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Knowledge Transfer and Valorisation in SI I&DT – Perspectives from the Portuguese entrepreneurial ecosystem

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Internship report

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Abstract

Governments in the European Union are increasingly reinforcing business Research & Development (R&D) stimulation. Since 2005, the growth of R&D expenditure in Portugal has been mainly driven by the increase in Business R&D. Simultaneously, Open innovation (OI), that involves all stakeholders in the process of knowledge creation and knowledge absorption, has been emerging. OI requires a cultural shift from the traditional R&D inward focus to more outward-looking management towards the creation of shared value through knowledge transfer and valorisation (KTV). Therefore, this report aims to review how is KTV seen by a sample of Portuguese companies, particularly in what regards R&D investments made through the European Structural and Investment Funds. It is framed within a curricular internship in the Incentives Department of KPMG, with the purpose of paving the way to better understand real-life experiences and perceive current KTV. To achieve this goal, a mixed-method sequential explanatory design was followed. Initially, a quantitative methodology was used by presenting a survey to 114 companies that participated in SI I&DT, with the aim of providing a broader view of the research question. In a second phase, semi-structured interviews were conducted in seven companies that have participated in the initial sampling, with the aim of explaining and elaborating on the results obtained through the quantitative survey. The findings show that it may still exist some resistance towards the OI paradigm. Furthermore, the findings reveal that there may still exist a separation among Portuguese companies in their mindset in what regards KTV. While earlier research has addressed KTV within the academic and scientific-sides of the spectrum, so far, none has focused on the company's perspective. Given the increasing importance of Business R&D in the overall performance of Portuguese innovation and despite the limitations inherent to having a limited number of companies providing their view on the phenomenon under study, the author believes this study contributes to the literature and practice by shedding light on the industry perspective on KTV.

Key words: R&D subsidies, R&D, EU funding, knowledge transfer and valorisation, knowledge dissemination, open innovation

JEL-codes: H25; H81; O3; O31; O36

Resumo

Os governos dos países da União Europeia estão a reforçar cada vez mais o estímulo às atividades de Investigação e Desenvolvimento (I&D). As despesas de I&D em Portugal, desde 2005, têm vindo a sofrer sucessivos acréscimos impulsionados, maioritariamente, pelo aumento do investimento em I&D realizado pelo setor empresarial. Simultaneamente, a Inovação Aberta (IA), que integra toda a diversidade de *stakeholders* no processo de criação e absorção do conhecimento, começa a emergir. A IA exige uma mudança cultural, da forma mais tradicional de desenvolvimento meramente interno de I&D para um processo de criação de valor mais abrangente, através da transferência e valorização de conhecimento (TVC). Neste sentido, a presente dissertação pretende compreender como é que a TVC é vista pelas empresas portuguesas, partindo de uma amostra de empresas que beneficiou dos fundos Europeus Estruturais e de Investimento para investir em I&D. O presente relatório enquadra-se no âmbito de um estágio curricular levado a cabo no Departamento de Incentivos da KPMG, e tem como objetivo aprofundar conhecimento sobre a perceção atual do mundo empresarial relativamente à TVC, através da recolha de experiências concretas. Para atingir este objetivo, seguiu-se uma metodologia mista. Foi inicialmente utilizada uma abordagem quantitativa, que consistiu na aplicação de um inquérito a 114 empresas que participaram no SI I&DT, com o objetivo de alcançar uma visão geral da questão em estudo. Posteriormente, foram realizadas entrevistas semiestruturadas a sete das empresas que participaram na amostragem inicial, com o objetivo de aprofundar os resultados obtidos na fase anterior. Os resultados do estudo evidenciam que poderá ainda existir resistência à IA em Portugal. Adicionalmente, concluiu-se que existe discórdia no mundo empresarial no que diz respeito à opinião relativamente à TVC. Embora estudos anteriores tenham abordado a TVC nos meios académico-científicos, até ao momento, nenhum se focou na perspetiva empresarial do espectro. Dada a crescente importância da I&D empresarial no desempenho global da Inovação em Portugal, acredita-se que este estudo contribuí, na prática e na teoria, para um melhor entendimento da perspetiva empresarial sobre a TVC.

Palavras-chave: incentivos à I&D; I&D; financiamento Europeu, transferência e valorização do conhecimento; disseminação do conhecimento; inovação aberta

JEL-Codes: H25; H81; O3; O31; O36

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List of acronyms and abbreviations

EIS	European Innovation Scoreboard
ESIF	European Structural and Investment Funds
EU	European Union
HR	Human Resources
ICT	Information and Communication Technologies
IP	Intellectual Property
KTV	Knowledge Transfer and Valorisation
OECD	Organisation for Economic Cooperation and Development
OI	Open Innovation
PT2020	Portugal 2020
R&D	Research and development
R&I	Research and innovation
SI I&DT	Incentive Scheme for Research and Technological Development (in Portuguese, *Sistema de Incentivos à Investigação e Desenvolvimento Tecnológico*)
SPSS	Statistical Package for the Social Sciences
S&T	Science and Technology

1. Introduction

After the Lisbon Agenda in 2000, governments in the European Union (EU) assumed a leading role in promoting the growth of Research and Development (R&D) investments. This Agenda, which represented an action and development plan for the member-states of the EU, had the purpose of transforming the European Union in *"the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion"* (Lisbon Council, 2000), by 2010. This conference represented a milestone that signalled a strategic change in the public R&D policies and reinforced the role of EU countries on stimulating business R&D, whose repercussions have gone far beyond the European Union *per se*.

During the same Agenda, the term 'knowledge valorisation' emerged during the debate about policy measures (Andriessen, 2005), with the aim of achieving a *knowledge and innovation-based economy*. Knowledge valorisation became the transfer of knowledge from R&D organizations *"to other parties envisaging the creation of social and economic value from it"* (Vilarinho, 2015). Therefore, EU-members became more committed to public policies of business R&D stimulation by increasing its generosity in incentives and business support.

EU-member states follow a common strategic goal of achieving economic and social cohesion, that aims to reduce structural disparities between them through a variety of actions financed by the European Structural and Investment (ESI) Funds (European Commission). Nevertheless, each member is responsible for taking their own measures to encourage technology and knowledge transfer, as a mean to reach the ultimate goal of achieving higher levels of R&D intensity (Mazgan, 2011). It was within this paradigm that Portugal 2020 was created, taking advantage of ESI funds to promote research, innovation, and entrepreneurship, and developing the skills to close educational gaps and boost employment.

This report aims to review how knowledge transfer and valorisation (KTV) is seen by Portuguese companies, taking into consideration a sample of companies that invested in R&D and took advantage of the ESI funds. The Portuguese Research and Technological Development Incentive Scheme (SI I&DT) is focused on strengthening and creating explicit knowledge transfer channels that guide the R&D held into its beneficiaries, whether companies or society in general, with the aim of increasing competitiveness and cohesion. But how is knowledge transfer and valorisation seen by the Portuguese companies, particularly

in what regards R&D investments made through the ESI Funds? Do KTV encourage companies to open their Innovative process? Or is it seen as a burden that concerns companies?

KTV is theoretically beneficial for the development of a country (Scherer et al., 2019). However, and despite the fact that it can be enhanced by this type of incentives, it can only be maximized by companies or non-entrepreneurial entities that allow the dissemination of the knowledge created. Therefore, it is extremely important to understand how companies perceive this topic in order to eventually adapt and/or (re)design future approaches to this issue in new programmes, instilling its importance within the entrepreneurial ecosystem, and enhancing the spread of knowledge in the future, particularly, in the OI system.

Furthermore, knowledge transfer and valorisation are numerously addressed in literature (for instance, Arqué-Castells et al., 2016; Grimpe & Hussinger, 2013; Walter et al., 2018), but always associated with universities and research centres, that invest in R&D, create knowledge, and provide their findings to the industry. This leads room for further investigation on the company-side of the spectrum, a much less studied perspective in literature.

This report will be written under the scope of a curricular internship at the consultancy company KPMG, and built from a mixed-methods sequential explanatory design, developed on the basis of structured surveys and deepen through semi-structured interviews with existing customers and non-customers who have participated in SI I&DT. It is the author's intent to contribute to a better understanding of how real-life companies are dealing with OI by collecting concrete experiences and examples to perceive current KTV. The internship motivated the development of this study. Perceiving the opinion of companies on KTV can be useful in optimizing specific incentive-related consultancy, leading to a better forecast of R&D projects and, consequently, to a better provision of consultancy services.

This internship report will be divided into 5 more sections. In Chapter 2, the internship under which this report was developed will be contextualised, in particular, a brief overview on the company and company-wide concerns that support the chosen theme. Chapter 3 is dedicated to the literature review in what regards both the theoretical background as well as the practical side of EU-incentive schemes. In Chapter 4 the methodology used to perform this research will be explained, along with the selected sample. In Chapter 5 the survey findings and results will first be analysed, being followed by a reflection and integration of both quantitative and qualitative research methods. Chapter 6 is dedicated to conclusions.

2. Internship: context and tasks

The focused topic for this dissertation is in line with the 6-month curricular internship at KPMG & Associados – Sociedade de Revisores Oficiais de Contas S.A. (hereby referred only as "KPMG"), in the incentives department – Tax area, started in October, the 16th and ended in April, the 15th. The main tasks were related with the application of incentives provided to companies that are focused on investing in different business areas. Working in this field supported the development of new skills and useful knowledge within the area.

2.1. The company

KPMG International Cooperative ("KPMG International") is a Swiss entity that operates as a global network of independent member firms, that offer audit, tax, and advisory services, while working closely with the clients, helping them mitigating risks and seizing opportunities. Currently, KPMG has member firms in more than 150 countries that together employ almost 220,000 people in different areas.

2.2. The internship

KPMG keeps a close relationship with the academic sphere, hiring dozens of graduates every year through their 'new joiners' programme, promoting summer internships, and welcoming master students into their facilities, in order to promote their connection with the business world while supporting them in their final dissertation work. It is within the scope of this former option that this internship report was written.

The tasks performed during the internship were very diversified. Initially, all the necessary information was provided, through training, courses, or other means, not only to perform the tasks in the best way possible, but also for a better framing of all existing incentives schemes, as well as the respective Portuguese legislation. From fieldwork, i.e. meeting with the customer to understand their needs, to back office tasks such as the research of funding opportunities, the activities were quite diversified. It was a daily challenge with the high pace that is expected from working at a 'big 4' company.

In this context, during the period in which the internship took place, several KPMG's customers had investment projects funded by Portugal 2020 (PT2020) that were still ongoing.

Moreover, there were also customers that were interested in applying to a certain Portugal 2020 incentive scheme. Therefore, this implied the involvement in several tasks that ranged from monitoring of the first (e.g. submission of payment requests by justifying, organizing, and requesting the refund of all the already (and eligible) incurred expenses), to assistance in the process of the second (e.g. meeting with the customer to understand the project; assessing different incentive opportunities by analysing the framework and the access conditions of each opening call; or even preparing the incentive application processes, including a descriptive and reasoning component as well as a financial component of the project).

Through the vast experience intrinsic to KPMG consultants, the theme KTV started to arise, once it was every so often an issue during the process of the submission of an application. In fact, it was usually a concern that the consultants had – when a company submits a proposal of an investment project, it is analysed by technical operational public entities, that evaluate and determine the merit (i.e. 'score') of the project and that sends their eligibility proposal to the Management Entity of the Programme. At this stage, the selected projects are sorted by a descending order of their merit and chosen until the limit of the budget is achieved.

KTV plays an important role and is an increasing concern for the public authorities, meaning that it scores in the merit of a R&D project reaching almost 20% of the project's score in some SI I&DT calls. However, KPMG perceived that companies, in general, had still not instilled the importance that this topic represents, being only more prone to it whenever the project was in cooperation with non-corporate entities of the Research & Innovation (R&I) system, namely, universities.

Therefore, this research question emerged and was born out of a need and a curiosity held by KPMG, which concluded that, by perceiving the opinion of companies in this topic, the application process could be optimized, addressing KTV in a way that start developing an inherent interest in the entrepreneurial ecosystem. Additionally, it could also positively impact incentive-related consultancy to new and existing players on the R&D scene, while better leveraging existing and future innovation funding.

3. Literature review

3.1. The emergence of a knowledge-based economy

In 2000, EU-countries conferenced at the Lisbon Agenda, often referred to as the Lisbon Strategy, in order to outline a plan, composed by several initiatives and goals to be achieved, that aimed to solve the issues of low productivity and economic growth stagnation that had been arising in the European Union. At that point in time, governments in the EU assumed a leading role in "*mak*[ing] *Europe, by 2010, the most competitive and dynamic knowledge-based economy in the world"* (Lisbon Council, 2000).

Throughout the past 2 decades, leading countries have increasingly evolved towards this concept of a *knowledge-based economy* (Asongu, 2017), an economy that encompasses knowledge, high skilled human capital, and technology for economic growth (Kurtić & Đonlagić, 2012). Accordingly, countries that have knowledge as the base of its economy drive economic prosperity, employment creation, and wealth generation through the production, exchange, distribution and use of knowledge (McKeon & Weir, 2001).

3.1.1. R&D: the quest for in-depth knowledge

The first known form of Research and experimental Development came from the earliest *homo habilis'* experiences with knapping flint to make stone age tools. However, the first formalized R&D accounts only to the late 19th century with the creation of industrial labs, arising as a component of the arsenal of modern corporation (Hall, 2006).

The amount of resources devoted to R&D rapidly escalated, encouraging the Organisation for Economic Cooperation and Development (OECD)-member countries in collecting statistical data in this field. Nevertheless, the comparability within R&D data was difficult to achieve once a considerable latitude was given to companies in what regards the definition of the concept (Becker, 2015).

These problems were the motto to the meeting held in the city that baptized the Frascati Manual with the purpose of creating a framework that facilitated international comparisons while stimulating the data-collection within member countries (OECD, 1963). As a result, this Manual has been defining R&D as the ensemble of *"creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge"* (OECD, 2015) over the past 6 decades.

3.1.2. Openness in Open Innovation

R&D is closely linked to business activity and the direct economic benefits that arise from the knowledge created. The literature review suggests a link between knowledge and economic growth: on one hand, knowledge is considered a driver of productivity (Acs et al., 2009; Shane, 2004; Thurow, 2009); on the other hand, knowledge production is related to economic growth, through the return on investment made on R&D (Harris, 2001). Thus, economic growth is supported by the inputs to the knowledge value chain – science, new knowledge, and new technologies (Ala et al., 2014) that are all driven by R&D.

Therefore, R&D has been seen as a vital asset and, in many industries, a barrier to competitive entry. However, return on research and development increase when in-house R&D are complemented with external entities, technologies, and knowledge. Research centres and industry need to intensify combined efforts in order to spark innovation, create new businesses and transfer and disseminate knowledge (Thurow, 2009). This cooperation is the proposition behind several models, such as Mode 2 knowledge production (Gibbons, 1994), Triple Helix (Etzkowitz & Leydesdorff, 1995) and its extension to the Quadruple Helix (Carayannis & Campbell, 2009), and mainly Open Innovation (Chesbrough, 2003b), which all analyse the emergence and transformation of R&D into a collaborative process.

Open Innovation is a new and emerging concept that is based on *"integrated collaboration, co-created shared value, cultivated innovation ecosystems, unleashed exponential technologies, and extraordinarily rapid adoption"* (Curley & Salmelin, 2013, 2017). In fact, this new paradigm is crucial to the foreseen European Innovation System, once, by getting all stakeholders involved in the process of knowledge creation and knowledge absorption, innovation's performance increases (see, *inter alia*, Chiang & Hung, 2010; Duysters & Lokshin, 2011; McMillan et al., 2014; Wang et al., 2015). Table 1 displays the main differences between Closed and Open Innovation.

Table 1. Closed vs. Open Innovation principles

Closed Innovation	Open Innovation
Internal HR are the best in the market	There are good internal and external HR
To profit from R&D, discover, development, and supply has to be done inside the company	External R&D can further create value for the company
Only the company who discovers something will be the one 'putting it on the market' first	Internal R&D is needed to understand the value of external discoveries
The first company commercializing a discovery is the one who 'wins'	An involvement in theoretical research is needed, but the discovery can be made by some other entity

Closed Innovation	Open Innovation
The company who creates the best ideas within the industry, 'wins'	The company who integrates internal and external knowledge in the best way, 'wins'
By having a full control over internal knowledge and the innovation process, the competitors are not able of profiting from those innovative ideas	The company should transfer the results of internal innovation with the acquisition of external innovation, whenever the former is more efficient, in order to optimize internal results

Source: Based on Chesbrough (2003a, 2003b)

Henry Chesbrough (2006) core philosophy underlying OI replaces the traditional logic of "Closed Innovation" tacitly held by companies for years (Chesbrough, 2003a). OI relates to the quicker, easier, and more effective way from which innovation can arise when exchanging ideas and knowledge. This process starts with the existing knowledge and the economic base-level, that gathers training and advanced education, university-based R&D and business-based R&D to provide crucial inputs for innovative activities. At this point, knowledge transfer becomes more intense, not only regarding the flows of knowledge within the different contributors to R&D, but also in what regards the potential beneficiaries (Mateus et al., 2018). It is within this process that the knowledge created through R&D can be shared and valued, generating a set of impacts at economic and social levels – *knowledge transfer and valorisation* (Andriessen, 2005; Vilarinho, 2015).

This innovation process spans organizational boundaries far beyond the normal licensing and collaborative schemes once it uses external sources for ideas, technologies and knowledge through an extensive networking and co-creative association between a large number of stakeholders. To open this process of innovation, R&D has to change from a traditional inward focus to more outward-looking management, gathering inputs from networks of universities and public research entities, suppliers, competitors, and the entrepreneurial ecosystem at large (Chesbrough, 2003c). To do so, KTV has to be present in companies' DNA. This requires a cultural shift and a change of *status quo* towards the creation of shared value, that has to happen in each company.

3.1.2.1. Splitting transfer from valorisation

As already briefly analysed, KTV can be a step forward into shifting from the current paradigm based on resource exploitation, that is deeply rooted in the entrepreneurial ecosystem, particularly in the Portuguese industry, to a new one based on knowledge and (open) innovation.

KTV represents the transformation of the knowledge generated through R&D into value. Whereas *knowledge transfer* is a narrower concept directly linked to the commercialization of knowledge created and its subsequent monetary and commercial benefits; *knowledge valorisation* is a broader concept that encompasses the creation of social and economic value rather than exclusively monetary value (Goorden et al., 2008; Hladchenko, 2016; Vilarinho, 2015).

In reality, the former definition emerged during the Lisbon Agenda in the course of the debate about policy measures (Andriessen, 2005), with the aim of achieving a knowledge and innovation-based economy, while overcoming productivity and economic-growth issues. Within the scope of funded R&D projects, knowledge valorisation was also defined as society's direct and indirect return for the investment that the public sector made in R&D. In this last definition, Asunción et al. (2012) stated that when R&D is financed by public authorities, KTV represents the use of the results and knowledge created for socio-economic purposes.

In fact, there are countless terms that encompass the set of activities that lie between the production of knowledge, the economic activities through which knowledge is transformed into value, the disclosure of R&D outcomes, and the utilisation of knowledge in further activities other than those covered by the primary research and development activities.

Actually, both knowledge transfer and knowledge valorisation are considered different concepts used in literature, nevertheless end up being usually used to refer the same phenomena, while considering all the characteristics described above (Baycan & Stough, 2013). These complex phenomena stimulate economy growth by developing capabilities and improving economic performance of regions (Baycan & Stough, 2013), highlighting that knowledge can be created in a context and transformed and applied in a multiplicity of contexts.

