional antes de iniciar o doutoramento?

2. Qual foi a sua motivação para fazer um doutoramento?

3. Qual foi a sua motivação para se inscrever neste programa de doutoramento?

4. Que tipo de atividades de cariz académico e profissional desenvolveu no programa de doutoramento?

5. Como foi feita a sua investigação? (onde, apoio financeiro, orientação, etc.)

6. Tomou decisões independentes em termos de escolha de problema, metodologia, planeamento e organização do trabalho, resultados?

7. Criou ou reforçou redes de contacto e de trabalho durante o doutoramento, dentro e fora da universidade? Como?

8. Quantos anos levou a concluir? O que dificultou/ajudou a conclusão?

MÓDULO II – Programa de doutoramento

9. Quais os principais contributos do programa de doutoramento face ao seu percurso académico e profissional que já tinha?

10. Como descreve o tipo de conhecimento que é privilegiado no seu programa de doutoramento? Básico, aplicado, interdisciplinar, etc.?

11. Que conhecimentos e competências desenvolveu durante o seu doutoramento? (conhecimento científico; pensamento analítico; trabalho de equipa; independência; competências de comunicação e de apresentação; capacidades de escrita; gestão de projetos; etc.)

12. Quais os aspectos do seu programa de doutoramento que destaca como aspectos positivos?

13. Quais os aspectos que destaca como aspectos negativos?

14. Quais foram as dificuldades que enfrentou ao longo do doutoramento? Algum relacionado com a colaboração com a empresa? (por exemplo, satisfazer simultaneamente as necessidades e expectativas da universidade e da empresa; lidar com dinâmicas e pressões diferentes; lidar com diferentes níveis de interesse dos parceiros; ter que "duplicar" relatórios de resultados de pesquisa; etc.)

MÓDULO III – Colaboração com empresas e seus efeitos

15. Por favor, descreva a sua experiência com empresas no programa de doutoramento: com quantas empresas teve contacto desde que iniciou o doutoramento? O que fez? Quanto tempo fez?

16. Como são/foram as suas relações com a empresa?

17. Quais considera ser os aspectos positivos da colaboração com empresas no seu programa? (por exemplo, obter *insights* do setor não académico, outras capacidades de pesquisa, competências transferíveis, enfrentar problemas de pesquisa da "vida real", aumentar as oportunidades de empregabilidade, oportunidade de construir uma rede de contatos fora da academia; etc.)

18. Considera que o trabalho que faz/fez com a empresa beneficia a empresa? Ou a universidade? Ou a sua tese?

19. Quais considera ser as mais-valias da colaboração com empresas no seu programa de doutoramento? (por exemplo, obter *insights* do setor não académico, enfrentar problemas de pesquisa da "vida real", outras capacidades de pesquisa, competências transferíveis, aumentar as oportunidades de empregabilidade, oportunidade de construir uma rede de contatos fora da academia; etc.)

20. Quais considera ser os aspectos negativos dessa colaboração?

21. Para si, quais as principais diferenças e semelhanças entre a investigação que se faz na universidade e a investigação que se faz em empresas?

22. Quais pensa ter sido ser os efeitos da colaboração com empresas na sua trajetória? (foco de pesquisa, mobilidade intersectorial, competências adquiridas, produtividade científica, redes criadas/desenvolvidas, etc.)

MÓDULO IV – Papel do doutorando e doutorado

23. Que tipo de atividades desenvolveu na universidade e na empresa enquanto doutorando?

24. Sentiu ou teve algum conflito entre estar entre a universidade e numa empresa (valores, perspectivas, objetivos, divulgação de resultados, financiamento)? Se sim, como foi resolvido?

25. Para si, qual é o papel que os doutorandos devem assumir nas universidades? E nas empresas?

26. Qual considera ser o papel dos doutorados na sociedade?

MÓDULO V – Característica da carreira

27. O que aconteceu em termos de carreira depois de se graduar como doutorado? (por exemplo, pós-doc, fora da academia, etc.)

