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Understanding the Roles of Private Consultants as Innovation Intermediaries in Technology Transfer: A Case Study in the Portuguese National Innovation System

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Abstract

The fields of innovation systems and technology transfer (TT) have seen growing interest in recent years, especially in the context of open innovation. Private consultants, play a vital role in mediating and facilitating interactions among various stakeholders in the innovation process. However, the specific roles of private consultants as innovation intermediaries have received limited attention in the literature. This study presents a case analysis of a Portuguese consultancy firm involved in 219 TT projects between 2015 and 2021. The research identifies six key intermediary roles consistently played by the consultancy: funding and finance, project management, technology scouting, design and ideation, feasibility assessment, and marketing/business development. The study further reveals that the type of entity initiating the TT project may influence the roles performed by private consultants. This research contributes to a deeper understanding of the evolving nature and significance of private consultants as intermediaries in technology transfer.

Keywords: technology transfer, innovation, intermediary, private consultants.

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1 Introduction

The fields of innovation systems (IS) and technology transfer (TT) have received increasing attention in recent decades, leading to a growing body of literature. However, the dynamic nature of markets, especially when viewed through an open innovation lens(Chesbrough, 2003), adds complexity to the innovation process. This complexity is further compounded by the recurrent emergence of new market needs, agents, and mechanisms within the IS, which have created new gaps that private innovation management consulting firms see as market opportunities for selling specialized and knowledge-intensive business services (KIBS).

Within the context of open innovation, various players, including suppliers, clients, competitors, research institutes, universities, consulting firms, and other public organizations, tend to work together combining the value of playing distinct roles. TT stakeholders constantly seek access to

external information and knowledge, which is facilitated by the growing involvement of innovation intermediaries. These intermediaries maintain networks, source market intelligence and technology knowledge, and facilitate access to other players and funding programs (Chesbrough et al., 2006; Čučković & Vučković, 2019).

Innovation intermediaries play a critical role in the innovation process by serving as mediators or brokers between two or more parties, providing knowledge, brokering negotiations and contracts, mediating within networks, building project consortiums and partnerships, advising and consulting, obtaining funding, and monetizing innovation outcomes (Howells, 2006; Silva et al., 2018). Private players such as consultants and KIBS have professionalized the intermediation role and sold it as a specialized value-added service. The increasing growth in the number and range of these intermediary players within the systems has led to their recognition as too significant and too wide to be ignored by the system (Dalziel, 2010; Dalziel & Parjanen, 2012).

The role of innovation intermediaries in technology transfer has been explored by several authors, with different typologies of intermediary organizations/entities having different roles that cannot be compared (Agogué et al., 2017; Howells, 2006; Pinto et al., 2015; Silva et al., 2018). The Portuguese national innovation system (NIS) is mainly governed by public and academic entities, but there has been a multiplication of private consulting firms operating in it, providing a wide range of services to businesses from a market pull perspective (Jun & Ji, 2016; Laranja, 2009). These private consultants have been positioning themselves as unofficial innovation intermediaries within the NIS, with their role and positioning when participating in TT projects (Basu & Taylor, 2010; Bessant & Rush, 1995; Costa et al., 2021; Tether & Tajar, 2008).

The literature on innovation intermediaries focuses on various mentions and approaches to the topic. However, consultants who see themselves as innovation intermediaries tend not to be the focus of research and publications. The increasing number of consultants with this role emphasizes their importance in innovation policies and systems (Klerkx et al., 2015). Nevertheless, there is still a lack of depth in the literature regarding an understanding of what "technology transfer intermediation" is and the real role and positioning of these key intermediary agents within the innovation system (Howells, 2006; Silva et al., 2018).

Following a clustered framework of roles to be performed by an innovation intermediary during a TT process, a statistical analysis was conducted on a sample of 219 TT projects in which a case study consultancy firm had intervened. The study aimed to identify the key intermediary roles played by the case study consultancy firm and how these might be influenced by the client organization responsible for their involvement in the TT project.

2 Related Work

2.1 Innovation Intermediaries

In the traditional and linear TT literature, up to the 90s, the mention of an intermediary commonly aims to depict a public or academic institution formally responsible for performing the intermediary role in support of the TT processes. These public and academic institutions are traditionally connected to universities and research centres as knowledge sources, providing a layer of intermediary brokerage to interact with the industry (i.e., companies).

Literature greatly focuses on traditional (public) types of intermediaries, such as Technology Transfer Offices (TTOs), responsible for supporting and intermediating technology transfer and other aspects of the commercialization of the research that takes place in the university (Baglieri et al., 2018; Motta et al., 2017; Rocha & Romero, 2012); and Technology Interface Centres (TICs), newly created hybrid entities (i.e., semi-public) that serve as an intermediary link between higher

education institutions and companies. TICs are dedicated to valuing R&D results in the form of new products and services, mostly through technology transfer (Meyer et al., 2003; Prud'homme et al., 2018; Rocha & Romero, 2012).