3.1.2.2. Absorptive capacity

Knowledge has to be considered an important asset to a company once it has a positive impact on R&D processes and means a superior performance and competitive advantage (Martín-de Castro et al., 2011). However, a major part of knowledge flows with and among people who hold it. In fact, the R&D process will only conduct to a competitive advantage if the company has the ability to collect, store and allocate specific knowledge properly – knowledge itself will only lead to innovation by being absorbed and/or shared among employees (Sulistyo & Ayuni, 2018). Thus, a key concept for KTV is related with the absorptive

capacity that an enterprise has.

The presence of highly qualified human resources (HR) – i.e. with bachelor, master, and/or doctorate degrees – in companies is a vital factor to increase the absorptive capacity of a given entrepreneurial entity. The number of HR with a master's degree or a PhD working at companies are usually seen as an important proxy to assess company's capacity in absorbing knowledge (Mateus et al., 2018).

In Portugal, the number of PhDs employed in companies is still not very significant, although it has been gradually increasing since the beginning of this century – only 3% of Portuguese doctorates are actually working in companies, while the EU-average is 35%, meaning that the Portuguese percentage is more than 11 times lower (Conselho de Reitores das Universidades Portuguesas, 2019). This small percentage coupled with the fact that the Portuguese National Innovation System is characterised by a participation of companies in R&D below the EU-average, creates a difficult environment to absorb the knowledge produced, conditioning the Portuguese positioning in terms of R&D outcomes.

3.1.2.3. Transferring and valuing knowledge

As already briefly analysed, producing, disseminating, and applying knowledge are base-procedures that characterise the competitiveness of a knowledge-based economy (Audretsch & Link, 2012; Schwab, 2012), which is dependent on research and innovation systems' success and the correspondent investments made in them.

Measuring R&D and how technology and knowledge are spread out into society is a sensitive theme in what regards which practices are more likely to disseminate the knowledge generated through R&D. Kalar and Antoncic (2015) differentiated between entrepreneurial and traditional activities of technology and knowledge transfer, stating that the first ones can range from more to less formal behaviours, being related to patenting, licensing, or even applied research. In fact, the authors explained that traditional activities were prone to be associated to universities, such as participating at conferences or scientific publishing. Agasisti et al. (2019) did not make the same separation between results, however they confirmed that measuring *"the development of human capital and skills, technology transfer activities, new product development, and research activities"* are of high importance. On the other hand, Čučković

and Vučković (2018) state that the process of R&D leads to spin-off ventures that are capable of knowledge commercialization and to introduce new and/or improved products, services, and processes.

Similarly, Beck et al. (2017) lists the benefits of academic based research that impacts both the entrepreneurial ecosystem, as well as society at large. Once again, emphasis is given to outputs that come from academic research rather than business R&D. In fact, it is stated that this type of universities and other public research institutions impact industrial research both directly, through technology and knowledge transfer, and indirectly, through education of human capital. Focus is given on the improved diffusion of knowledge and technology through the creation of spin-offs, technology transfer offices, academic consulting, and academic entrepreneurship. Concluding, despite of the emphasis given to academic research, Beck et al. (2017) also state that partnerships between academic and business spheres have positive effects on increasing R&D-levels, and that the first plays an important 'entrepreneurial mediator'-role in regions with high entrepreneurial activities.

Deen and Vossensteyn (2006), in their case, compare different ways of analysing technology and knowledge transfer across different countries, being the Netherlands and Australia the main focus. In the Dutch's case, the KTV activities used are usually associated with dissertations or scientific publications. The authors focus mainly on the evolution of university's research performance, that evaluates productivity through quantitative indicators (bibliometrics – e.g. number of publications and citations; technometrics – e.g. number of patents; or sociometric – concerned with research or socio-economic performance).

In the same report Deen and Vossensteyn (2006) also evaluate the R&D outputs in Australian's case, developing a list of the set of metrics of knowledge transfer that help public agencies measuring the benefits from science and technology investments. Outputs are divided into deliverables, intermediate outcomes, and final outcomes. In fact, the final outcomes are in line with all previously stated authors (Agasisti et al., 2019; Beck et al., 2017; Čučković & Vučković, 2018), that ensure economic growth, employment, and society as the ultimate goal of R&D investments. The deliverables and intermediate outputs range from (i) Intellectual Property protection, through patenting and licensing, and transfer and exploitation, through start-ups and Spin-outs formation, to (ii) Research Contracts & Consultancies,

that are measured via the number of reports, number of publications, and number of conferences and seminars. This is in line with the appreciation that universities not only supply knowledge outputs, such as graduates and research papers, but are also involved in collaborations with private firms through licensing and spin-offs (Agasisti et al., 2019).

Recently, Van de Burgwal et al. (2019) divided the process of transforming knowledge into value and its related activities into, on the one hand, knowledge transfer activities, which are related to formal academic activities, such as receiving revenues from Intellectual Property (IP) rights, shareholding, royalties, or bonuses; and, on the other, knowledge valorisation activities that encompass an entrepreneurial branch as the transformation of research findings into products, services, processes, and/or business activities, which include spin-off companies, incubators, patent and licensing applications, and even book writing and development of guidelines for policy improvements. They went even further dividing all the activities into knowledge production, exchange, and use on the one hand, and the target groups and subsequent areas of impact, on the other, as can be seen in Table 2.

Table 2. Division of KTV activities per target group and its subsequent social or economic impact

	Target group			
	Scientific community	**Civil society**	**Entrepreneurial actors**	**State-governmental decision makers**
Knowledge production	Scientific publications	Lay publications	Patents, products	Guideline development, professional publications
Knowledge exchange	Lectures, scientific consultations	Speeches, courses for general public	Consultancy, contract research	Membership of professional associations, participation in policy research
Knowledge use	Citations	Use of (school) books	Use of patents and products	Use of guidelines, application of advices
	With an impact on:			
	Knowledge	**Culture**	**Economy**	**Wellbeing**

Source: Based on Van de Burgwal et al. (2019)

As it can be seen, this value creation approach, that encompasses both knowledge transfer and knowledge valorisation processes, ensembles a set of interrelated activities that are part of a process that contribute to the creation of value until reaching the ultimate goal of spreading new knowledge to all interested parties (Ala et al., 2014). This set of activities lie between the production of knowledge and the economic activities through which

knowledge is transformed into value. The surplus value that is created through KTV processes can either be financial and/or societal, accelerating scientific progress, endorsing economic development of each region and country, while stimulating the creation of new businesses and, therefore, boosting a country's competitiveness (Hladchenko, 2016). However, the mechanisms for transferring knowledge and technology in an innovation system are complex and multidirectional, depending largely on the actors of each innovation system. Furthermore, it was seen that KTV activities associated with universities and research centres were the ones mainly stressed in literature – universities and research centres invest in R&D, create knowledge, and provide their finding to the industry. This leads room for further investigation in the company-side of the spectrum that, to the best of the author's knowledge, was still not addressed by literature, being the focus of the present dissertation.

3.2. PT2020: Fundamentals of business R&D public intervention

During European Union's history, eight Framework Programmes for Research and Technological Development, also known only as Framework Programmes, have already been implemented, starting in 1984. Horizon 2020 is the current programme under implementation, being claimed to be the biggest Research and Innovation funding programme in the world and taking up about 8 per cent of the European Commission budget, as well as the same share of total government R&D spending across the EU (Fernández et al., 2019). This programme emerged in order to achieve the goals proposed by the European's Commission strategy – Europe 2020, that came to replace the already mentioned Lisbon Strategy.

Portugal 2020 is a partnership agreement adopted between Portugal and the European Commission that embraced the Europe 2020 strategy principles. In order to execute Europe 2020 strategy, the ESI Funds are allocated among EU-countries. PT2020 aims economic, social, environmental, and territorial development, in order to stimulate growth and job creation, reduce poverty and correct external imbalance that still exists. In practical terms, Portugal, between 2014 and 2020, will reach € 25 billion in funds destined to four cornerstones of this Operational Programme – (i) Social Inclusion and Employment, (ii) Human Capital, (iii) Sustainability and Resource Efficiency, and (iv) Competitiveness and Internationalization (Portugal 2020, 2014). This last pillar includes one of Portugal 2020 main goals, which is stimulating research, innovation, and the transfer of knowledge in order to create jobs and generate economic value in Portugal.

In 2019, the final stage of Portugal 2020 strategy, Portugal had a 'moderate innovator' profile, according to the European Innovation Scoreboard[1] (Hollanders et al., 2019). This profile implies that Portugal is/was performing below the EU-average, as the result of a combination of factors that has been seen in the past few years – an insufficient coordination between the entrepreneurial ecosystem and the non-corporate entities of the R&I system, low levels of patenting and poor absorptive capacity (Hollanders et al., 2019; Rodrigues, 2016). However, in the 2011-2019 period, Portugal's performance improved in certain indicators that are used in the international comparison, reaching the EU-levels in 'attractive research systems' and surpassing its average in 'innovation-friendly environment' and 'innovators'.

ESI Funds have been critical to the Portuguese improvements. In fact, Portugal 2020 strategy focused on promoting R&D and the transfer of knowledge to and from the business sector with the aim of increasing competitiveness and added value, and reinforcing the tradable orientation of the Portuguese economy (Rodrigues, 2016).

3.2.1. Incentive Scheme for Research and Technological Development

The different types of *public intervention* that can be carried out by the government can be divided into direct support and indirect support. In terms of direct governmental support mechanisms to increase business R&D, two categories arises – fiscal incentives, that alleviates the corporate tax pressure; and financial support, which is a policy of direct funding (Van Pottelsberghe et al., 2003). The use of the former has a long tradition and it is split among subsidies, grants, and loans. SI I&DT is an incentives scheme that works as direct funding given to companies in the form of grants.

The target group of this funding measure are companies; however, non-entrepreneurial entities of the R&I system are also eligible in the framework whenever participate in a consortium led by companies. Therefore, SI I&DT ends up being an important bridge in sensitizing Portuguese companies towards the transfer, valorisation, dissemination, and exploitation of knowledge. It influences companies to (i) embrace their relationships with universities, research centres, and other business entities, (ii) increase their investment in R&D, (iii) embrace knowledge-flows through the increase of interest in KTV, while (iv) encouraging OI (Ferreira

[1] European Innovation Scoreboard (EIS) evaluates the innovation capacity of the EU-countries, in the context of knowledge transfer, that is based on indicators that measure innovation performance. This Scoreboard is the most relevant and up-to-date statistical publication that includes Portuguese data.

et al., 2018).

3.2.2. Rationale behind public funding R&D

Investing in R&D is non-comparable with investing in other type of asset. In fact, R&D has characteristics that differ from the ordinary investments covered in the investment theory, i.e. the research and development devoted in the present will continuously benefit both those who undertake it as well as society at large in the future (Hall, 2006).

Private R&D investments are biased by the different forms of market failure, reaching amounts that do not correspond to the socially optimal value. Table 3 summarizes the R&D characteristics that culminate in both over or underinvestment in Research & Development.

Table 3. Why are support mechanisms needed to support R&D investments?

	Input	Result
Indivisibility	The outputs that come from the investment in R&D can be applied at increasingly lower cost per unit (i.e. economies of scale), which can create a monopolistic competition in industries that are R&D-intensive (Arrow, 1971).	Overinvestment Underinvestment
Lack of full appropriability	The result obtained with the investigation undertaken can be replicated or imitated, usually at a lower cost than the original investment in R&D. This type of knowledge suggests a natural positive external effect, or spill-overs, that creates some form of resistance to investigation (Romer, 1986).	Underinvestment
Uncertainty	The nature of the outputs produced by R&D often suggest asymmetric information within the researcher and who might finance the investment. This additional gap increases the risk of investing in R&D which indicates difficulties in financing (Hall, 2002).	Underinvestment

In order to correct this market inefficiency, the neoclassical economics defends that regulatory entities, such as governments, have to interfere with policy instruments that will understate those flaws, rising investment in R&D to its optimal level.

3.2.3. Why subsidising KTV?

Public subsidies to business R&D are used in most OECD countries (Aschhoff & Sofka, 2009), being the main public instrument that enhances R&D networking and collaboration within organizations (De Jong et al., 2010). Accordingly, the rationale behind these economic

incentives are the stimulation of economic growth, the improvement of employment opportunities, the ability to provide higher wages, and the enhancement of a country's competitiveness (Tchamyou, 2017). In fact, incentive schemes and subsidies are seen as an important innovation driver that creates an institutional environment for companies which is more favourable to their R&D development, creating synergies and knowledge spill-overs that help them to adapt to transformations of techno-economic environment (Čučković & Vučković, 2018).

With the intensification of global competition as well as the increase of the risk and cost of R&D, companies start opening their innovation processes by partnering with external entities, for instance suppliers, customers, universities (Greco et al., 2017). Withal, public authorities start recognizing inter-organizational collaborations by granting public financial R&D incentives or subsidies (Backer & Cervantes, 2008). Furthermore, the state plays an important role in stablishing rules to KTV, as well as create an environment that stimulates industry for this type of activities (Hladchenko, 2016), once KTV was only addressed by universities throughout years.

The American Fund for Small Business Innovation Research (SBIR Programme) ends up being a reference programme given its achieved results, also having similar characteristics when compared to the European Community Fund used in Portugal 2020 Operational Programme. In fact, the projects that are financed by this fund yield a variety of KTV activities. Wessner (2009) exemplified that this type of knowledge contributions *"are embodied in data, scientific and engineering publications, patents and licenses of patents, presentations, analytical models, algorithms, new research equipment, reference samples, prototypes products and processes, spin-off companies, and new "human capital" through enhanced know-how and expertise"*. Such programmes result in various benefits that go from economic to non-economic, once companies use the funds to advance in R&D projects and develop firm-specific capabilities (Wessner, 2009).

The Netherlands are also a success case in what regards knowledge transfer and valorisation – the Dutch government created a process in which state and universities clearly collaborate and understand which functions to perform. On the one hand, the state provides the legal basis and the funding to KTV, achieving a beneficial environment for this process, while, on the other hand, universities also create stimulating conditions, providing support to businesses in the KTV process (Hladchenko, 2016).

Indeed, it is highlighted in literature (Mazzucato, 2015) the entrepreneurial states, i.e. government has not only the role of creating knowledge through national labs and universities, but also the responsibility of mobilizing resources that would allow knowledge to diffuse broadly across the different economic sectors. Čučković and Vučković (2018) consent with the previous article in the fact that public funding, despite of being at national or EU-level, have a significant role in promoting R&D, thus *"enabling greater technological innovations, but also channelling and spreading the benefits of them directly to the society"*.

In fact, R&D processes deserve public support due to the wider social benefits that it can deliver when responsible for developing solutions that increase economic growth and solve social challenges (Čučković & Vučković, 2018). Similarly, Agasisti et al. (2019) explain that the activities related to technology and knowledge transfer should be explicitly stated and kept in mind during the development of incentives and funding models that acknowledge R&D multiple missions. R&D incentives, such as SI I&DT, are the needed help to push access to finance that ends up being the impetus for developing R&D projects in certain firms (Čučković & Vučković, 2018). It is important to consider not only the funding to develop and produce new knowledge, but also the resources that will enable knowledge deployment and dissemination into society (Ala et al., 2014).

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KTV is theoretically beneficial for the development of a country. However, and despite the fact that it can be enhanced by this type of incentives, it can only be maximized by companies (or non-entrepreneurial entities of the R&I system) that allow the dissemination of the knowledge created. Therefore, the next section will be extremely important to understand how companies perceive this topic in order to eventually adapt and/or (re)design future approaches to this issue in new programmes, instilling KTV's importance within the entrepreneurial ecosystem, and enhancing the spread of knowledge in the future, particularly, in the Open Innovation system.

4. Methodology

This study was conducted by using a *mixed-methods sequential explanatory design* that considers two different phases for data gathering (Creswell et al., 2003): one first phase based on quantitative data, and a subsequent phase relying on qualitative data.

Firstly, quantitative data was collected via an online survey. This first approach aimed to provide a broader view on "How is knowledge transfer and valorisation seen by Portuguese companies". Secondly, additional data was collected through semi-structured interviews performed to representatives from national firms that displayed both meaningful inputs during the first phase as well as interest in deepening the topic afterwards. The info collected from this second phase and its analysis was used to explain and elaborate on the results obtain through the quantitative surveys.

The two methods are often used together when investigating social sciences events – while quantitative data can provide evidence of patterns and a general understanding for this research problem, qualitative data refines and explains those results by exploring more in-depth insights on participants' thoughts, views, and actions (Creswell et al., 2003; Tashakkori et al., 1998).

4.1. Quantitative approach

Web-surveys were used in order to evaluate preliminarily the opinion of the selected companies in what regards KTV in R&D projects, particularly when funded by SI I&DT. Despite the fact of this methodology only being able to provide estimates for the population (Salant et al., 1994), conducting surveys can be useful when collecting information in what regards characteristics, actions, or opinions of a pre-established sample and the incidence, distribution, and relationship that exists among variables (Coughlan et al., 2009; Pinsonneault & Kraemer, 1993).

4.1.1. Defining the target group

Firstly, the population had to be defined based on the list made available at Portugal 2020 website, which included all the approved projects under the scope of this programme, reported on March 31st, 2020. The Excel sheet that had this database was filtered by the first thematic objective – "Strengthening research, technological development and innovation", reaching a population of 1,527 companies that benefited from R&D and Innovation funded

projects.

To define the group to which surveys would be sent, a random sampling technique was combined with a non-random sampling technique. The first 14 companies ('individuals') represented KPMG's customers that have been working in the past with the consultancy company to submit at least one SI I&DT application. The following 100 individuals were randomly selected from the remaining companies – each randomly selected company had to have at least one SI I&DT approved application to be then added to the group. As a result, the target group was defined with 114 individuals that would be asked to participate in the survey.

4.1.2. Survey design

The survey was designed at an online software that creates, distributes, and analyses surveys, called Online Pesquisa. That survey assembled a total of 30 questions (See Annex A), from which 29 were close-ended questions, ranging from multiple choice questions, questions classified by Likert scales, to even partial closed-ended questions. The remaining one was an open-ended question that, despite being more complex to analyse, was useful to explore additional insights in the qualitative approach section (Salant et al., 1994).

Before sending the survey to sampled companies, it was tested by several KPMG consultants that optimized the protocol by slightly revising the order of the questions and developing additional ones. The 114 requests were sent in mid-April, through email or through a LinkedIn message, monitored by a follow-up email/message whenever no response was received within a week since the first contact.

4.2. Qualitative approach

The second phase of this mixed methodology involved a qualitative approach to explore in-depth the results from the previous phase, intensifying the general understanding on "How is knowledge transfer and valorisation seen by the Portuguese companies", while deepening some specific insights that were risen by the quantitative survey.

Qualitative methodologies are used to understand complex social phenomena. In this case, a sample of companies was chosen to help retaining a holistic and real-world perspective on the research question. In order to provide deep and rich data to the analysis of this contemporary event, (i) seven semi-structured interviews with representatives from different profile

companies were combined with (ii) the responses to the survey's open-ended question, (iii) public information about each of the projects and about its correspondent company, and (iv) researcher's reflection notes on each participant's attitude, tone, and enthusiasm during the interview.

4.2.1. Interview

Semi-structured interviews were chosen because this approach fully adapts for analysing perceptions and opinions of respondents in what regards a complex and sensitive topic, helping to collect clearer and more informative answers (Barriball & While, 1994).