28. Considera que o programa de doutoramento o preparou para uma inserção no mercado de trabalho?

29. Qual a sua atividades profissional atual? (onde, principais actividades, etc.)

30. Quais as razões que o levaram a esse trabalho? (por exemplo, criatividade, desafio intelectual, responsabilidade, grau de independência, possibilidade de desenvolver novas capacidades, contribuição para sociedade)

31. De que forma o seu trabalho atual está relacionado com o que fez no doutoramento?

32. Está satisfeito com o seu trabalho actual? Era isso que esperava durante o doutoramento? (por exemplo, benefícios; segurança de trabalho; oportunidades de trabalho dentro da organização; política de carreira da organização e gestão de recursos humanos; grau em que trabalho oferece oportunidades para o avanço da carreira; circunstâncias pessoais e relacionadas à família)

MÓDULO VI – Balanço

33. Que experiências ou que factores mais influenciaram o seu caminho durante o doutoramento?

34. Se pudesse voltar no tempo até ao momento da inscrição no programa de doutoramento, o que mudaria? (por exemplo, orientador diferente, tópico diferente, campo ou subcampo diferente, universidade diferente, não fazer o doutoramento)

ANEXO F: Guião de entrevistas a doutorandos e doutorados sem colaboração

---------- **DOUTORANDOS** ----------

MÓDULO I – Trajetória e experiência de doutoramento

1. Qual foi a sua trajectória académica antes de iniciar o doutoramento?

2. Qual foi a sua motivação para se inscrever neste programa de doutoramento?

3. Este programa foi a primeira escolha ou havia outra/s?

4. Como tem sido a sua trajetória desde que se inscreveu no programa de doutoramento? (por exemplo, outros projectos além da tese, etc.)

5. Como descreve o processo de orientação?

6. Até que ponto tem tomado decisões independentes em termos de escolha de problema, metodologia, planeamento e organização do trabalho, resultados?

7. Como está a ser feita a sua investigação? (onde, em que condições, selecção do tema, etc.)

8. Houve ou haverá algum período de tempo entre o inicio do programa e a conclusão do grau em que não esteve a trabalhar na sua investigação?

9. Esteve fora do contexto da sua universidade em algum período ou tenciona fazê-lo?

10. Quais foram os desafios que tem enfrentado ao longo do seu percurso de doutoramento?

11. Tem criado ou reforçado redes de contacto e de trabalho durante o doutoramento? Como?

MÓDULO II – Programa de doutoramento

12. Como descreve o seu programa de doutoramento?

13. Que capacidades e competências tem desenvolvido durante o seu doutoramento?

14. Quais os aspectos do seu programa de doutoramento que destaca como aspectos positivos?

15. Quais os aspectos que destaca como aspectos negativos?

MÓDULO III – Papel do doutorando e doutorado

16. Para si, qual o papel que os doutorandos devem assumir nas universidades e nas empresas?

17. Qual considera ser o papel dos doutorados na sociedade?

MÓDULO IV – Colaboração com empresas e seus efeitos

18. Gostaria que houvesse ligação a empresas no seu programa de doutoramento? Porquê?

19. O que considera que dificulta a existência de colaboração com empresas no programa de doutoramento onde está inserido?

20. Quais considera ser as mais-valias dos programas que têm colaboração com empresas?

21. Quais considera ser os aspectos negativos dos programas que têm colaboração com empresas?

22. Qual é o entendimento que faz da ciência e investigação académica e a ciência e investigação empresarial?

23. Esse entendimento mudou desde que entrou no programa de doutoramento?

24. O que acha que um programa de doutoramento que tenha colaboração com empresas oferece mais do que programas sem essa colaboração?

25. Quais considera ser as mais-valias e os desafios enfrentados pelo doutorando quando existe colaboração com uma empresa?

MÓDULO V – Expectativas e ambições de carreira

26. O que pretende fazer em termos de carreira depois de concluir o doutoramento?

27. Considera ser "empregável" depois do doutoramento?

MÓDULO V – Balanço

28. Que experiências ou que factores mais influenciaram o seu caminho durante o doutoramento?

29. Se pudesse voltar no tempo até ao momento da inscrição no programa de doutoramento, o que mudaria?

30. Para si, qual é o principal valor de ter um grau doutoramento?

---------- DOUTORADOS ----------

MÓDULO I – Trajetória e experiência de doutoramento

1. Qual foi a sua trajectória académica antes de iniciar o doutoramento?

2. Qual foi a sua motivação para se inscrever neste programa de doutoramento?

3. Este programa foi a primeira escolha ou havia outra/s?

4. Como foi a sua trajetória desde que se inscreveu no programa de doutoramento? (por exemplo, outros projectos além da tese, etc.)