From the 68 received surveys, 31 individuals showed interest in being interviewed. Each interviewee was chosen based on several factors, some more objective and others more subjective, such as (i) the response to the open-answer question, that indicated to what extent he/she was comfortable with the theme, (ii) his/her overall opinion on the topic, whether the responses were mainly 'positive' or 'negative', and (iii) some specific factors that were rare among the sample, e.g. having patents, being highly ranked in terms of R&D intensity, etc. On the other hand, objective factors related to the company that each respondent were representing were also taken into consideration:

(i) Dimension, whether the company is considered small, medium, or large enterprise based on the Portuguese National Statistics Institute guidelines. In this study it was taken into consideration both the total number of employees as well as the overall turnover;
(ii) CAE[2], that is used to assess the economic activity that is held by the company;
(iii) The year of establishment, to understand the company's market experience.

Furthermore, an opinion is influenced by its holder and the timeline when it was expressed (Liu, 2012), so who would be the interviewee and its current job position was also taken into consideration. The definition of the sample aimed to cover the different types of companies surveyed and the different points of view. However, it is important to note that not all respondents were interested in being interviewed and that not all of those who indicated interest during the survey phase responded to the follow-up email.

[2] The Portuguese standard for the classification of economic activities (CAE) is a classification system which groups economic activities.

4.2.1.1. Profile of the selected companies

Company **A** is a medium enterprise established in 1993. It is a high-technology intense software company and considered one of the five Portuguese SMEs that have the most R&D expense (DGEEC, 2020). This company has constantly dozens of ongoing R&D projects, some of which are co-financed by public entities. In what regards the answers given to the survey, the opinion on KTV is mostly positive.

Company **B** is a large enterprise established in 1937. It has a large number of R&D projects financed by Portugal 2020, namely three individual projects and two co-promoted. This company has also a close relationship with patenting, a not so common factor among Portuguese enterprises. In this case, in what regards the answers given to the survey, the opinion on KTV is mostly neutral or even negative in some questions.

Company **C** is also a medium enterprise established in 1987. It is one of the biggest Portuguese companies that are specialized in Information, Technology, and Communication products and services. It is also one of the few dozens of Portuguese companies certified in Research, Development, and Innovation by the NP 4457 standard. In what regards the answers given to the survey, the opinion on KTV is mostly positive.

Company **D** is also a medium enterprise established in the same year, 1987. It is a top-ranked innovative company that has a large number of R&D projects financed by Portugal 2020, in this case, only one individual and five co-promoted with different entities. It is also certified by the same standard, NP 4457, and has been wining some innovation and technology-related awards over the years. In this case, in what regards the answers given to the survey, the opinion on KTV is considered neutral.

Company **E** is a large company that was established in 1824, being one of the oldest Portuguese companies. It is a world-renowned leader in its sector, that yearly wins multiple awards for its innovation and design. By analysing the answers given in the survey, it is a company with a favourable view in what regards KTV.

Company **F** is a small family own company, established in 2001, that has a prominent position in the sector of integration and installation of telecommunications and electronic systems. In fact, this company only had one R&D funded project and the opinion on KTV is mostly positive during the survey.

Table 4. Comparison of the selected companies' profiles and correspondent interviewees

Company	Project			Company			Interviewee	
	Technological domain	**Typology**	**Partners**	**CAE**	**Dimension**	**Year of establishment**	**Job position**	**Opinion**
A	ICT	Individual	–	Information and communication	Medium enterprise	1993	Product Owner	Positive
B	Materials technology	Co-promoted	(1) non-corporate entities of the R&I system	Manufacturing	Large enterprise	1937	Key Process Manager (Innovation)	Neutral/ negative
C	ICT	Individual	–	Information and communication	Medium enterprise	1987	Quality & Investment Projects Manager	Positive
D	Other	Co-promoted	(1) non-corporate entities of the R&I system	Manufacturing	Medium enterprise	1987	Innovation Management & Intelligence Director	Neutral
E	Materials technology	Co-promoted	(1) company	Manufacturing	Large enterprise	1824	Innovation & Projects Manager	Positive
F	Environmental technologies	Co-promoted	(1) company	Non-specialised wholesale trade	Small enterprise	2001	CFO	Neutral
G	Mechanical engineering	Co-promoted	(1) non-corporate entities of the R&I system	Manufacturing	Medium enterprise	1946	Product engineer	Neutral

Company **G** is a medium company that has more than 70 years of experience in the market. It is a traditional family enterprise, that considers that the sustainability of a business is based on its ability to generate innovative ideas and through the valorisation of knowledge and its subsequent value-dissemination into the market. With that being said, the answer given to the survey were considered neutral.

4.2.2. Processing and analysing qualitative interviews

Each selected individual was then contacted by email, in order to schedule a videoconference meeting, held between May, the 18th and June, the 5th. Given the current situation of Covid-19 pandemic, the 7 interviews were conducted using the communication and videoconference platform that best suited the interviewee (i.e. Zoom or Microsoft Teams) and had an average duration of 36 minutes and 29 seconds. Each interview followed the same script (see Annex D), however, it was given a certain amount of room in each interview to adjust not only the sequence of the questions being asked, but also to add questions based on the course of the participant's interventions (Wildemuth, 2016), aligning it with the correspondent survey answers.

All seven interviews were consentingly recorded into the computer in order to achieve the most accurate transcription and analysis of the answers received. Before initiating the recording, all the interviewees were also informed on the scope of the investigation, that the information given would only be used in the present study, and that the identification of each company and each interviewee will be safeguard, with the main goal of achieving a safe environment for honest answers. After each interview, the recording file was multiply played in order to verbatim transcribe the interviews into a Word document – both recording as well as verbatim transcription are often considered vital aspects of in-depth qualitative research methodology in order to inherently improve the rigour of the research through a clear display of the discourse and language used by the interviewee (Loubere, 2017).

The next phase was then processing and analysing the data through the use of a qualitative data analysis software – NVivo software. The Word documents were imported to the software in order to start the process of coding and analysing qualitative data. Coding was an iterative process, which analytically questioned all the data obtained while directing it towards the questions posed in the context of this study.

There was an initial coding process, in which the data was mainly divided into three topics, (i) insights on academic and scientific spheres, (ii) process of knowledge transfer and valorisation, and (iii) perceptions on open innovation. The NVivo software helps in organizing all the data about a particular theme into a node for further exploitation. Nodes and more nodes were created in order to group the information by categories and subcategories. This process helped gathering all the information that had been initially transcribed from the semi-structured interviews into an objective data set.

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This Chapter explained the methodology being used to answer the research question – a mixed-methods sequential explanatory design. In the next Chapter, quantitative data will firstly be analysed. In this first phase, it is expected to gather a broader view of the research question. In a second phase, and since priority will be given to the qualitative portion of data collection, both phases will be integrated. On the one hand, it is expected to better understand some topics that can emerge during the first phase, and, on the other, it is also expected to explain and elaborate on the results obtained through the quantitative survey.

5. Discussion

A mixed-methods sequential explanatory study uses the results of the first quantitative data collecting methodology to develop and inform the qualitative method that succeeds the first.

Therefore, the quantitative data will firstly be analysed in an intermediate stage. These results will be used not only to identify a purposive sample for more in-depth interviews, but also as a guide to design the interview script based on the topics that raised issues and further interest. In the second phase, both the quantitative and the qualitative results will be analysed and combined to achieve a meaningful and robust understanding of 'How is knowledge transfer and valorisation seen by Portuguese companies?'. Furthermore, the Open Innovation paradigm and the relationship between companies and the scientific and academic spheres will be also analysed, as well as its relation to the primary research question.

5.1. Intermediate discussion of results

In the mixed-methods sequential explanatory design, there is an intermediate stage where quantitative data is analysed to better inform and guide the qualitative phase (Ivankova et al., 2006), further selecting the participants for, in this case, the semi-structured interviews. Therefore, the quantitative data will firstly be analysed in this intermediate stage that will precede the integrative phase and final analysis of the outcomes.

The overall response rate was 59.6%, meaning that 68 responses (n = 68) were received. In fact, from KPMG's customers group, the response rate was relatively lower (50%) while the random one had a 60% response rate. This gap could probably have been fixed by sending a follow-up email to KPMG customers, as it happened with the former group.

On May 22nd, the online survey was deactivated, and the raw data was exported to an Excel spreadsheet in order to be deeply analysed with the Statistical Package for the Social Sciences (SPSS). There were mainly categorical variables, that were all coded (see Annex B), in order to estimate descriptive statistics and correlational analysis to all of them with the SPSS Software. The descriptive statistics as well as the correlation analysis[3] were estimated to all variables that qualified for it, however, only some of them will be highlighted in this section.

The majority of the survey's questions were related to the company's general opinion and

[3] Please refer to Annex C for an in-depth methodological explanation

not specifically linked to a certain specific project. However, there were a couple of questions exclusively about the most recent SI I&DT funded R&D project. This was important once an opinion is influenced by its holder and by the timeline when it was expressed (Liu, 2012), meaning that the company's opinion on the topic is probably more influenced by its last experience with a funded project. Therefore, it seemed important to analyse some characteristics, such as the project typology and the technology domain of the last approved and subsidized R&D project, as well as the number of R&D projects already developed by the company, or even the motivation in investing in R&D through the next few years.

The first step was then categorising the sample by each category that was previously explained. Firstly, as can be seen in Figure 1, the majority (54.5%) of the respondents stated that their last approved project was co-promoted (i.e. in collaboration with other companies and/or with non-corporate entities), from which 11% partnered only with companies, and the remaining 89% was divided equally among partnering only with non-corporate entities of the R&I system, or with both types of partners. This means that almost 90% of the co-promoted projects were in consortium with universities and/or research entities.

Figure 1. Project typology of the most recent approved project (outputs from question 3. and 3.1.)

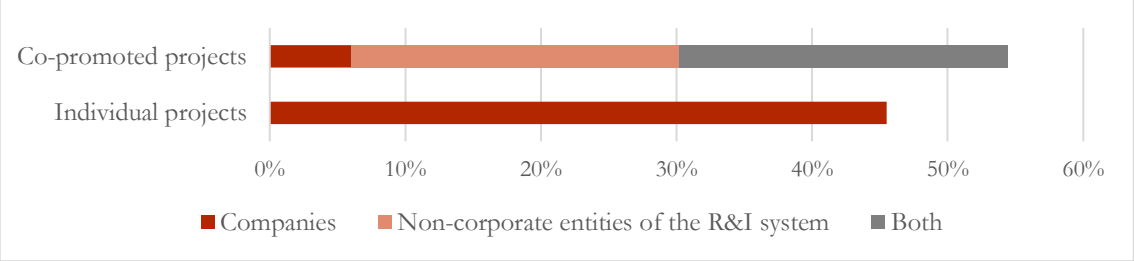
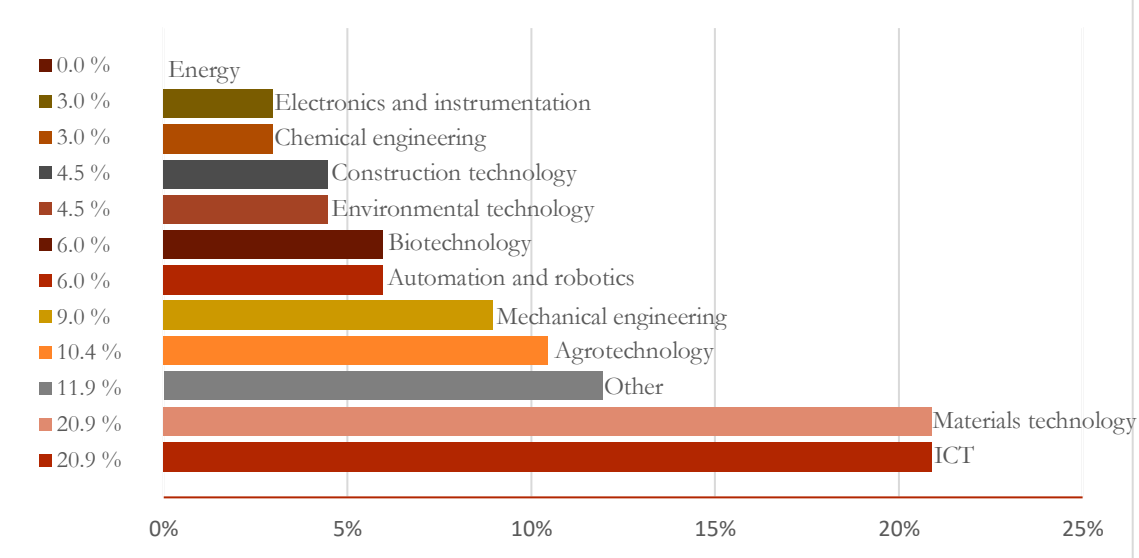


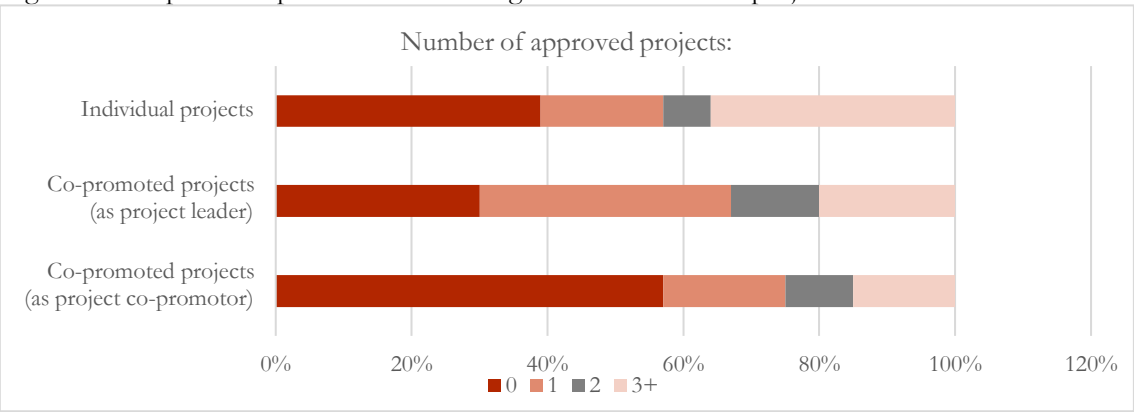
Figure 2. Technological domain of the most recent approved project (outputs from question 2.)



On the other hand, in terms of technology domain of the projects, half of them were distributed among Information and communication technologies (ICT), Materials technology, and Agrotechnology, as can be seen above in Figure 2.

Lastly, Figure 3 displays the three ways that a company can be benefited by SI I&DT – by doing an individual project, and through a co-promoted project, whether as the project leader or as a co-promotor entity. The respondents could choose among '0', '1', '2', or '3 or more' projects for each of the explained types.

Figure 3. Companies' experience in benefiting from funded R&D projects



This describes to what extent this sample was experienced in benefiting from funded projects or if it was only sporadic experiences. It is important to highlight that thirteen companies stated never having co-promoted funded R&D projects, weather as a project leader or a co-promoter. All the other stated having developed at least one financed R&D co-promoted project in the past.

On another note, it is interesting to realize that 90% of the respondents intend to develop new R&D projects in the next three years (question 15), from which 100% intend to apply to SI I&DT. Despite the variety of industrial areas among the 68 companies, almost all of them demonstrated interest in investing in R&D and successive interest in applying to SI I&DT, which may indicate that SI I&DT was a positive experience to all of them.

It is possible to conclude that this sample represents companies with interest in increasing R&D levels, from which 80% of them are familiar with co-promoted projects that require intense knowledge-flows, between the promoter company and the remaining entrepreneurial and/or non-entrepreneurial entities. Their last experience with a funded R&D project is

equally divided among individual or consortium projects and were mainly in the ICT and Materials technology domains.

5.1.1. Proximity with academic and scientific spheres

After categorising the sample, it is possible to conclude that the majority of the individuals have already developed R&D funded projects in collaboration with non-corporate entities of the R&I system – almost 50% of the sample's ultimate project was in collaboration with the academic and scientific spheres (Figure 1) and only thirteen of the respondents never did a co-promoted project (Figure 3) funded by Portugal 2020. As already explained in Chapter 3., Section 3.1., the proximity with the academic and scientific spheres can highly influence companies' perception in KTV, either through smoothing the process of absorbing external knowledge or through the methodology used by them in the process of knowledge creation.

Furthermore, as highlighted in Section 3.2. of the same Chapter, Portugal's poor absorptive capacity is one of the reasons why Portugal is performing below EU-average in terms of knowledge transfer measured by the EIS.

In fact, 68% of the respondents hired highly qualified HR to the development of their last project, from which 83% included personnel with master's degrees and/or PhDs. This is quite positive once, whenever a company hires HR specifically for the development of a funded project, those specific employment positions will have to be kept in the company for a period of 3 years. Furthermore, 35% reported the hiring of research fellows for the development of the project.

Still in line with this topic, Table 5 represents an overview of the sample's answers to the three statements related to the presence of highly qualified HR and job creation due to the funded project. Taking into consideration the previous analysis, it was expected this positive outline.

Table 5. Outcomes in HR allocation from having a funded project (outputs from question 6.)

	Statement	Strongly agree /Agree	Strongly disagree /Disagree
6.1.	The number of job positions in the company increased	65 %	19 %
6.2.	There was a greater integration of HR from academic and research spheres in the company	75 %	12 %
6.3.	The ratio of highly qualified HR to the total HR in the company, increased	53 %	24 %

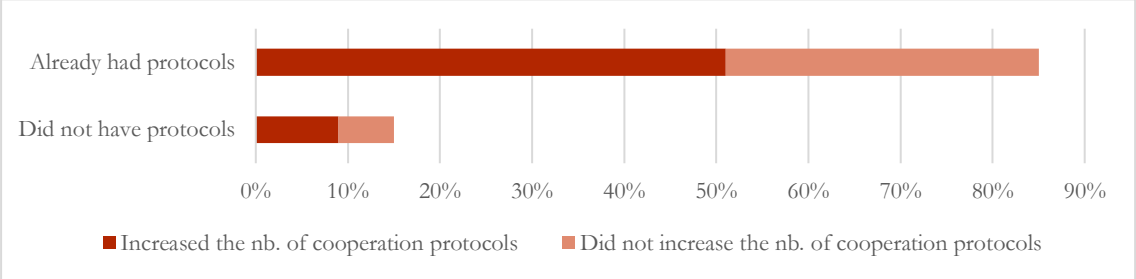
Furthermore, Table 6 provides the summary of the survey's questions related to the business-academia relationship. These three statements elicit very positive reactions from the respondents – (i) almost all of them agreed that the relationship with the scientific and academic spheres were promoted through the funded project; (ii) there was already a high rate of respondents that previously have cooperation protocols with universities and/or research institutions; and (iii) 60% of the companies state an increase in the number of protocols in comparison with the pre-project period.

Table 6. Outcomes in business-academia relationship (outputs from questions 7. and 8.)

	Statement	Yes	No
7.	Did the participation in this funded project promote the relationship with the scientific and academic spheres?	94 %	6 %
8.	Before developing this R&D project, did the company had cooperation protocols with universities and/or research institutions?	85 %	15 %
8.1.	Consequently, with the participation in this project, did the number of these cooperation protocols increase?	60 %	40 %

Figure 4 illustrates the percentage of companies that increased their number of cooperation protocols, whether they already have any or not. In both situations, the development of an R&D funded project enhances that relationship, which can be considered positive.

Figure 4. Cooperation protocols variation



The two statements displayed in Table 7 evaluate the organizational changes that may or may not have occurred with the participation in a R&D funded project. These types of interfaces, e.g. R&D infrastructures, technology or knowledge transfer offices; are theoretically linked to higher education institutes as a mean of connecting public science with a broader socio-economic environment, i.e. business (Pinto & Fernández-Esquinas, 2018). The creation of specific company departments, areas, or teams that are explicitly focused on KTV is the best way to manage university-industry relations, that can enhance knowledge-flows within sci-

ence-intensive activities to knowledge-intensive business, bridging the *existing gap between academic institutions and firms* (Mowery, 2011; Muscio, 2010; Pinto & Fernández-Esquinas, 2018).

Table 7. Outcomes on organizational changes (outputs from questions 13. and 13.1.)

	Statement	Yes	No
13.	Did KTV activities change the company's organizational structure?	29 %	71 %
13.1.	If so, has the company created a department/area/team focused on KTV?	31 %	69 %

However, it is seen that only 29% of the companies that answered this survey changed their organizational structure, from which only 31% actually created this type of interfaces that were previously mentioned. This means that only 9% of the inquired companies created a specific team or department that are entirely focused on enhancing KTV.

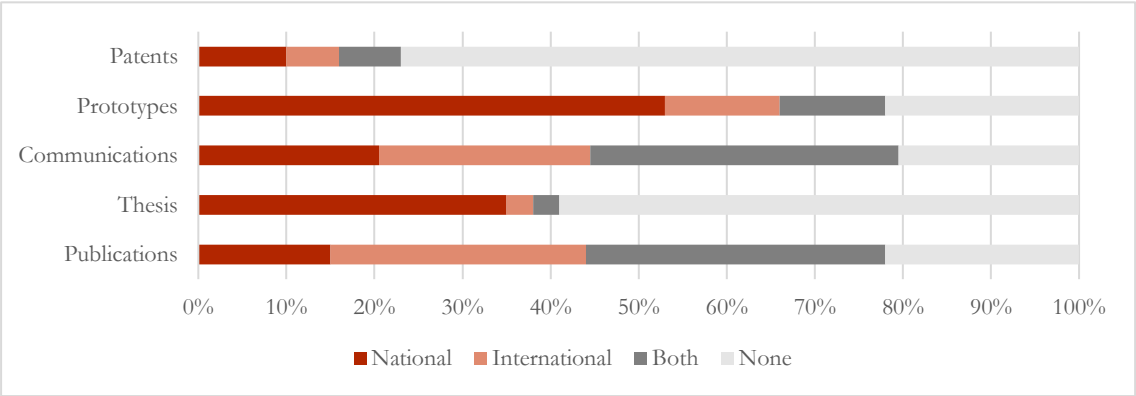
5.1.2. Tangible impacts from KTV

As already briefly explained in Chapter 2, Section 2.2., companies have to submit an application to the SI I&DT managing agency that can decide favourably (or not) after screening and ranking all the proposals. This rank is based on the innovative content of the proposal, the technical abilities that the firm has for carrying it out, and the project's market potential.

KTV scores in the merit of a R&D project, reaching almost 20% of the project's total score in some SI I&DT calls, once it is an increasing concern for the public authorities. They are concerned with the project's contribution to the Portuguese economy – it is assessed whether the project and its potential effects on the company contribute to the economy's competitiveness, namely favouring the productive profile towards more technology and knowledge-intense activities. It is also considered the project's contribution to other PT2020 thematic areas, as well as the effects on the diffusion and dissemination of knowledge and the subsequent positive externalities to the Portuguese economy.

Therefore, the SI I&DT application process requires that a company predicts how it will value and disseminate the knowledge acquired, quantifying the direct results that are expected to achieve. In Figure 5 it can be analysed the percentage of respondents that opted for each type of KTV activities, i.e. publications (that include articles, reports, books); thesis (including master's, doctoral, post-doc or others); communications, seminars and conferences; prototypes or pilots; and patents.

Figure 5. Preferred KTV activities to disseminate the knowledge created (outputs from question 9.)



Prototypes, communications, and publications are the direct results preferred by the companies belonging to this sample – almost 80% of them opted by these activities. On the other hand, only 41% of the companies developed thesis as a form of using the knowledge acquired. In terms of patents, only 24% of the respondents opted to value the R&D project through patenting its knowledge and outputs.

Still related with the previous survey's question, Table 8 represents the opinion of the respondents regarding two highly important questions, if (i) the cost associated with the activities listed in Figure 5 was an obstacle that prevented its implementation, and if (ii) the benefits associated with the same activities surpassed its compulsory costs. In fact, all these KTV activities have costs associated with them. Despite the different cost dimension between, for instance, patenting or writing a scientific article, all these KTV activities require investments in time, money, and resources.

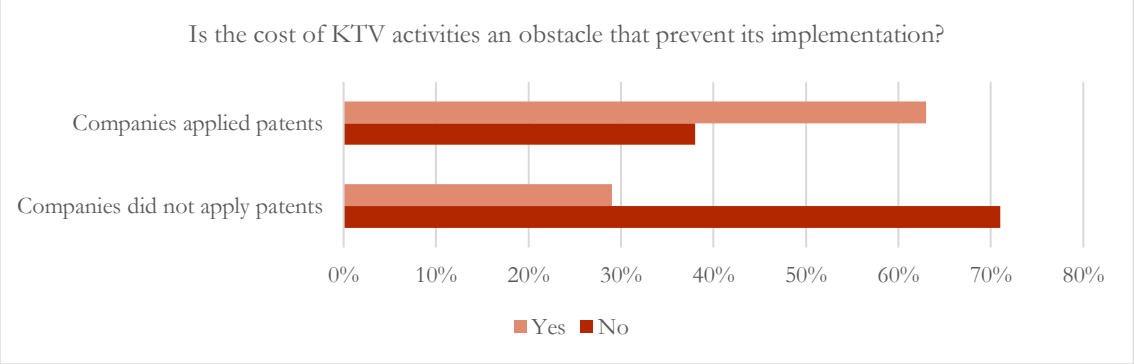
Table 8. Outputs from question 9.1. and 9.2.

	Statement	Yes	No
9.1.	Is the cost of KTV activities an obstacle that prevented its implementation?	37 %	63 %
9.2.	Does the benefits associated with the same activities surpass its costs?	71 %	29 %

As seen in Table 8, the majority of the participants did not consider the cost associated to these activities an obstacle to its implementation. This means, the cost is not the main motivation for not disseminating knowledge (as proven by the 63% of negative answers). Furthermore, 71% of the respondents agreed that the benefits that the company receives from these KTV activities surpass the associated costs.

However, when analysing the correlations among question 9.1 and the different KTV activities chosen in question 9, it was seen that there was a negative correlation between having patented in the last funded R&D project and question 9.1, which was statistically significant ($\tau_B = -0.315, p < 0.01$). Keeping in mind the coding explained in Annex B, this confirms that companies only tend to consider cost as a burden when they effectively apply patenting as a KTV activity.

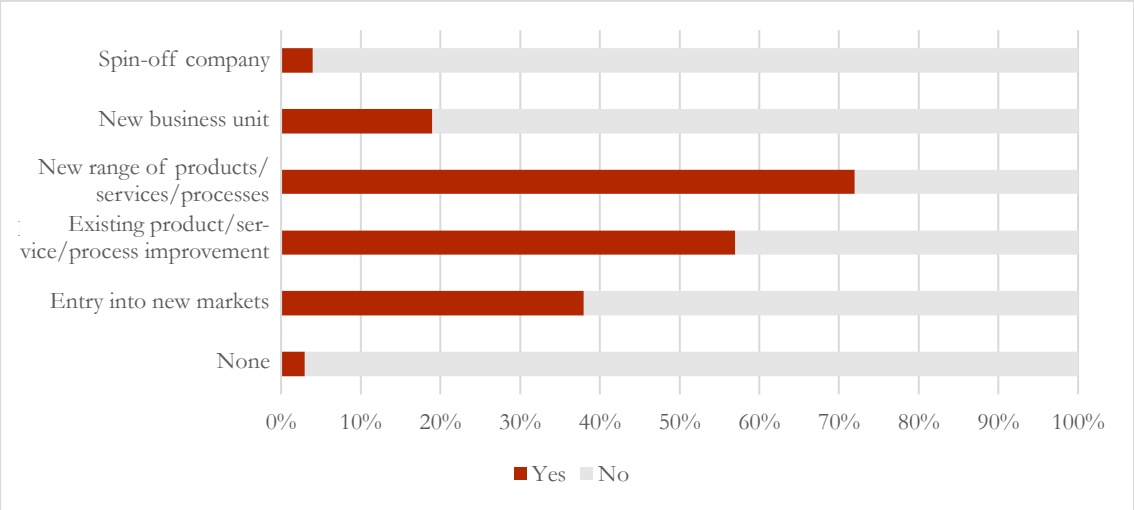
Figure 6. Negative correlation between patenting and question 9.1.



This can be further understood by analysing Figure 6 – when considering only the participants who patented the knowledge acquired during the R&D project, the majority (63%) of them consider that KTV activities, in general, are costly and, therefore, are an obstacle to its implementation. On the other hand, when considering only the respondents who did not patent, the ratio turns the opposite with only 29% considering that KTV activities are costly and yet an obstacle to its implementation. This is an interesting correlation once *patenting is the most costly* KTV activity, in terms of time and resources, listed in the SI I&DT application form – only the companies that actually used patents through the development of their project considered the general cost of KTV activities a problem.

The positive externalities that come from the R&D projects also score on the SI I&DT project's application merit, similarly to KTV activities. In this criterion, it is assessed the expected capacity to generate positive externalities to the economy and to other companies, valuing each of following practices – creation of a spin-off company, creation of a new business unit, creation of a new range of products/services/processes, improvement of existing products/services/processes or enter into new markets.

Figure 7. Positive externalities (outputs from question 10.)



As seen in Figure 7, only 3% of the respondents did not expect to cause positive externalities in the sequence of KTV activities. The most common activities expected to lead to positive externalities were (i) the creation of a new range of products, services or processes, and (ii) the improvement of existing products, services, or processes with 72% and 57%, respectively, of the respondents opting by this type of practice. These higher percentages were actually expected once the ultimate goal of a company is generating profit that is usually associated with the production of highly differentiated products, processes, or services, depending on the industry.

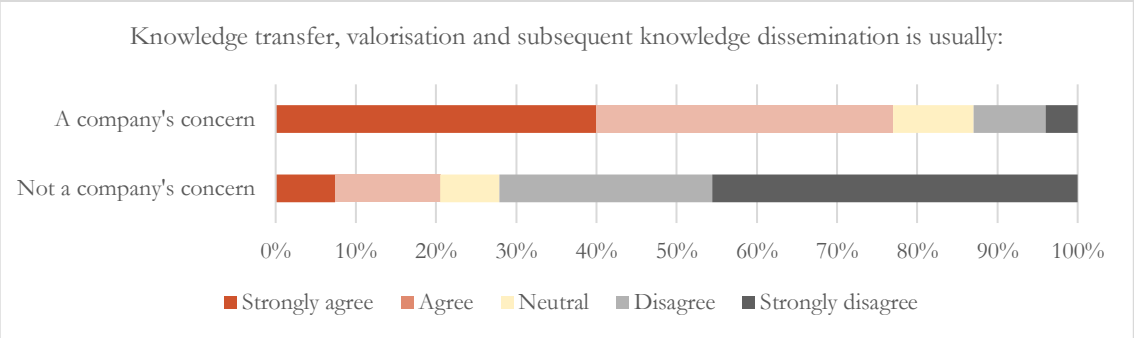
The creation of spin-off companies is usually stated in literature as an universities' economic contribution through the valorisation of the knowledge acquired in the academic sphere (Benneworth & Jongbloed, 2010) and its transformation in entrepreneurial initiatives. Spin-offs are, in fact, considered an important KTV activity that encourage economic development, particularly, local and regional, throughout (i) the production of innovative products that subsequently generate significant economic value, (ii) job creation, in particular for highly qualified HR, (iii) investments in the development of technology and of university technology, and (iv) highly local economic impacts (Baycan & Stough, 2013). Therefore, a higher percentage would be more positive to enhance enterprise KTV.

5.1.3. General opinion on KTV

General opinion on KTV was collected through a third group of questions. Firstly, it is important to highlight that 35% of the participants stated that it was through the application process for the SI I&DT fund that the company became aware about knowledge transfer,

valorisation and subsequent dissemination of the knowledge acquired (question 11). Moreover, as seen in Figure 8, the majority of the companies stated that knowledge transfer, valorisation and its subsequent knowledge dissemination were usually a concern.

Figure 8. Outputs from question 11.1.



In fact, it is actually contradictory to the previous question – only 28% of the companies strongly agreed, agreed, or stated a neutral opinion in what regards not being usually concerned with these type of activities, however, if 35% were not familiar with the theme before the project, it could not be a concern.

Table 9. Outputs from question 13.2. (considering only the 76% that assumed a concern with KTV)

	Statement	Yes	No
13.2.	With the participation in this project, did the company start considering KTV activities as structured and recurring practices?	58 %	42 %

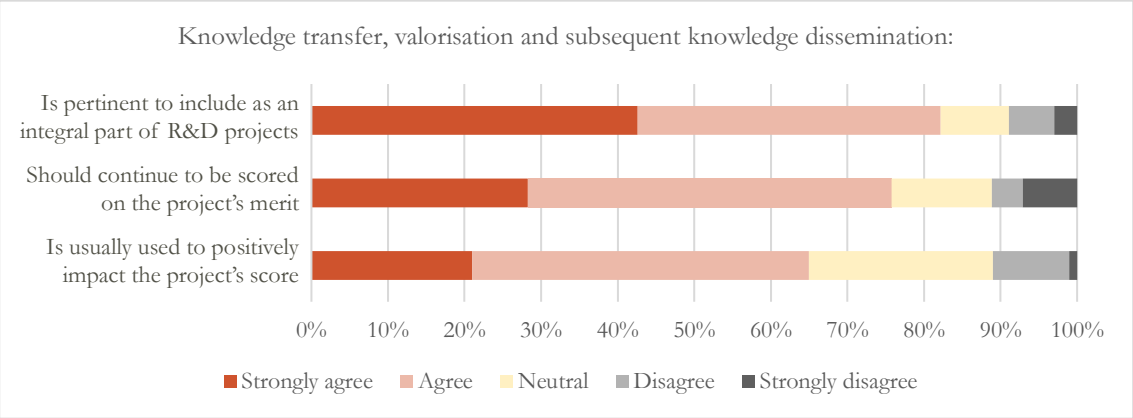
Furthermore, this theme can actually be a concern to 76% of the respondents, however, and as seen in Table 9, from that 76%, only 58% consider these KTV activities as structured and recurring practices within their companies.

In fact, there was a negative correlation between being concerned with KTV and start considering KTV activities as structured and recurring practices. This correlation was statistically significant ($\tau_B = -0.410$, $p < 0.01$). As it can be seen, despite the fact that the majority of the participants have a concern in transferring and valuing the knowledge acquired through the R&D project, there is not so many companies actively embracing these dissemination practices. Furthermore, the more the company is concerned with KTV, the less the same company respond affirmatively to question 13.2. In fact, companies that actively embrace KTV actives have already this type of activities as structured and recurring practices, meaning that it could not be the last R&D project raising this concern. On the other hand, the companies

that previously did not consider KTV as a concerned are more prone to be changing that mindset, embracing KTV activities as structured and recurring practices, which justifies the negative correlation coefficient.

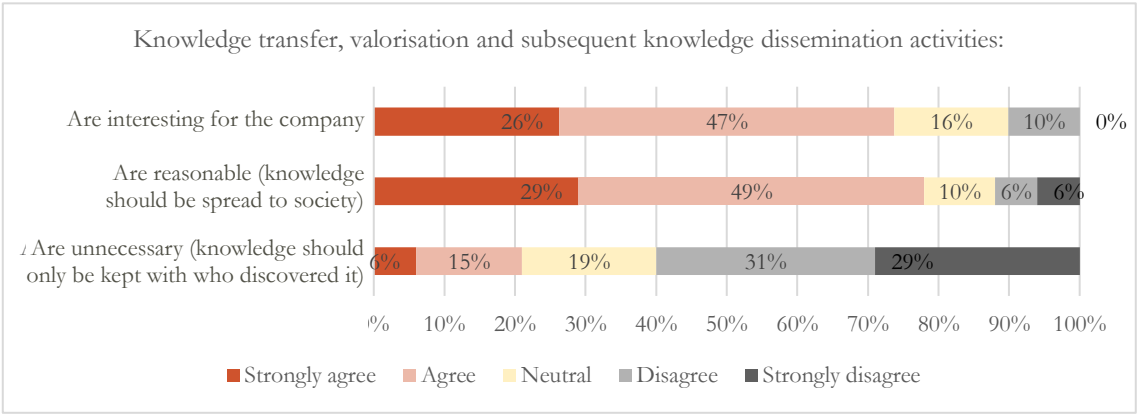
As stated, when applying to SI I&DT, KTV scores in the merit of the R&D project. In Figure 9, it is seen that the majority of the respondents 'strongly agreed' or 'agreed' that including KTV as an integral part of R&D projects is important, as well as it should continue to be scored in the projects merit. In fact, there was a strong, positive correlation between these two questions, that was statistically significant ($\tau_B = 0.712, p < 0.01$).

Figure 9. Scoring KTV in the merit of a project (Outputs from question 11.2.)



Nevertheless, more than 60% of the respondents confessed that it is usually added to positively impact the project's score. This is not necessarily bad – it is important to spread the knowledge developed through R&D projects despite of the motivations behind this dissemination. However, it will be positive if the *companies' interest in sharing knowledge was intrinsic*, not requiring to be motivated through extra merit points.

Figure 10. Opinion on KTV activities (outputs from question 12.)



In Figure 10, it can be seen that the majority of the participants consider KTV and its subsequent knowledge dissemination activities interesting for their company and reasonable, once the knowledge developed through internal R&D should be spread into society.

The type of activities that are incentivized by the SI I&DT application process and that expect an increase in knowledge flows, are seen as interesting and reasonable under the scope of an *open innovation society*. Nevertheless, there were more that 20% that 'strongly agreed' or 'agreed' that knowledge should be kept inside the company and more 20% that did not 'agree' nor 'disagree' of this thought that contradicts open innovation process.

***

This intermediate stage represented the analysis of the quantitative data. In fact, this first quantitative phase was already robust; however, it was limited to one source of data collection – the survey, that was only analysed through the estimation of two statistical techniques: descriptive statistics and correlation analysis. Furthermore, and as seen in Annex C, the correlation coefficients were mainly non-significant. Nevertheless, this phase helped in better developing and framing the subsequent qualitative phase, highlighting some topics that should be further studied. In fact, those specific insights are, on the one hand, in line with the reasons behind Portugal's low performance in terms of knowledge transfer measured by the EIS, namely, (i) the low levels of patenting, (ii) the poor absorptive capacity, and (iii) the existing gap between academic institutions and firms that retards the implementation of KTV as an implicit subject inside the Portuguese companies. On the other hand, are related to the Open Innovation process in Portugal.

5.2. Integrative discussion of results

During the entire data collection process, both quantitative and qualitative questions have been asked to companies in order to better understand not only the current perception of knowledge transfer and valorisation in the Portuguese entrepreneurial ecosystem, but also the role of SI I&DT in this process.

This section aims to achieve an overall analysis and integration of the outcomes coming from both the quantitative and qualitative phases. On the one hand, it is expected to better understand the abovementioned specific insights, and, on the other, it is also expected to explain and elaborate on the results obtained through the quantitative survey. To do so, data was

collected through (i) seven semi-structured interviews, (ii) the researcher observations and judgments, that were reproduced in the researcher's reflection notes after each interview, and (iii) the analysis to the open-ended question asked in the surveys.

5.2.1. Interviewees profiles

Firstly, it is important to highlight that the responses given, the course of each conversation, and the topics emphasized are a reflection of the company's (and the interviewee) experience with R&D funded projects.