5. Como descreve o processo de orientação?

6. Até que ponto tomou decisões independentes em termos de escolha de problema, metodologia, planeamento e organização do trabalho, resultados?

7. Como foi feita a sua investigação? (onde, em que condições, selecção do tema, etc.)

8. Houve ou haverá algum período de tempo entre o inicio do programa e a conclusão do grau em que não esteve a trabalhar na sua investigação?

9. Esteve fora do contexto da sua universidade em algum período ou tenciona fazê-lo?

10. Quais foram os desafios que tem enfrentado ao longo do seu percurso de doutoramento?

11. Tem criado ou reforçado redes de contacto e de trabalho durante o doutoramento? Como?

12. Quantos anos levou a concluir? O que dificultou/ajudou a conclusão atempada?

MÓDULO II – Programa de doutoramento

13. Como descreve o seu programa de doutoramento?

14. Que capacidades e competências desenvolveu durante o seu doutoramento?

15. Quais os aspectos do seu programa de doutoramento que destaca como aspectos positivos?

16. Quais os aspectos que destaca como aspectos negativos?

MÓDULO III – Papel do doutorando e doutorado

17. Qual o seu entendimento do papel dos doutorandos nas universidades e nas empresas?

18. Qual considera ser o papel dos doutorados na sociedade?

MÓDULO IV – Colaboração com empresas e seus efeitos

19. Gostaria que tivesse havido ligação a empresas no seu programa de doutoramento? Porquê?

20. O que considera que dificulta a existência de colaboração com empresas no programa de doutoramento onde esteve inserido?

21. Quais considera ser as mais-valias dos programas que têm colaboração com empresas?

22. Quais considera ser os aspectos negativos dos programas que têm colaboração com empresas?

23. Qual é o entendimento que faz da ciência e investigação académica e a ciência e investigação empresarial?

24. Recorda-se se esse entendimento ao longo do seu percurso no programa de doutoramento?

25. O que acha que um programa de doutoramento que tenha colaboração com empresas oferece mais do que programas sem essa colaboração?

26. Quais considera ser as mais-valias e os desafios enfrentados pelo doutorando quando existe colaboração com uma empresa?

MÓDULO V – Expectativas e ambições de carreira

27. O que aconteceu depois de se graduar como doutorado em termos de carreira?

28. Qual o seu trabalho atual? (onde, principais actividades, etc.)

29. Quais as razões que o levaram a esse trabalho?

30. De que forma o seu trabalho atual está relacionado com o que fez no doutoramento?

31. Está satisfeito com o seu trabalho actual? Era isso que esperava durante o doutoramento?

MÓDULO V – Balanço

32. Que experiências ou que factores mais influenciaram o seu caminho durante o doutoramento?

33. Se pudesse voltar no tempo até ao momento da inscrição no programa de doutoramento, o que mudaria?

34. Para si, qual é o principal valor de ter o grau doutoramento?

ANEXO G: Árvore de categorização das entrevistas

1. CARACTERÍSTICAS DOS PROGRAMAS DE DOUTORAMENTO

1.1. Componente letiva
1.2. Tipo de conhecimento
1.3. Produtos e resultados valorizados
1.4. Perspetivas sobre estruturação dos programas
1.5. Perspetivas sobre promoção de competências transversais
1.6. Perspetivas sobre apoio à empregabilidade

2. Trajetória de doutorandos e doutorados

2.1. Motivações para o doutoramento
2.1.1. Desejo de trabalhar numa empresa
2.1.2. Importância do grau para a empregabilidade
2.1.3. Desenvolvimento de competências
2.1.4. Falta de alternativas
2.1.5. Desejo de continuar na investigação ou área científica
2.1.6. Proposta de orientadores/docentes
2.1.7. Oportunidade de bolsa