Table 10 highlights the main responsibilities of each interviewees' job position, based on the description that each one of them made during the interview. As previously seen in Table 4, all 7 interviewees had different job positions, therefore, this division by type of 'responsibilities' were mainly helpful to analyse if the answers and the path of each interview was actually related to the interviewees daily activities, despite of the job position's name.

Table 10. Different responsibilities of each interviewee highlighted during the interview

Responsibilities	**Company**	**Nb.**	**%**
Research, development, and innovation related	B, C, D, E	4	57%
Investment projects related	B, C, E, G	4	57%
Product development related	A, G	2	29%
Finance-related	F	1	14%

There was an association between the interviewees' job responsibilities and the attitude, tone, and enthusiasm demonstrated by them during the interview, that were subsequently registered in the researcher's reflection notes. Companies C, D, and E demonstrated a more enthusiastic and open attitude towards the theme, displaying a lot of interest, expertise, and willingness to transfer and value the knowledge developed in internal R&D projects. On the other hand, companies A, B, F, and G showed the opposite characteristics. In companies' A, F, and G cases, it can probably be related to the interviewees' job responsibilities, mainly related to profit making and development of differentiated products. In company's B case, in which the interviewee's job responsibilities are much more similar to the first group, there is no obvious association for the mindset demonstrated by the interviewee.

5.2.2. Process of knowledge transfer and valorisation

During the curricular internship, some expectations started to arise in what regards "how is

knowledge transfer and valorisation seen by Portuguese companies" – this topic was often postponed during the application process and the concern only appeared in the final phase, closer to the submission date. Nevertheless, this is a quite recent topic, meaning that opinions and judgements can rapidly change as well as perceptions might be misunderstood.

This topic was mainly assessed through the seven semi-structured interviews and by the open-ended question asked in the survey. This former method was the starting point, asking the survey's participants to provide a further comment or opinion on KTV. It was an optional answer, and the response rate was 50%. Given the generic nature of the question, it was already expected a wide range of responses – some of which were unrelated to KTV, but rather opinions on the existing R&D incentive scheme. The eighteen answers that survived the screening were coded in the NVivo software by perspective of the comment described (whether on the positive aspects of KTV or the negative side), and by the reasoning that was pointed out either as positive or negative input, as can be seen in Table 11.

Table 11. Insights received in the open-ended survey question

Perspective	**Inputs**	**Nb.**[4]	**%**[5]
Positive	Maximizing the knowledge created through synergies	9	50%
	Maximizing network and collaboration among entities	3	17%
	Value adding to the company	3	17%
	KTV is the key factor to the success of a project	2	11%
Negative	Knowledge gap between academia and industry	3	17%
	Intellectual property sensitivity	2	11%
	"Secret sharing" sensitivity	2	11%
	The main goal of a company is commercializing the product	1	6%
	Practical difficulty in implementing KTV	1	6%
	Total:	18	100%

Valuable inputs were received by the companies that decided to answer the optional question. It was understood that the main KTV characteristic were positive and related to the fact that it maximizes the knowledge produced through a synergy-creation process that assembles the empirical experience that companies have with the academic and scientific knowledge provided by academia. At least two companies highlighted the sensitivity that Portuguese com-

[4] This column ('Nb.') represents the number of respondents/interviewees that shared the same perspective and/or reasoning.
[5] This column ('%') represents the share of the correspondent 'Nb.' in the total responses.

panies still have in what regards secret sharing, as one said, *"secret is the soul of the business"*, being it interestingly commented in the following answer:

> *"KTV in SI I&DT is still a low-promoted theme among SMEs. The small and medium enterprises have still a long path to understand that knowledge sharing only brings more knowledge rather than the disclosure of professional secrets."* – SME in the food industry.

In fact, this comment is supported by the literature that states that KTV provides a multi-directional knowledge-flows whenever a company is willing to share its own internal knowledge and technology with external entities., hereby gaining direct and early access to the knowledge and technology being developed inside someone else's boundaries (Feldman & Kelley, 2006).

However, it was also stressed that this resistance to knowledge sharing is countered by incentive schemes such as SI I&DT, that drive companies' actions into a more open mindset:

> *"KTV from R&D projects is a sensitive matter – Its importance is recognized, but difficult to become a practice. From the national point of view, the transfer of technical and scientific knowledge is little appreciated, particularly in this industry, however, SI I&DT projects push and impact national competitiveness to higher levels."* – Large enterprise in the manufacturing industry

In terms of the KTV activities used to disseminate the knowledge created in the last R&D funded project, the answers provided by the surveys were already summarised in Figure 5. In particular, Table 12 highlights the responses from the seven companies that were chosen to be interviewed.

Table 12. Preferred KTV activities to disseminate knowledge (outputs from survey's question 9.)

Different dimension of return	**Company**	**Nb.**	**%**
Publications	A, B, C, D, E, F, G	7	100%
Thesis	C, D	2	29%
Communications	A, B, C, D, E, F, G	7	100%
Prototypes	A, B, C, D, E, F, G	7	100%
Patents	B, G	2	29%
	Total:	7	100%

All companies stated that usually the same activities were used in R&D projects, but the motivations behind were different. Furthermore, all interviewees claimed some sort of return coming from KTV activities, however there was no consensus reached, as seen in Table 13.

Table 13. Different dimension of return from the chosen KTV activities pointed out by the companies

Different dimension of return	Companies	Nb.	%
Return		7	100%
Economic (directly or indirectly)	A, C, E, F, G	5	71%
Mature existing ideas	B, D, E, G	4	57%
New knowledge (exchange of knowledge)	B, C, D	3	43%
Notoriety	A, B, C, E, F	5	71%
Innovation driven culture	A, B, E, F	4	57%
Shows flexibility to customers	E, F	2	29%
Shows versatility to customers	E, F	2	29%
	Total:	7	100%

Companies A, E, and F explained that this type of KTV activities, namely the communications and the presentation of the prototypes in fairs, brings both direct and indirect economic benefits. The indirect economic benefits were highlighted in, for instance:

> *"Sometimes, when our customers see our prototypes at specific fairs, they come up with ideas for using that certain technology on their own products, and then those special editions will be with us, and that translates into economic benefits"* – Company E

Company F also stated that *"after promoting the product at seminars and fairs,* [they] *were challenged by some companies that saw it, to present them similar solutions for their needs"*, nevertheless, the same company also stated that this *"mass dissemination"* is not the most efficient or interesting thing to do when trying to sell the specific products that were developed through R&D projects:

> *"When trying to achieve economic return, we have to talk to the decision-makers within organizations who need the products and try to highlight to them the attributes that solve their specific needs".*

Table 14. Different difficulties emerging from the chosen KTV activities pointed out by the companies

Different difficulties or disadvantages	Companies	Nb.	%
Difficulties/disadvantages	A, B, C, G	4	57%
Does not bring directly economic return	B, G	2	29%
Trade secret	A, B	2	29%
Does not benefit society or other industries	B	1	14%
Difficulties in market recognition	C	1	14%
		7	100%

On the other hand, four interviewees also highlighted some difficulties or disadvantages that arise from knowledge transfer and valorisation activities, as abovementioned in Table 14.

In terms of economic return, some (company B and G) argued that:

> *"Shar*[ing] *the results that come from R&D projects does not bring more income or capital gains to the company because it is not yet a product that we can sell. We sell products, we do not sell R&D in particular, so it ends up not bringing an economic benefit".*

In addition, 'trade secret' was also pointed out by both companies A and B that indicated the fact that being actual companies, they had to sell products that could be compromised by KTV activities. *"Each company wants to preserve their share and get there first!"*, and, for the interviewee, innovation is a competitive advantage, so he *"do*[es] *not see a company developing knowledge internally and handling it over to another company, at least if they do not already have a supply chain".*

In sum, all the difficulties or disadvantages that were emphasized in Table 14 are related to economic gain or, in this case, the lack of profit from the investment made in KTV activities. In fact, two of the seven interviewed companies had already stated in the survey's 9.2. question that the benefits associated with KTV activities do not surpass its cost.

In terms of patents, and as already assessed through the survey, only a minority of companies end up patenting the knowledge generated through their last funded R&D project – only 24% of the respondents in what regards the survey.

Figure 11. Patent application to the European Patent Office (per million inhabitants)

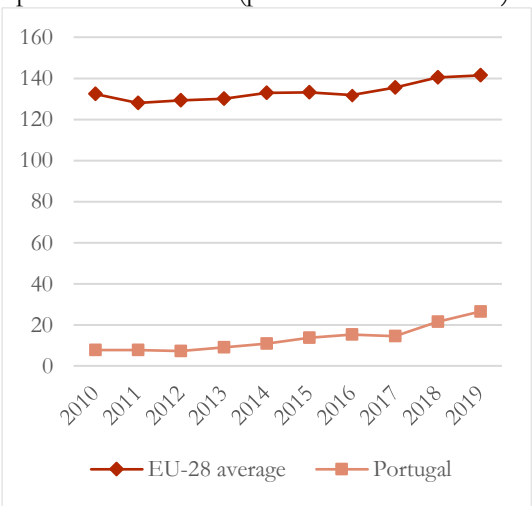
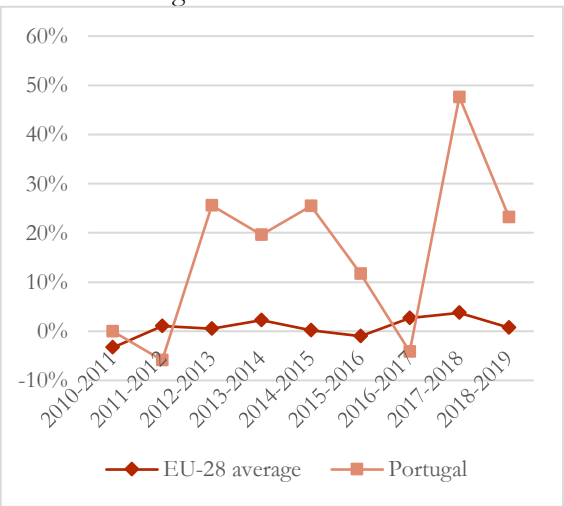


Figure 12. Patent application to the European Patent Office growth rate



Source: EPO (European Patent Office) Statistics

The low rate was already expected once Portugal has still a propensity to patent much lower than the EU-average, as it can be seen in Figure 11. However, it should be noted that Portugal has been growing at rates much higher than the EU-28 average (Figure 12), which can represent a change in the paradigm that is being lived in Portugal.

In a country that the patent application per million inhabitants is substantially lower than the European average, it may be interesting understanding why is this happening. In that sense, six of the interviewees explained the reasoning behind the much lower propensity to patent that Portugal has in comparison to the EU-average, summarised in Table 15.

Table 15. Different reasons pointed out to the Portuguese propensity towards a no-patent culture

	Reasoning	**Companies**	**Nb.**	**%**
Why companies do not patent?		A, B, C, D, E, G	6	86%
	Cost	D, G, B, E	4	57%
	Difficulty in characterising the scope	A, C, D	3	43%
	Not advantageous (cost-benefit ratio)	D, E	2	29%
	Not instilled in Portuguese culture	G, E	2	29%
	Not commonly used in the industry	C, D	2	29%
	Time consuming	D	1	14%
	Trade secret (some information has to be revealed)	B	1	14%
	Total:		7	100%

Patenting is costly and time consuming, these are already commonly known characteristics (e.g. Feldman & Kelley, 2006). On the other hand, there were reasons pointed out during the interviews that were not so frequently used to justify the low rates of patenting in Portugal, namely cultural justification, as company G stated:

> *"Waiting for someone else to do it first is part of the Portuguese culture. If company X started to patent, company Y will follow them, and everyone will also start doing it. However, in my opinion, Portuguese companies are not very concerned about patenting because Portugal is a small country, and if my competitor does not patent and has a product similar to mine, I will not be suing in court because the volume of business that I have will not justify, so no one cares about it. We do see advantages and that is why we patent, but the truth is that Portugal does not have that habit."*

Moreover, company B, that has more than 20 patents, suggested that trade secret decreases the company's will in patenting – the patenting process inevitably ends up forcing the sharing of knowledge. This is in line with the literature (Feldman & Kelley, 2006), that states that the

value of knowledge is only determined by sharing and communicating it to outsiders.

In this sense, three of the companies that did not patented during their last R&D funded project stated alternatives to patents that still protect intellectual property – Trademark and commercial agreements, as can be seen in Table 16. These IP protection policies were defined as instruments that better suited the type of knowledge that were produced by them, as well as the reality lived in their correspondent industry.

Table 16. Different reasons pointed out to the Portuguese propensity towards a no-patent culture

Reasoning	Companies	Nb.	%
Intellectual property alternatives to patents	C, D, E	3	43%
Trademark	C, E	2	29%
Agreements	D	1	14%
Total:		7	100%

As has been described through this study, SI I&DT application process obligates and benefits companies who value and transfer the knowledge obtained through R&D. As already analysed in Figure 9, 60% of the survey's respondents confessed that this type of activities is usually added to positively impact the project's score. In the interview, all seven interviewees stated that, in fact, they will write articles, go on seminars, communicate the results obtained either way. However, it was pointed out that it is highly related to the presence of either universities or research centres in the development of the R&D project. Additionally, it was also pointed out by company C and D that the companies motivation in transferring and valuing the knowledge produced needs to be aligned with the motivation of the non-entrepreneurial entity – in fact, these entities are periodically evaluated in terms of number of articles, number of publications in scientific journals, etc:

> *"We always cooperate directly with an ENESII* [a non-entrepreneurial entity of the R&I system] *in each R&D project, so the dissemination of results is a mandatory requirement that is also part of the application process. I think it is also our responsibility and a commitment that we must honour as a business entity"* – Company C

Lastly, the interviewees reflected about whether or not KTV could become a barrier to increase R&D through incentives. As has already been discussed, KTV is assessed and scored on the project's merit, up to 20% of the project's total score. At the end of this year, PT2020 reaches its end, and what is expected is that the new Framework Programme that will replace it will be even more demanding with increasing KTV. Therefore, it is interesting to see if this

knowledge sharing that becomes almost mandatory when entering a financed R&D project can become a barrier and dissuade Portuguese companies from applying for these incentives, in which the ultimate goal is to increase the national R&D investment levels.

All interviewees stated that, in their company's point of view, being incentivised or obligated by incentive schemes such as SI I&DT, in transferring and valuing internal knowledge will not represent a barrier to applying for these funds.

> *"I do not see anything negative in scoring KTV, or even being more demanding when scoring KTV in this type of projects. If it is a burden to some companies, they have to adapt. We gain so much more with interfaces, with sharing knowledge… innovation is much harder and much more limited if done alone. And if we want to protect something, we have other means."* – Company E

However, Company A, for instance, demonstrated being more concerned with it when arguing *"I believe that it will have to be the incentive scheme itself helping companies overcoming these barriers, with clear and well defined rules, in which everyone feels confident that their research will not be misused by other companies or players".*

5.2.3. Perceptions on open innovation

KTV can be considered the 'mean' behind Open Innovation as an 'end'. That is, to open the process of innovation in Portugal, R&D has to change from a traditional inward focus to a more outward-looking management by inserting KTV as an intrinsic process inside Portuguese companies. Table 17 reflects some insights given by the seven interviewees in terms of (mainly) positive and negative aspects that were related to this paradigm change.

Table 17. Positive and negative insights on Open Innovation

	Insights on open innovation	Companies	Nb.	%
Positive	Increases knowledge flows and knowledge sharing	A, B, D, E, F, G	6	86%
	Leads to better products	B, C, D, E, F, G	6	86%
	Simplifies the research and development process	A, C, D, E, G	5	71%
	Complement the company skills at a technical-scientific level	B, F, G	3	43%
	Brings commercial benefits	B, C, G	3	43%
Negative	Delays the development process	F	1	14%
	Total:		7	100%

The most repeated pro in opening the innovation process was related to the increase of knowledge-flows that were closely related to the simplification of the R&D process, leading

to an easier and faster process. Company A said that "*Nowadays, collaboration accelerates the advances and leaps that are being made"*

It was also pointed out by six interviewees that this collaborative process usually led to better innovations, whether in terms of products, processes or services, mainly related to the complementarity that academic and scientific entities give to companies in terms of technical and scientific skills:

> *"I would say that the possibility of associating with different entities that have different contributions, only adds value into the final product – it becomes something more robust and that was well thought by specialists in all its dimensions."* – Company F

On the other hand, the same company also made a statement that contradicts the majority of the other companies' opinions, saying that:

> *"It is good to have a very rich ecosystem to develop a good product. However, I must say that having a consortium with heterogenous entities turns this process into a development with many advances and setbacks that requires some patience".*

Additionally, six of the seven interviewees stated that Open Innovation is a key factor that has to be implemented in companies in order to survive in the future.

> *"Open innovation is very enriching. Whenever I share something with someone, either during the development phase or after the project is concluded, knowledge rebounds into me"* – Company E

On another note, each interviewee was also questioned about his/her perspective on Open Innovation in Portugal, if it was already implemented, or if the innovative process was still closed inside the company's boundaries, and if there was some resistance in changing the paradigm towards OI. The answers are summarised in Table 18:

Table 18. Portuguese paradigm towards open innovation

	Companies	**Nb.**	**%**
The paradigm is changing from a closed innovation towards an open innovation	A, B, C, D, E, G	6	86%
It still exists some resistance towards this change	B, C, D	3	43%
It depends on the industry and who manages the company	A, F, G	3	43%
There is no resistance towards this change	E	1	14%
Total:		7	100%

In fact, six out of seven interviewees agreed that the paradigm in Portugal is currently chang-

ing, evolving from a Close Innovation towards an Open Innovation process. However, three different interviewees stated that, in fact, they feel that Portugal still has some resistance in transferring and valuing the knowledge generated by them into society:

> "*It is funny, actually, because it* [being afraid to share information and knowledge with external elements] *is a very Portuguese reality. We have some European projects, and I do not see that concern there. I see mainly cooperation because each one of us has a different way of being in the market*" – Company D

On the other hand, Company E stated:

> *"I do not experience this resistance, at least with who I have worked with. I think that companies are increasingly open to this, and they have already realised that it is not closed in their cocoon that they will get anywhere. These companies tend to perish, but soon enough they will end up disappearing. I believe that close philosophies are already old-fashioned management, with an outdated vision*".

Company D provided an insight that is important to be highlighted. This company, which is in the manufacture of food products industry, is part of a Portuguese association that joins companies, non-entrepreneurial entities of the R&I system, and regional and national entities that are related to the agri-food sector in Portugal.

By being part of this association, companies receive a much closer, differentiated, and specific support, feeling that their rights are safeguarded. This interface manages and organizes knowledge in a way that is beneficial for all the affiliates, boosting networking among business and non-business partners. This association represents *"a set of companies that help each other"*, in some cases, companies with similar market segments and targets, and similar market shares among players which increases a strong and direct competitive environment. In those cases, these companies are prone to set up a burden to KTV, however, they still cooperate because they have all this support system behind them.

Additionally, by providing support to each company, helping them with the more technical-scientific knowledge, this association *"complements well what, in our case, we do internally, but that some companies cannot do. A lot of Portuguese companies have no HR dedicated to R&D, and* [association's name] *comes to fill this gap, almost giving a R&D department to all their associates"*. Therefore, this interface gives the means so all companies of the agri-food sector can develop R&D, even if they do not have the internal structure for that purpose.

This type of associations can boost visibility and credibility of R&D projects, increase the range of knowledge dissemination, enhance KTV activities, and pave the way towards an open innovation paradigm. Therefore, this sector, or at least the company that was interviewed, is much more openminded towards KTV, and this mindset can be linked with the association from which the company is part.