3. Escola de orientador e processo de orientação

3.1. Sem conhecimento prévio
3.2. Com conhecimento prévio

4. Seleção do tema de tese

4.1. Definição de outros atores
4.2. Definição do doutorando
4.3. Definição do doutorando e outros atores

5. Outras atividades desenvolvidas durante o doutoramento

5.1. Divulgação científica
5.2. Lecionação e orientação
5.3. Projetos paralelos
5.4. Experiências internacionais

6. Tipo de conhecimento valorizado e produzido

6.1. Aplicado

6.2. Fundamental

6.3. Múltiplos propósitos

7. Competências e conhecimentos adquiridos

7.1. Especialização

7.2. Competências transversais

8. Produtividade

8.1. Produtividade académica

8.2. Produtos e patentes

9. Dificuldades

9.1. Proliferação de atividades e responsabilidades

9.2. Conciliar doutoramento com trabalho / família

9.3. Falta de materiais e recursos

9.4. Integração na empresa / outra instituição

9.5. Pressão para resultados e produtos

9.6. Problemas com a orientação

9.7. Incertezas e dificuldades no fazer ciência

9.8. Interesses e processos diferentes entre universidade e empresa

10. Características da colaboração com empresas

10.1. Histórico de colaboração

10.2. Motivações

10.3. Iniciativa

10.4. Atividades em colaboração

10.5. Formalização da colaboração

11. Dificuldade na colaboração

11.1. Financiamento

11.2. Transferência de conhecimento

11.3. Disponibilidade / compromisso da empresa

11.4. Interesses e processos divergentes

11.5. Pressão para resultados

11.6. Integração do doutorando

12. Obstáculos à colaboração

12.1. Diferentes culturas

12.2. Disponibilidade / compromisso da empresa

12.3. Interesses académicos e económicos divergentes

12.4. Patentes

12.5. Sigilo

12.6. Estabelecimento da parceria

13. Efeitos da colaboração

13.1. Para a empresa

13.1.1. Mão-de-obra qualificada

13.1.2. Acesso a know-how

13.1.3. Criação de produtos

13.1.4. Utilização de equipamentos da universidade

13.2. Para a universidade

13.2.1. Acesso a problemas reais

13.2.2. Acesso a financiamento

13.2.3. Produção de conhecimento aplicado

13.3. Para os doutorandos

13.3.1. Competências transversais

13.3.2. Redes criadas e desenvolvidas

13.3.3. Conhecimento e experiência no setor empresarial

13.3.4. Qualidade da investigação realizada

13.3.5. Produtividade científica

13.3.6. Produtividade comercial

13.3.7. Empregabilidade

14. Carreira de doutorandos e doutorados

14.1. Preparação para o mercado de trabalho

14.2. Expectativas e planos

14.3. Trabalho atual

14.4. Satisfação com o trabalho atual

15. Perspetivas sobre o tecido empresarial português e colaboração universidade-empresa

15.1. Para diretores dos programas de doutoramento
15.2. Para as empresas
15.3. Para doutorandos e doutorados

16. Investigação académica versus investigação empresarial

16.1. Objetivo social
16.2. Organização do trabalho
16.3. Tempos e ritmos diferentes
16.4. Grau de burocracia
16.5. Grau de autonomia e independência
16.6. Grau de inovação
16.7. Valor económico

ANEXO H: Análise dos *Curriculum Vitae* dos doutorandos e doutorados

			Conferências nacionais		Conferências internacionais		Artigos científicos nacionais		Artigos científicos internacionais		Livros nacionais		Livros internacionais		Patentes	Publicações/ano
Domínio	**Tipo**	**Colaboração**	Autoria	Co-autoria	Autoria	Co-autoria	Autoria	Co-autoria	Autoria	Co-autoria	Autoria	Co-autoria	Autoria	Co-autoria		
CS	Doutorando	Com	5	26	2	26	0	1	0	5	0	0	0	0	0	0,86
CS	Doutorado/a	Com	0	4	1	9	0	0	0	14	0	1	1	2	0	4,5
CS	Doutorado/a	Sem	2	0	8	5	1	0	6	1	2	1	0	1	0	3
CS	Doutorando/a	Sem	0	2	0	1	0	0	0	3	0	0	0	0	0	0,75
CE	Doutorado/a	Sem	0	0	0	3	0	0	0	16	0	0	0	0	1	4
CE	Doutorando/a	Sem	0	1	0	0	0	0	0	0	0	0	0	0	0	0
CE	Doutorando/a	Com	2	0	4	0	0	0	0	8	0	0	0	0	0	2
CE	Doutorado/a	Com	0	2	0	4	0	0	0	7	0	0	0	5	0	2,4
CET	Doutorado/a	Sem	2	0	4	0	0	0	0	3	0	0	0	0	0	0,6
CET	Doutorado/a	Sem	0	2	0	10	0	0	0	9	0	0	0	0	0	2,25
CET	Doutorado/a	Com	0	0	0	0	0	0	0	1	0	0	0	0	1	0,2