5.2.4. Relationship with the academic and scientific spheres

As has been explained, the relationship with the academic and scientific spheres is really important (and almost fundamental) to the development of R&D projects. The companies that were interviewed usually decide for either co-promoted projects or, when deciding for individual projects, subcontract those non-entrepreneurial entities to have access to the expertise that universities and R&D entities have to develop knowledge. Either way, they work closely with 'knowledge experts', i.e. academia and research centres.

During the interviews, this relationship between the academic and scientific spheres was explored and deepen, however, no question was directly asked in what regards the possibility of an existing gap between them and the industry. Nevertheless, six of the seven interviewees displayed opinions and agreement in the existence of a gap between both spheres, being the reasoning that justifies this divergence listed in Table 19.

Table 19. Reasoning for the existing gap between the industry and academic/scientific spheres

Reasoning		Companies	Nb.	%
Existing gap between the industry and the academic/scientific spheres:		A, B, C, D, E, F	6	86%
	Goals	B, C, D	3	43%
	Intellectual Property	C, D, F	3	43%
	Language	B, C	2	29%
	Pace	B, C, E	3	43%
	Trust	A, C	2	29%
	Total:		7	100%

This inherent gap was already addressed by some companies in their open-question answer. It can slow up the path to a more open innovative process as well difficult valorisation and dissemination of knowledge developed through R&D. By what the interviewees pointed out, the main challenges that companies have to deal with when working in cooperation with non-entrepreneurial entities is related to the different goals that both have:

> *"What does a company want? To make profit, fast, with the minimum resources and with maximum success – these are our key performance indicators. What does a scientific entity want? To publish articles, to do a lot of activities to disseminate results, divulge as much as they are developing – that is exactly what a company does not want! We want to have this competitive advantage, otherwise if they shout that knowledge from the rooftop, we will have competitors taking the concepts, developing quicker into the market, and that will represent a loss of value for the project."* – Company D

Closely related with the previous reason is intellectual property shocks. While developing knowledge together, intellectual property shocks are a reality – *"what knowledge is whose?"*. In these topic, three interviewees explained that this can be exceed through a 'knowledge exploitation contract' that clearly separates who will be the 'owner' of each discover, when can they commercialize or disseminate that knowledge, and what cannot be sold or shared.

In fact, it is curious to note that some companies see those non-entrepreneurial entities as 'knowledge creators', ignoring the possibility that companies themselves can also create and share knowledge, as can be seen in the following open-ended survey answers:

> *"I believe that KTV is very important to ensure the creation of new products, services, or processes capable of succeeding in an increasingly competitive market. As for knowledge, it must be transmitted to interested business entities that can apply a practical sense to the knowledge generated, creating value"* – Small enterprise in the ICT

Or even in an insight given by a large enterprise in the manufacturing industry – *"In projects funded by SI I&DT, institutes dedicated to technical and scientific research are strong knowledge bridges in the business environment, that transfer and value knowledge without jeopardizing business competitiveness."*

On another note, the positive impact that highly qualified HR can have in KTV was already addressed through the past chapters, namely their capacity in absorbing, understanding, and expanding knowledge. In fact, all seven interviewees confirmed that their last R&D funded project had highly qualified HR. Furthermore, all reinforced the presence of HR with master's degrees, and four still confirm the participation of PhDs. This represents the impact that R&D funded projects can have on the capacity of companies absorbing highly qualified HR, countering the Portuguese difficulties in merging highly qualified HR, namely PhDs, in the industry. Nevertheless, two of the interviewees argued that highly qualified HR are not essential:

> *"Are people with master's degrees, and specially, PhDs an asset? It is an asset to have someone who*

understands the subject, whether they have the degree or not. If whoever has the degree is more likely to be an expert on the subject? I do not know, but I would say that what is essential is having people who are truly connoisseurs about the subject." – Company F

The literature states that highly qualified HR are related to better search, evaluation, assimilation, and integration of external knowledge and technology, thus better KTV into the market (Piening et al., 2013). However, in production-oriented firms, such as Company F, external knowledge is mainly used by production staff that have their expertise based on tacit knowledge (Zhang et al., 2018). Therefore, the interviewee statement is reasonable – they need HR with tacit knowledge rather than highly educated HR.

There were highlighted by the interviewees, some characteristics that arise from having cooperation protocols with non-entrepreneurial entities of the R&I system, that are summarised in Table 20.

Table 20. Pros & cons of having cooperation protocols

Perspective	**Pros & cons**	**Companies**	**Nb.**	**%**
When having cooperation protocols:				
Disruptive innovation	New knowledge	A, B, C, D, E	5	71%
	New vision	B, C, E	3	43%
	Different deliverables	B, D	2	29%
When working only inside the company's boundaries:				
	Tacit knowledge	A	1	14%
	Close-minded (due to routine activities)	E	1	14%
	Company culture	A	1	14%
	Total:		7	100%

In fact, all interviewees claimed that the fact of having cooperation protocols (addressed in the survey) and a close relationship with universities and/or with R&D centres helped them understanding better KTV and the benefits of open innovation:

"We alone, without an academic partner, would not have become so receptive to open innovation and to sharing knowledge" – Company G

In fact, this is line with literature, that states that the more linkages a firm has with universities and/or research centres, the greater the potential for knowledge transfer and valorisation (Feldman & Kelley, 2006). In fact, this type of voluntary cooperation protocols represents reciprocal information-sharing mechanisms, that are the base of KTV, and that enhance

company learning and its subsequent performance.

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During the analysis of the quantitative phase, a certain tendency towards more positive responses was observed. This same trend has persisted throughout most of the qualitative interviews. This was already expected – all companies have a sense of what the 'correct answer' is, regardless of whether it was expected an honest and sincere interview. It is in this sense that it is seen the importance of developing face-to-face interviews (in this case though videocalls), so that body language, speech, and even type of language and tone used can be deciphered in order to cover this inevitability that happens with interviewees that are representing a certain company.

6. Conclusion

KTV is theoretically beneficial for the development of a country – by increasing KTV, the value of R&D improves due to its major impact at economic and social levels (Scherer et al., 2019). Economically, it boosts scientific progress, stimulates the creation of new businesses, and supports country-level economic development and competitiveness. In social terms, it stimulates further research and build knowledge for the country, contributing to society in general (Hladchenko, 2016). However, and despite the fact that it can be enhanced by incentives such as SI I&DT, it can only be maximized by companies or non-entrepreneurial entities that allow the dissemination and exploitation of the knowledge created. Therefore, this study sheds light on company's perceptions about knowledge transfer and valorisation – an important and under-investigated matter.

The findings of this study confirm that the global perception of KTV among Portuguese companies is positive. In fact, it was clear that the majority of the participants in this study reacted positively to this topic – at least in a preliminary phase of survey analysis. Nevertheless, when the theme was deepened, namely through interviews, these lines became less defined – the advantages were no longer unanimous among the sample.

One of the interviewees' main concerns was the disclosure of professional secrets, that, in their opinion, could happen in the process of valuing and transferring knowledge to external entities. In this sense, some companies (namely A, B, F, and G) were mainly focused on using R&D projects to create an innovative product and to profit from it. As abovementioned, these companies see knowledge transfer and valorisation as the disclosure of professional secrets that can negatively impact profit maximization objectives. Therefore, their speech during the interview was never as enthusiastic as the remaining companies, leading to an underestimation of KTV's benefits that go beyond profit making. Based on the info collected, we could argue that companies that have a more traditional management structure and that claim that the secret is effectively the *'soul of the business'*, will have major difficulties in perceiving the benefits that come from a process with more knowledge sharing among organizations. These companies tend to be more resistance towards Open Innovation.

OI is closely linked to the use of practices that allow valuing, transferring, disseminating, and exploiting knowledge. Based on the companies' responses and their perspectives over

the remaining players of their correspondent industries, it was also able to assess that Portuguese companies may still be resistant to OI. As some stated, this resistance is also related to the industrial sector. In fact, the propensity to engaging in KTV activities fluctuated among industries. According to Naqshbandi (2018), this happens because the need to innovate and the nature of the businesses are highly volatile among industries. Computer, Electronics, and ICT industries are more prone to open their innovative process – belonging to fast-changing and dynamic industries, KTV becomes crucial to keep its advancements (Naqshbandi, 2018). This is in line with Company C perspective, and also with Company D. Although this former company not being part of the mentioned industries, is part of a highly technological portion of the manufacturing industry.

All interviewees had the perception that the relationship that companies have with universities and research centres play a crucial role in KTV enhancement. This is in line with previous literature that states that higher cooperation protocols with educational and research centres, has a positive contribution to companies' innovative capacity (Lund Vinding, 2006). Furthermore, highly qualified HR are considered fundamental to, on the one hand, identify, acquire, assimilate, and absorb external knowledge; and, on the other hand, value, transfer and disseminate internal knowledge (Zhang et al., 2018). Once all the interviewees stated having highly qualifies HR working closely in R&D projects, this may justify the interviewees' more receptive stance towards KTV. Furthermore, all of the interviewees stated that this external knowledge that is acquired through cooperation protocols complement internal R&D, leading to better outcomes, which is aligned with prior literature (Caloghirou et al., 2004; Chesbrough & Crowther, 2006)

The present study contributes to a better understanding of the business perspective on knowledge transfer and valorisation by finding out how different players, from different industries perceive and accept a collaborative process of intrinsic knowledge sharing. Based on the sampled companies, the findings reveal that there may still exist a separation among Portuguese companies in their mindset in what regards knowledge transfer and valorisation. Moreover, perceiving the barriers conceived by the companies not so prone to KTV may represent an important insight on how to overcome those barriers towards a more open process.

In sum, it is important to retain that KTV means neither disclosing of professional secrets

nor the cancellation of individual value. Rather, the transfer, valorisation, dissemination, and exploitation of knowledge stimulate economic growth, promote competitiveness of Portuguese companies, and drive innovative performance.

6.1. Limitations and future research

Like all studies, the present one is subject to several limitations. Firstly, participants who believed they did not have an active role in KTV may have been less inclined to respond to the survey or to develop their answers further through the interview. In fact, when sending requests for the 114 companies, some mentioned they were not the relevant person to participate in this study as they did not have any role in KTV. This limitation was partially overcome by re-sending it to a 'more suitable' person within the company. However, some important insights may have been lost regarding those who opted not to respond to the survey.

Secondly, there may have been some bias in the data due to a defensive attitude in favour of the company that each participant was representing. Despite the expectations of obtaining an honest and sincere opinion during both the survey and the interview, participants may have had a sense of which was the 'correct answer'. As such, participants may have responded based on their sense of what the correct opinion should be, rather than what is actually the opinion shared within their company. This limitation is difficult to overcome. According to Podsakoff et al. (2003), to mitigate it, privacy should be guaranteed to the participant and inexistence of right or wrong questions should be explained upfront. These recommendations were followed during the entire data-gathering procedure.

Finally, the sample chosen for this study was composed only by companies that applied for, and took advantage of SI I&DT to finance their internal R&D projects. For that this reason, it is not possible to comparatively evaluate KTV perceptions in companies that develop R&D without ESI funds. Furthermore, the number of participants should have been higher. In order to achieve a higher response rate, more reliable responses, and close-to-reality perceptions, the survey was always directly sent to a specific person that was related to investment projects, R&D, and/or Innovation in each company. This process required time and specific research, thus turning the process of sending each survey a lagging process. Therefore, due to time constraints, the sample had to be smaller. Additional research could overcome these limitations by extending the analysis to a broader sample, including participants that never benefited from SI I&DT or similar incentive schemes.

6.2. Theoretical application

In what regards theoretical contributions, this study contributes to the literature mainly by exploring the industry perspective on knowledge transfer and valorisation.

While earlier research has addressed knowledge transfer and valorisation within the academic and scientific-sides of the spectrum (for instance, Arqué-Castells et al., 2016; Grimpe & Hussinger, 2013; Walter et al., 2018), so far, to the best of the author's knowledge, none has focused on the company-side perspective. Given the increasing importance of Business R&D in the overall performance of Portuguese innovation, this study represents a step forward in closing this existing gap in the literature, by extending the industry perspective on knowledge transfer and valorisation.

6.3. Practical application

When applying for ESI funds, KTV scores in the merit of R&D projects. Perceiving the opinion of companies on KTV can be useful in optimizing specific incentive-related consultancy, leading to a better forecast of R&D projects and, consequently, to a better provision of consultancy services. It provides managerial contributions to incentive-related consultancy to new and existing players on the R&D scene. It is also extremely important to eventually adapt and/or (re)design future approaches to this issue that can better leverage existing and future funding programmes. In fact, during the internship, it was perceived that many companies had still not instilled the importance that this topic represents. Therefore, this internship report had the purpose of paving the way to a better understanding of real-life situations concerning KTV by collecting opinions and information of concrete experiences.

In sum, there is an expectation that this study may contribute to optimize the application process to R&D incentive schemes. By understanding what the companies' main concerns are in what regards KTV, these barriers can be addressed and overcome in order to increase the score of R&D projects, with a positive impact on the approval rate of funded R&D projects. Furthermore, by perceiving the opinion of companies in this topic, KTV can be addressed in a way that starts developing an inherent interest in the entrepreneurial ecosystem.

Additionally, the author hopes that this study inspires other researchers in further explore this area of research.

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Annexes

Annex A

Survey's template

The following screenshots represent the survey that was provided to all the 114 companies:

Figure A1. Survey's first page

Figure A2. Survey's second page – project's characterisation

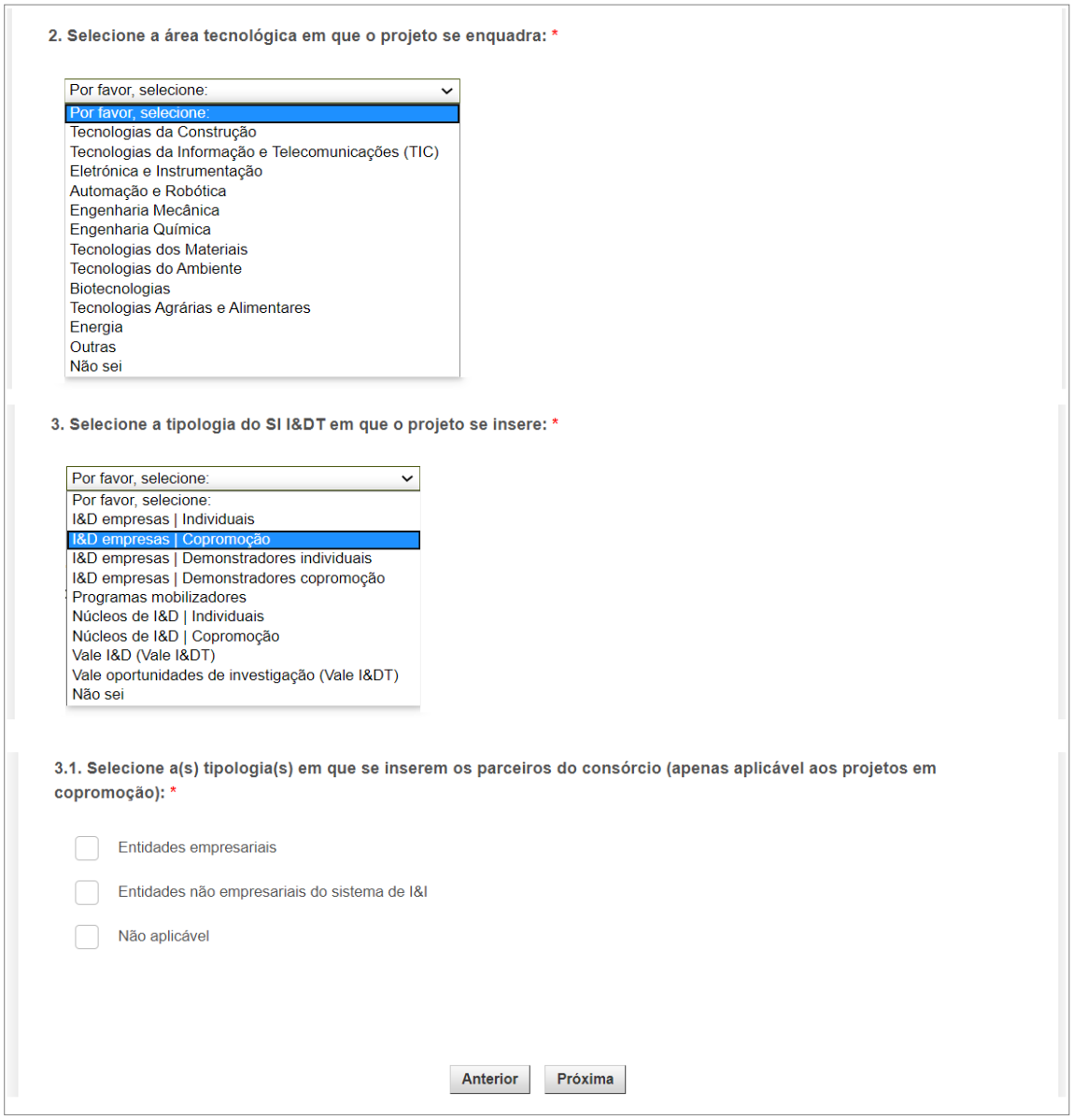


Figure A3. Survey's third page – Scientific and academic spheres

4. Relativamente à equipa que desenvolveu o projeto de I&D, esta era constituída por: *

- [ ] RH dos quadros da empresa
- [ ] RH das entidades copromotoras do projeto
- [ ] Novas contratações, com integração posterior nos quadros da empresa
- [ ] Novas contratações, sem integração posterior nos quadros da empresa
- [ ] Bolseiros

5. A implementação do projeto apoiado implicou a criação de postos de trabalho altamente qualificados (com Licenciatura ou superior)? *

- ( ) Sim
- ( ) Não

5.1. Se sim, especifique o(s) nível(eis) de qualificação dos recursos contratados: *

(Se respondeu "Não" na pergunta anterior, por favor selecione "Não aplicável")

- [ ] Licenciatura
- [ ] Mestrado
- [ ] Doutoramento
- [ ] Não aplicável

6. Com a participação no projeto de SI I&DT: *

	Discordo totalmente	Discordo parcialmente	Não concordo nem discordo	Concordo parcialmente	Concordo totalmente
O n.º de postos de trabalho na empresa aumentou	( )	( )	( )	( )	( )
Houve uma maior integração de RH de meios académicos e investigação nos quadros da empresa	( )	( )	( )	( )	( )
O rácio de colaboradores altamente qualificados face ao total de colaboradores da empresa aumentou	( )	( )	( )	( )	( )

7. A participação no projeto apoiado promoveu a relação com o mundo científico e/ou académico? *

- ( ) Sim
- ( ) Não

8. Antes da participação no projeto apoiado, a empresa usufruía de protocolos de cooperação com universidades e/ou centros de I&D? *

- ( ) Sim
- ( ) Não

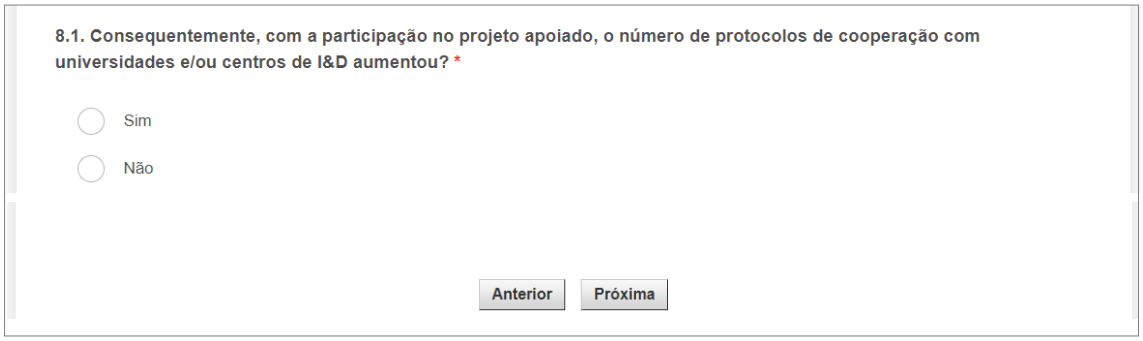
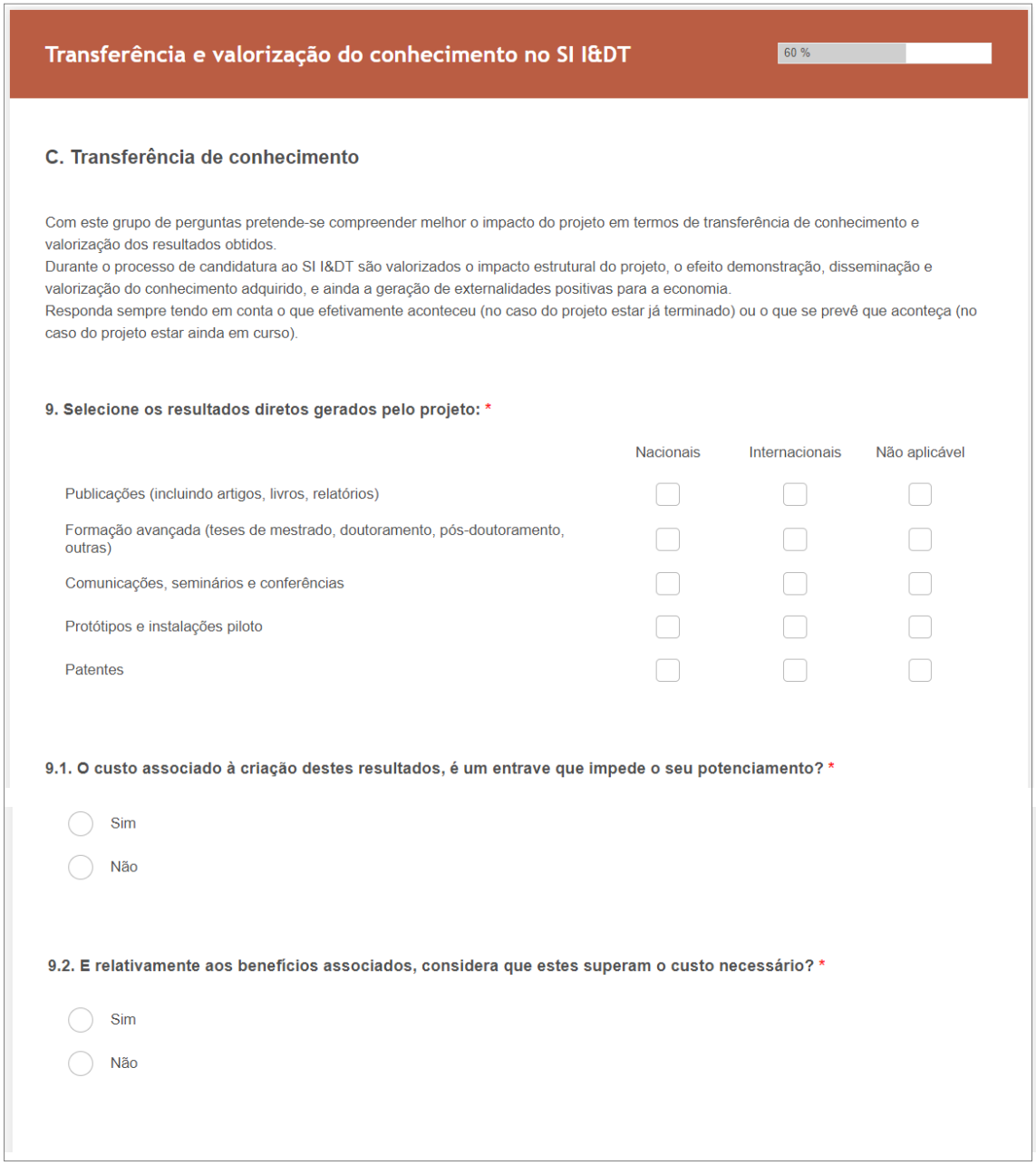


Figure A4. Survey's fourth page – Knowledge transfer and valorisation



10. Os resultados do projeto apoiado pelo SI I&DT levaram à criação de alguma(s) destas formas de valorização económica dos resultados? *

- [ ] Criação de empresa difusora / spin-off
- [ ] Nova área de negócio dentro da empresa
- [ ] Nova gama de produtos/serviços/processos
- [ ] Melhoria de produto/serviço/processo já existente
- [ ] Entrada em novos mercados
- [ ] Não levou a nenhuma das formas de valorização económica listadas

11. Foi o processo de candidatura ao SI I&DT que alertou a empresa para a temática da divulgação e disseminação dos resultados? *

- ◯ Sim
- ◯ Não

11.1. Relativamente à divulgação e partilha de resultados de projetos de I&DT: *

	Discordo totalmente	Discordo parcialmente	Não concordo nem discordo	Concordo parcialmente	Concordo totalmente
Costuma ser um objetivo da empresa	◯	◯	◯	◯	◯
Não costuma estar prevista nos planos da empresa	◯	◯	◯	◯	◯

11.2. Relativamente à avaliação da divulgação e partilha de resultados de projetos de I&DT, qual a opinião da empresa relativamente às seguintes afirmações: *

	Discordo totalmente	Discordo parcialmente	Não concordo nem discordo	Concordo parcialmente	Concordo totalmente
É pertinente incluir este tema como parte integrante dos projetos de I&DT	◯	◯	◯	◯	◯
Este tema deve continuar a ser considerado e pontuado no mérito do projeto	◯	◯	◯	◯	◯
Este tema é geralmente adicionado, de modo a impactar positivamente a pontuação do projeto	◯	◯	◯	◯	◯

12. As atividades de disseminação e valorização dos resultados obtidos: *

	Discordo totalmente	Discordo parcialmente	Não concordo nem discordo	Concordo parcialmente	Concordo totalmente
Influenciam positivamente a decisão de candidatura ao incentivo	◯	◯	◯	◯	◯
Influenciam negativamente a decisão de candidatura ao incentivo	◯	◯	◯	◯	◯
São interessantes, do ponto de vista da empresa	◯	◯	◯	◯	◯
São uma preocupação e um assunto delicado para a empresa	◯	◯	◯	◯	◯
Fazem sentido, com vista a disseminar o conhecimento gerado pelo projeto na sociedade	◯	◯	◯	◯	◯
São dispensáveis, uma vez que os resultados deveriam ser apenas da empresa	◯	◯	◯	◯	◯

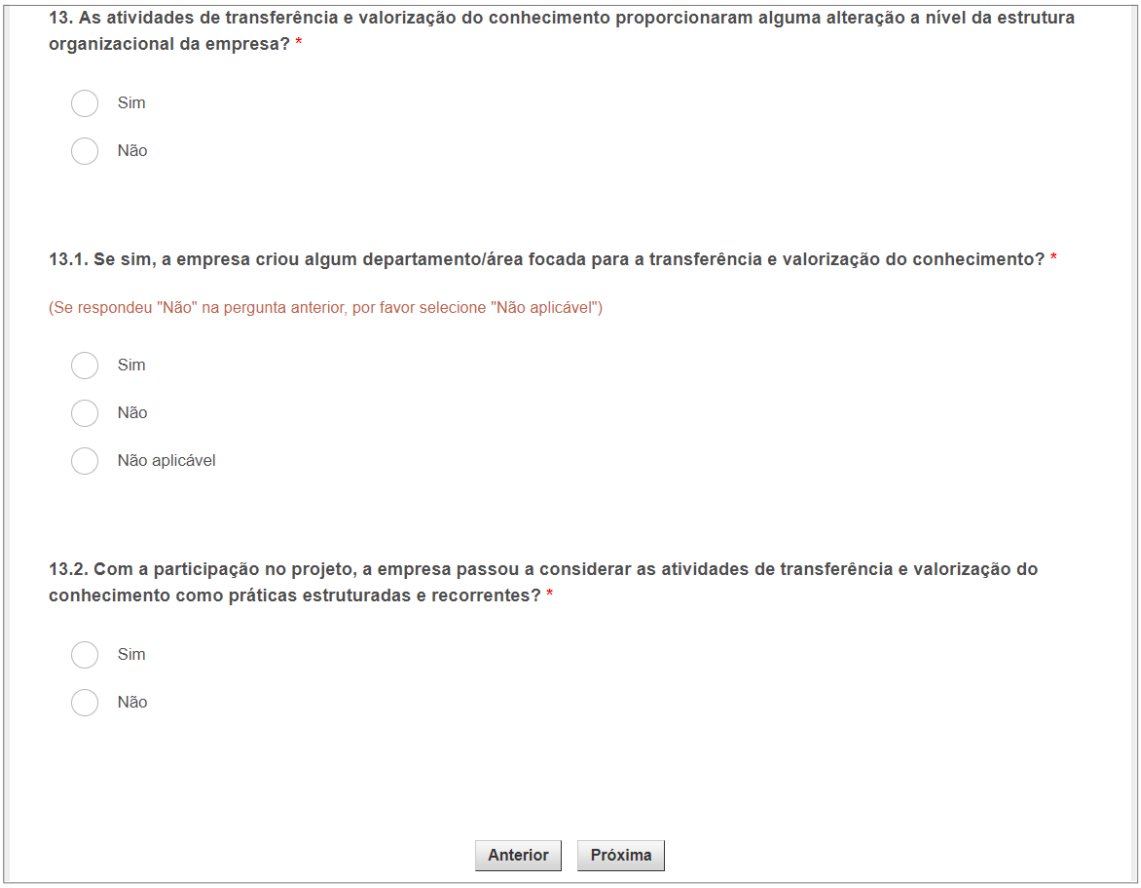
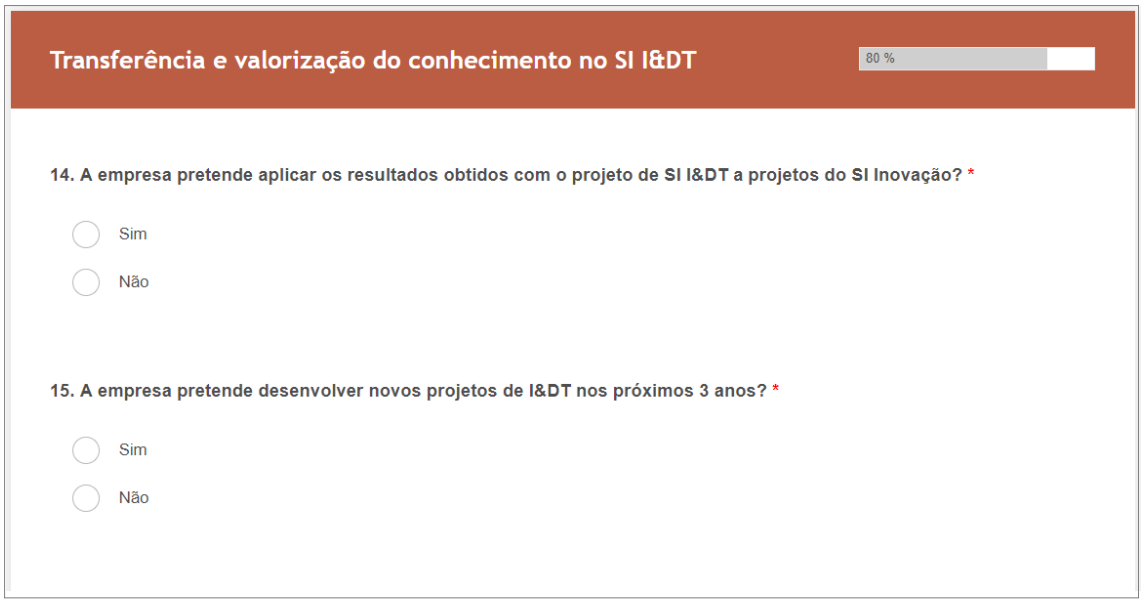


Figure A5. Survey's fifth page



15.1. Se sim, pretende voltar a candidatar um projeto ao SI I&DT? *

(Se respondeu "Não" na pergunta anterior, por favor selecione "Não aplicável")

- ○ Sim
- ○ Não
- ○ Não aplicável

Opinião/comentário sobre a transferência e valorização do conhecimento no SI I&DT:

(Adicione a perspetiva geral da empresa no tema em análise)

Para efeito de controlo das respostas, por favor indique o nome da empresa *

(será garantida a confidencialidade das respostas)

Designação da empresa:

Estaria disponível para agendar uma entrevista, com duração máxima de 30 minutos, em que seriam aprofundados alguns destes temas? *

- ○ Sim
- ○ Não

Se sim, deixe por favor o contacto para o efeito:

Muito obrigada pela sua colaboração!

Sofia Coutinho
sofia.coutinho97@gmail.com

Anterior Concluído

Annex B

Excel data coding

The following tables represent the coding used to analyse the quantitative data through the Statistical Package for the Social Sciences (SPSS software). Once all variables used are considered categorical variables, they had to be transformed into numbers, or codes, in order to be easily analysed. Therefore, each of the following tables represent a question of the survey, and the corresponding code that was used to analyse the data. This information will be useful to understand the descriptive statistics and correlation analysis outputs provided by SPSS.

Number of approved projects

Code	**Nb. approved projects** (as individual project, as project leader, and as a co-promoter)
1	0 projects approved
2	1 project approved
3	2 projects approved
4	3 or more projects approved
0	I do not know

Project's technological domain

Code	**Technological domain**
1	Construction technologies
2	Information and communication technologies
3	Electronics and instrumentation
4	Automation and robotics
5	Mechanical engineering
6	Chemical engineering
7	Materials technology
8	Environmental technology
9	Biotechnology
10	Agrotechnology
11	Energy
12	Other
0	I do not know

Project's typology

Code	**Typology**
1	Enterprise R&D | Individual project
2	Enterprise R&D | Co-promoted project
3	Enterprise R&D | Individual demonstrator project
4	Enterprise R&D | Co-promoted demonstrator project
5	R&D Teams | Individual project
6	R&D Voucher
0	I do not know

Project's partners

Code	**Type of partners**
1	Companies
2	Non-entrepreneurial entities of the R&I system
3	Both
0	Non applicable

(Q4) Composition of the R&D team that developed the project

Code	
1	Internal team (only internal HR)
2	Collaborative team (Company's HR + co-promoter's HR)
3	Newly hired/external team (only newly hired HR or only external HR)
4	Mixed team (Internal HR + newly hired HR)

Were any research fellows hired for the development of the project? (Question added during the analysis process, based on Q4 answers)

Code	Answer
1	Yes
2	No

(Q5) Did the project require hiring highly qualified human resources?

Code	Answer
1	Yes
2	No

(Q5.1) Degree of the hired highly qualified human resources

Code	Degree(s)
1	Bachelor
2	Master
3	PhD
4	Bachelor + Master
5	Bachelor + PhD
6	Master + PhD
7	All
0	Non applicable

(Q6.1) The number of job positions in the company increased

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q6.2) There was a greater integration of HR from academic and research spheres in the company

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q6.3) The ratio of highly qualified HR to the total HR in the company, increased

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q7) Did the participation in this funded project promote the relationship with the scientific and/or academic spheres?

Code	Answer
1	Yes
2	No

(Q8) Before developing this R&D project, did the company had cooperation protocols with universities and/or research institutions?

Code	Answer
1	Yes
2	No

(Q8.1) Consequently, with the participation in this project, did the number of these cooperation protocols increase?

Code	Answer
1	Yes
2	No

KTV activities to disseminate the knowledge created (outputs from question 9.)

Code	Answer	Activities
1	National	Publications
2	International	
3	Both	
0	Non applicable	
1	National	Thesis
2	International	
3	Both	
0	Non applicable	
1	National	Communications
2	International	
3	Both	
0	Non applicable	
1	National	Prototypes
2	International	
3	Both	
0	Non applicable	
1	National	Patents
2	International	
3	Both	
0	Non applicable	

(Q9.1) Is the cost of KTV activities an obstacle that prevented its implementation?

Code	Answer
1	Yes
2	No

(Q9.2) Does the benefits associated with the same activities surpass its costs?

Code	Answer
1	Yes
2	No

Did the company used the following activities to increase positive externalities? (outputs from question 10.)

Code	Answer	Activity
1	Yes	Spin-off company (Q10a)
2	No	
1	Yes	New business unit (Q10b)
2	No	
1	Yes	New range of products/services/processes (Q10c)
2	No	
1	Yes	Existing products/services/processes improvement (Q10d)
2	No	
1	Yes	Entry into new markets (Q10e)
2	No	
1	Yes	None (Q10f)
2	No	

(Q11) Was through the application process for the SI I&DT fund that the company became aware about KTV and subsequent dissemination of the knowledge acquired

Code	Answer
1	Yes
2	No

(Q11.1a) Knowledge transfer, valorisation and subsequent knowledge dissemination is usually a company's concern

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q11.1b) Knowledge transfer, valorisation and subsequent knowledge dissemination is usually not a company's concern

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q11.2a) Knowledge transfer, valorisation, and subsequent knowledge dissemination is pertinent to include as an integral part of R&D projects

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q11.2b) Knowledge transfer, valorisation, and subsequent knowledge dissemination should continue to be scored on the project's merit

Code	Answer
1	Strongly disagree

Code	Answer
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q11.2c) Knowledge transfer, valorisation, and subsequent knowledge dissemination is usually used to positively impact the project's merit

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q12a) Knowledge transfer, valorisation, and subsequent knowledge dissemination positively influence the company when applying to SI I&DT

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q12b) Knowledge transfer, valorisation, and subsequent knowledge dissemination negatively influence the company when applying to SI I&DT

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q12c) Knowledge transfer, valorisation, and subsequent knowledge dissemination are interesting for the company

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q12d) Knowledge transfer, valorisation, and subsequent knowledge dissemination are a concern and a delicate subject inside the company

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q12e) Knowledge transfer, valorisation, and subsequent knowledge dissemination are reasonable (knowledge should be spread to society)

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q12f) Knowledge transfer, valorisation, and subsequent knowledge dissemination are unnecessary (knowledge should only be kept with who discovered it)

Code	Answer
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

(Q13) Did KTV activities change the company's organizational structure?

Code	Answer
1	Yes
2	No

(Q13.1) If so, has the company created a department/area/team focused on KTV?

Code	Answer
1	Yes
2	No
0	Non applicable

(Q13.2) With the participation in this project, did the company start considering KTV activities as structured and recurring practices?

Code	Answer
1	Yes
2	No

(Q14) Does the company intend to apply SI I&DT results to a SI Innovation project?

Code	Answer
1	Yes
2	No

(Q15) Does the company intend to develop new R&D projects in the next 3 years?

Code	Answer
1	Yes
2	No

(Q15.1) If so, does the company intend to re-apply for the SI I&DT fund?

Code	Answer
1	Yes
2	No
0	Non applicable

Annex C

Quantitative data analysis

In order to analyse the quantitative data, there were estimated two data analysis techniques: descriptive statistics and correlation analysis.

Descriptive Statistics

Descriptive statistics were the first technique to be used, once it is usually the most basic statistical technique to analyse and understand a dataset. This method was used to describe the main features of the categorical variables, that were highlighted through graphical representations in Chapter 5., Section 5.1. Once this dataset only comprises categorical values, it was only estimated the mode and the frequency tables (within one variable at a time or, when justifiable, two) for the descriptive statistics portion.

Table B1. SPSS descriptive statistics for Figure 1 – Frequency tables and crosstabulation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Individual	30	44.1	45.5	45.5
	Co-promoted	36	52.9	54.5	100.0
	Total	66	97.1	100.0	
Missing	0	2	2.9		
Total		68	100.0		

Co-promoted projects * Partners Crosstabulation

			Partners			
			Companies	Non-entrepreneurial entities	Both	Total
Valid	Co-promoted	Count	4	16	16	36
		% of Total	11.1%	44.4%	44.4%	100.0%
Total		Count	4	16	16	36
		% of Total	11.1%	44.4%	44.4%	100.0%

Table B2. SPSS descriptive statistics for Figure 2 – Frequency tables

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	4.4	4.5	4.5
	2	14	20.6	20.9	25.4
	3	2	2.9	3.0	28.4
	4	4	5.9	6.0	34.3
	5	6	8.8	9.0	43.3
	6	2	2.9	3.0	46.3
	7	14	20.6	20.9	67.2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	8	3	4.4	4.5	71.6
	9	4	5.9	6.0	77.6
	10	8	11.8	11.9	89.6
	12	7	10.3	10.4	100.0
	Total	67	98.5	100.0	
Missing	0	1	1.5		
Total		68	100.0		
Mode		2 / 7			

Table B3. SPSS descriptive statistics for Figure 3 – Frequency tables and crosstabulation

			Frequency	Percent	Valid Percent	Cumulative Percent
Individual	Valid	1	24	35.3	39.3	39.3
		2	11	16.2	18.0	57.4
		3	4	5.9	6.6	63.9
		4	22	32.4	36.1	100.0
		Total	61	89.7	100.0	
	Missing	0	7	10.3		
	Total		68	100.0		
	Mode		1			
Leader	Valid	1	19	27.9	29.7	29.7
		2	24	35.3	37.5	67.2
		3	8	11.8	12.5	79.7
		4	13	19.1	20.3	100.0
		Total	64	94.1	100.0	
	Missing	0	4	5.9		
	Total		68	100.0		
	Mode		2			
Co-promoter	Valid	1	35	51.5	57.4	57.4
		2	11	16.2	18.0	75.4
		3	6	8.8	9.8	85.2
		4	9	13.2	14.8	100.0
		Total	61	89.7	100.0	
	Missing	0	7	10.3		
	Total		68	100.0		
	Mode		1			

Leader * Co-promoter Crosstabulation

			Co-promoter				
			1	2	3	4	Total
Leader	1	Count	13	3	2	1	19
		% of Total	21.3%	4.9%	3.3%	1.6%	31.1%
	2	Count	14	4	2	2	22
		% of Total	23.0%	6.6%	3.3%	3.3%	36.1%
	3	Count	2	2	1	3	8
		% of Total	3.3%	3.3%	1.6%	4.9%	13.1%
	4	Count	6	2	1	3	12
		% of Total	9.8%	3.3%	1.6%	4.9%	19.7%
Total		Count	35	11	6	9	61
		% of Total	57.4%	18.0%	9.8%	14.8%	100.0%

Table B4. SPSS descriptive statistics for question 15 – Frequency tables and crosstabulation

Q15.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	57	83.8	90.5	90.5
	2	6	8.8	9.5	100.0
	Total	63	92.6	100.0	
Missing	System	5	7.4		
Total		68	100.0		

Q15. * Q15.1. Crosstabulation

			Q15.	
			1	Total
Q15.1.	1	Count	55	55
		% of Total	100.0%	100.0%
Total		Count	55	55
		% of Total	100.0%	100.0%

Proximity with academic and scientific spheres

Table B5. SPSS descriptive statistics for question 5 and related – Frequency tables

Q5.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	46	67.6	67.6	67.6
	2	22	32.4	32.4	100.0
	Total	68	100.0	100.0	

Q5.1. – Degree of the hired highly qualified HR					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	8	11.8	17.4	17.4
	2	15	22.1	32.6	50.0
	3	3	4.4	6.5	56.5
	4	10	14.7	21.7	78.3
	5	2	2.9	4.3	82.6
	6	6	8.8	13.0	95.7
	7	2	2.9	4.3	100.0
	Total	46	67.6	100.0	
Missing	0	22	32.4		
Total		68	100.0		

Were any research fellows hired for the development of the project?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	24	35.3	35.3	35.3
	2	44	64.7	64.7	100.0
	Total	68	100.0	100.0	

Table B6. SPSS descriptive statistics for question 6, Table 4 – Frequency tables

			Frequency	Percent	Valid Percent	Cumulative Percent
Q6.1.	Valid	1	10	14.7	14.7	14.7
		2	3	4.4	4.4	19.1
		3	11	16.2	16.2	35.3
		4	20	29.4	29.4	64.7
		5	24	35.3	35.3	100.0
		Total	68	100.0	100.0	
Q6.2.	Valid		5	7.4	7.4	7.4
			3	4.4	4.4	11.8
			9	13.2	13.2	25.0
			27	39.7	39.7	64.7
			24	35.3	35.3	100.0
			68	100.0	100.0	
Q6.3.	Valid		13	19.1	19.1	19.1
			3	4.4	4.4	23.5
			16	23.5	23.5	47.1
			19	27.9	27.9	75.0
			17	25.0	25.0	100.0
			68	100.0	100.0	

Table B7. SPSS descriptive statistics for question 7 and 8, Table 5 – Frequency tables and crosstabulation

			Frequency	Percent	Valid Percent	Cumulative Percent
Q7.	Valid	1	64	94.1	94.1	94.1
		2	4	5.9	5.9	100.0
		Total	68	100.0	100.0	
Q8.	Valid	1	58	85.3	85.3	85.3
		2	10	14.7	14.7	100.0
		Total	68	100.0	100.0	
Q8.1.	Valid	1	41	60.3	60.3	60.3
		2	27	39.7	39.7	100.0
		Total	68	100.0	100.0	

Q8. * Q8.1. Crosstabulation

			Q8.1.		
			1	2	Total
Q8.	1	Count	35	23	58
		% of Total	51.5%	33.8%	85.3%
	2	Count	6	4	10
		% of Total	8.8%	5.9%	14.7%
Total		Count	41	27	68
		% of Total	60.3%	39.7%	100.0%

Table B8. SPSS descriptive statistics for question 13 and 13.1, Table 6 – Frequency tables

			Frequency	Percent	Valid Percent	Cumulative Percent
Q13.	Valid	1	20	29.4	29.4	29.4
		2	48	70.6	70.6	100.0
		Total	68	100.0	100.0	
Q13.1.	Valid	1	8	11.8	30.8	30.8
		2	18	26.5	69.2	100.0
		Total	26	38.2	100.0	
	Missing	0	42	61.8		
	Total		68	100.0		

Tangible impacts from KTV

Table B9. SPSS descriptive statistics for question 9, Figure 5 – Frequency tables

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	N/A	52	76.5	76.5	76.5
	1	7	10.3	10.3	86.8

			Frequency	Percent	Valid Percent	Cumulative Percent
Patents	Valid	2	4	5.9	5.9	92.6
		3	5	7.4	7.4	100.0
		Total	68	100.0	100.0	
Prototypes	Valid	N/A	15	22.1	22.1	22.1
		1	36	52.9	52.9	75.0
		2	9	13.2	13.2	88.2
		3	8	11.8	11.8	100.0
		Total	68	100.0	100.0	
Communications	Valid	N/A	14	20.6	20.6	20.6
		1	14	20.6	20.6	41.2
		2	16	23.5	23.5	64.7
		3	24	35.3	35.3	100.0
		Total	68	100.0	100.0	
Thesis	Valid	N/A	40	58.8	58.8	58.8
		1	24	35.3	35.3	94.1
		2	2	2.9	2.9	97.1
		3	2	2.9	2.9	100.0
		Total	68	100.0	100.0	
Publications	Valid	N/A	15	22.1	22.1	22.1
		1	10	14.7	14.7	36.8
		2	20	29.4	29.4	66.2
		3	23	33.8	33.8	100.0
		Total	68	100.0	100.0	

Table B10. SPSS descriptive statistics for questions 9.1 and 9.2, Table 7 and Figure 8 – Frequency tables and crosstabulation

			Frequency	Percent	Valid Percent	Cumulative Percent
Q9.1.	Valid	1	25	36.8	36.8	36.8
		2	43	63.2	63.2	100.0
		Total	68	100.0	100.0	
Q9.2.	Valid	1	48	70.6	70.6	70.6
		2	20	29.4	29.4	100.0
		Total	68	100.0	100.0	

Patents * Q9.1. Crosstabulation					
			Q9.1.		
			1	2	Total
Patents	1	Count	10	6	16
		% within Patents	62.5%	37.5%	100.0%
	2	Count	15	37	52
		% within Patents	28.8%	71.2%	100.0%
Total		Count	25	43	68
		% within Patents	36.8%	63.2%	100.0%

Table B11. SPSS descriptive statistics for question 10, Figure 9 – Frequency tables

			Frequency	Percent	Valid Percent	Cumulative Percent
Spin-off company	Valid	1	3	4.4	4.4	4.4
		2	65	95.6	95.6	100.0
		Total	68	100.0	100.0	
New business unit	Valid	1	13	19.1	19.1	19.1
		2	55	80.9	80.9	100.0
		Total	68	100.0	100.0	
New range of (…)	Valid	1	49	72.1	72.1	72.1
		2	19	27.9	27.9	100.0
		Total	68	100.0	100.0	
Existing products (…)	Valid	1	39	57.4	57.4	57.4
		2	29	42.6	42.6	100.0
		Total	68	100.0	100.0	
Entry into new markets	Valid	1	26	38.2	38.2	38.2
		2	42	61.8	61.8	100.0
		Total	68	100.0	100.0	
None	Valid	1	2	2.9	2.9	2.9
		2	66	97.1	97.1	100.0
		Total	68	100.0	100.0	

General opinion on KTV

Table B12. SPSS descriptive statistics for question 11 – Frequency tables

Q11.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	24	35.3	35.3	35.3
	2	44	64.7	64.7	100.0
	Total	68	100.0	100.0	

Table B13. SPSS descriptive statistics for question 11.1, Figure 10 – Frequency tables

			Q11.1.			
			Frequency	Percent	Valid Percent	Cumulative Percent
Q11.1a	Valid	1	3	4.4	4.4	4.4
		2	6	8.8	8.8	13.2
		3	7	10.3	10.3	23.5
		4	25	36.8	36.8	60.3
		5	27	39.7	39.7	100.0
		Total	68	100.0	100.0	
Q11.1b	Valid	1	31	45.6	45.6	45.6
		2	18	26.5	26.5	72.1
		3	5	7.4	7.4	79.4
		4	9	13.2	13.2	92.6
		5	5	7.4	7.4	100.0
		Total	68	100.0	100.0	

Table B14. SPSS descriptive statistics for question 13.2 considering only 4 and 5 levels of question 11.1a, Table 8 – Frequency tables

			Q11.1a		
			4	5	
Q13.2.	1	Count	10	20	30
		% of Total	19.2%	38.5%	57.7%
	2	Count	15	7	22
		% of Total	28.8%	13.5%	42.3%
Total		Count	25	27	52
		% of Total	48.0%	52.0%	100.0%

Table B15. SPSS descriptive statistics for question 11.2, Figure 11 – Frequency tables

			Q11.2.			
			Frequency	Percent	Valid Percent	Cumulative Percent
Q11.2a	Valid	1	2	2.9	2.9	2.9
		2	4	5.9	5.9	8.8
		3	6	8.8	8.8	17.6
		4	27	39.7	39.7	57.4
		5	29	42.6	42.6	100.0
		Total	68	100.0	100.0	
Q11.2b	Valid	1	5	7.4	7.4	7.4
		2	3	4.4	4.4	11.8
		3	9	13.2	13.2	25.0

			Frequency	Percent	Valid Percent	Cumulative Percent
Q11.2b	Valid	4	32	47.1	47.1	72.1
		5	19	27.9	27.9	100.0
		Total	68	100.0	100.0	
Q11.2c	Valid	1	1	1.5	1.5	1.5
		2	7	10.3	10.3	11.8
		3	16	23.5	23.5	35.3
		4	30	44.1	44.1	79.4
		5	14	20.6	20.6	100.0
		Total	68	100.0	100.0	

Table B16. SPSS descriptive statistics for question 12, Figure 12 – Frequency tables

Q12.						
			Frequency	Percent	Valid Percent	Cumulative Percent
Q12c	Valid	2	7	10.3	10.3	10.3
		3	11	16.2	16.2	26.5
		4	32	47.1	47.1	73.5
		5	18	26.5	26.5	100.0
		Total	68	100.0	100.0	
Q12e	Valid	1	4	5.9	5.9	5.9
		2	4	5.9	5.9	11.8
		3	7	10.3	10.3	22.1
		4	33	48.5	48.5	70.6
		5	20	29.4	29.4	100.0
		Total	68	100.0	100.0	
Q12f	Valid	1	20	29.4	29.4	29.4
		2	21	30.9	30.9	60.3
		3	13	19.1	19.1	79.4
		4	10	14.7	14.7	94.1
		5	4	5.9	5.9	100.0
		Total	68	100.0	100.0	

Correlation Analysis

Correlation Analysis was then used to understand the strength and the direction of possible associations that could exist between two variables. The following tables provide the correlation coefficients to all the variables that qualified for it, being divided into (i) Proximity with academic and scientific spheres, (ii) Tangible impacts from KTV, and (iii) General opinion on KTV.

Table B17. Correlation coefficients – Proximity with the academic and scientific spheres variables

	Q4.	Re-search fellows	Q5.	Degree?	Q6.1.	Q6.2.	Q6.3.	Q7.	Q8.	Q8.1.	Q13.	Q13.1.
Q4.	1.000	-0.392**	-0.238*	-0.026	0.097	0.017	0.138	-0.065	0.012	-0.018	0.128	-0.138
Research fellows		1.000	-0.279*	-0.009	0.333**	0.269*	0.299**	0.185	-0.128	0.222	-0.139	-0.029
Q5.			1.000		-0.651**	-0.318**	-0.566**	-0.039	-0.110	-0.047	-0.037	0.264
Degree?				1.000	0.183	0.109	-0.046	-0.183	0.008	-0.078	0.085	0.050
Q6.1.					1.000	0.442**	0.633**	0.065	-0.005	0.103	0.069	-0.284
Q6.2.						1.000	0.457**	0.059	-0.091	-0.047	-0.016	-0.249
Q6.3.							1.000	0.092	0.081	-0.110	0.061	-0.315
Q7.								1.000	-0.104	0.180	-0.25*	0.241
Q8.									1.000	0.002	0.086	-0.120
Q8.1.										1.000	0.062	0.310
Q13.											1.000	-0.030
Q13.1.												1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table B18. Correlation coefficients – Tangible impacts of KTV

	Publ.	Thesis	Com.	Prot.	Patents	Q9.1.	Q9.2.	Q10a	Q10b	Q10c	Q10d	Q10e	Q10f
Publica-tions	1.000	0.262*	0.578**	0.291**	0.180	-0.221*	0.042	-0.160	-0.070	0.027	0.160	-0.158	-0.008
Thesis		1.000	0.272*	-0.074	-0.064	-0.086	0.189	-0.090	-0.021	0.069	0.065	-0.113	-0.020
Communica-tions			1.000	0.128	-0.044	-0.007	-0.139	-0.038	0.062	-0.006	0.013	-0.183	-0.017
Prototypes				1.000	0.242*	0.113	-0.272*	-0.104	-0.007	-0.164	0.067	-0.033	0.124
Patents					1.000	-0.315**	0.028	-0.026	-0.011	0.076	-0.107	0.050	0.092
Q9.1.						1.000	-0.177	-0.164	0.017	-0.069	-0.206	-0.098	0.048
Q9.2.							1.000	-0.018	-0.014	0.102	0.031	-0.023	-0.079
Q10a								1.000	0.078	-0.185	-0.104	0.126	-0.037
Q10b									1.000	0.136	-0.186	0.233	-0.085
Q10c										1.000	-0.272*	0.220	-0.280*
Q10d											1.000	-0.178	-0.202
Q10e												1.000	-0.137
Q10f													1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table B19. Correlation coefficients – General opinion on KTV

	Q11.	Q11.1a	Q11.1b	Q11.2a	Q11.2b	Q11.2c	Q12a	Q12b	Q12c	Q12d	Q12e	Q12f	Q13.2.
Q11.	1.000	-0.002	-0.185	-0.042	-0.072	-0.072	-0.217	0.081	0.110	-0.010	0.009	-0.130	0.145
Q11.1a		1.000	-0.486**	0.404**	0.479**	0.089	0.254*	-0.100	0.466**	-0.010	0.446**	-0.296**	-0.410**
Q11.1b			1.000	-0.268*	-0.359**	0.037	0.002	0.115	-0.305**	0.019	-0.227*	0.396**	0.090
Q11.2a				1.000	0.712**	0.196	0.204	-0.271*	0.378**	-0.016	0.504**	-0.378**	-0.189
Q11.2b					1.000	0.173	0.254*	-0.297**	0.412**	-0.066	0.394**	-0.398**	-0.245*
Q11.2c						1.000	0.325**	-0.177	0.090	0.178	0.028	0.038	-0.296**
Q12a							1.000	-0.463**	0.378**	-0.034	0.250*	-0.137	-0.346**
Q12b								1.000	-0.309**	0.100	-0.205*	0.316**	0.166
Q12c									1.000	0.008	0.346**	-0.430**	-0.237*
Q12d										1.000	-0.033	0.085	-0.039
Q12e											1.000	-0.401**	-0.370**
Q12f												1.000	-0.019
Q13.2.													1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Annex D

Interview script

- Clarification of general information related to the General Data Protection Regulation, namely in what regards recording the interview, confidentiality, and scope of the study.
- Description of the scope of the study and its main goals
- Job position and job description. Furthermore, the role that the interviewee had in the project identified in the survey

Process of knowledge transfer and valorisation

- Description of the KTV activities used to disseminate knowledge. Do the company always use the same activities in R&D projects?
- To what extent were the representation of the correspondent costs? Substantial or negligible percentage of costs in the total project's costs?
- Is there any economic return that come from this investment in the dissemination of knowledge? Is there any benefits or return coming from KTV activities? Which benefits? Which type of return?
- In terms of patenting, did you consider patenting in this specific project? Does your company usually consider patenting in R&D projects? Why? Why not? Why do Portuguese companies have a low propensity to patenting?
- Is the interest in disseminating knowledge related to the fact that Portugal 2020 R&D projects require and value this type of activities?
- Was though this type of financing that your company began to increase its interest and sensitivity in disseminating knowledge through KTV activities?

Perceptions on open innovation

- Is there any importance in making the R&D process more cooperative? Involving different companies, R&D institutes?
- How to manage sharing knowledge with external entities while creating a differentiating commercial product? On the one hand, there is an incentive to share knowledge, but, on the other, the ultimate goal of a company is to generate profit.
- Is there any resistance among Portuguese companies in relation to having an Open Innovation system? Are Portuguese companies still focused on a Closed Innovation system? Do Portuguese companies prefer to create and maintain this knowledge

within the organization?

- The fact that this R&D incentive scheme 'obligates' companies in sharing knowledge, can become a barrier for companies and negatively influence the decision to apply for the incentive scheme?
- How do you see Open Innovation in the future? How do you see the relationship of Portuguese companies with this new paradigm?

Relationship with the academic and scientific spheres

- There were HR with master's degrees or PhDs in the team that developed the project?
- Working with highly qualified HR in R&D projects is different from working with HR with different educational levels? Not only in terms of theoretical knowledge, but also in terms of vision, openness to innovation, etc.
- Do you feel that the closer relationship between your company and the academic and scientific spheres influences the company to become more involved in this process of Open Innovation?