However, some new kinds of organizations playing key roles as intermediaries have begun to emerge in the literature, with private entities (companies) being one of the least researched and depicted intermediary types, despite their increasing role as innovation intermediaries. Examples of such entities include Business Accelerators (Becker & Gassmann, 2006; Etzkowitz, 2002); Industrial Associations (Watkins et al., 2015), Venture Capitals (Papagiannidis & Li, 2005; Sung et al., 2003); Patent Attorneys (Li et al., 2015); Consulting Firms (Cesário et al., 2015; da Costa et al., 2021); and other types of Knowledge Intensive Business Services (KIBS) (Muller & Zenker, 2001; Shearmur & Doloreux, 2019), which perform a diverse and varied set of TT intermediary roles, including scanning and information processing, gatekeeping and brokering or even direct support to marketing and commercialization (Howells, 2006).

2.2 Defining the Intermediary's Role

In the literature, authors mostly tend to agree that the intermediary's role in innovation and TT is far more complex than just "mediating" or "brokering" - the most highlighted intermediation roles in TT literature. For instance, Howells (2006) made a significant contribution to the innovation intermediary literature by presenting a comprehensive study in which he compiled, systematized, and shed new light on ten activities that innovation intermediaries can undertake and why they are becoming key agents in IS, namely: 1) Foresight and diagnostics; 2) Scanning and information processing; 3) Knowledge processing and combination/recombination; 4) Gatekeeping and brokering; 5) Testing and validation; 6) Accreditation; 7) Validation and regulation; 8) Protecting the results; 9) Commercialization; and 10) Evaluation of outcomes.

Several authors have adopted Howells' framework proposal on the activities that intermediaries undertake in both innovation and TT (Kanda et al., 2018), seeking also to complement and add new roles and activities to the existing framework. Based on the widely accepted contributions of Howells (2006), Soares et al. (2020) gave new literature contributions on the TT intermediaries and their roles, activities, functions, and responsibilities, compiling it into a framework list of 13 roles (Table 1). This framework poses as a synthesized, yet updated set of roles an intermediary agent might undertake when involved in a TT process. Each of the roles clusters in itself a wide set of related responsibilities, functions and designations variations that might be used in the literature.

Table 1. The thirteen roles of Innovation Intermediaries.

Specializations	Description
Policy & Strategy (PS)	Support and lobby policymakers in the development and implementation of regional, sectorial, or national-wide innovation policy strategies, providing a connection to government and public entities in matters of innovation.
Mediation & Mobilization (MM)	Create and coordinate networks and other strategic intermediation platforms, providing neutral grounds to foster collaboration between innovation system's stakeholders and potentiate the mobilization of its key resources.
Knowledge Diffusion & Support (KDS)	Act as a two-way communication channel between university and industry, providing a centralized point of contact to both knowledge diffusion and knowledge support.

Specializations	Description
Funding & Finance (FF)	The focus is to identify and bid to funding opportunities aligned with project needs, or in the due diligence and activities related to the strategic selection and sourcing of public or private financing schemes.
Technology Scouting & Market Foresight (TSMF)	Constantly monitor the technology state of the art evolution, scan and gather information to support innovation decisions and technology procurement. Playing as an input source of market opportunities through strategic foresight activities, such as identifying and diagnosing market trends, industry' needs and innovation challenges.
Design & Idealization (DI)	Support the conceptualization and generation of new project ideas, by assisting in the idealization process contributing with knowledge and creative support.
Brokering & Gatekeeping (BG)	Brokering and gatekeeping technology, R&D results, and intellectual property, arranging and negotiate technology deals between sources and interested recipients.
Project Management & Assessment (PMA)	Assisting with the design, set-up and management of projects properly aligned with defined goals and needs, interacting regularly with key stakeholders from project administration and execution control tasks. Also, since acting as neutral third parties, intermediaries can independently assess and evaluate technology transfer projects performance and its impacts.
Financial and Technical Feasibility (FTF)	Assisting with concept proofing, supplying qualified feasibility analysis, and testing, diagnosing, and evaluating ideas, models, and technologies' prototypes in order to validate and evaluate its potential.
Accreditation & Quality (AQ)	Support in accreditation and standards, providing assistance in technology regulation and arbitration due diligences and through quality processes.
Intellectual Property & Rights (IPR)	Support R&D and technology needs through legal strategies, representing and supporting bureaucratic processes to protect and value intellectual property, rights, and other innovation assets.
Implementation & Knowledge Transfer (IKT)	Be part of the technology transfer and implementation processes fostering the recipient absorptive capacity through knowledge transfer strategies such as the selection and training of specialized workforces.
Marketing & Business Development (MBD)	Bridge and help to sell ready-to-market technology innovations, by assisting in key business activities like marketing research and strategy and after by assisting in the commercialization process. Also, in the case of entrepreneurial technology transfer strategies, being in the form of spin-offs and/or start-ups, it adds up the need for business development support to create, accelerate and grow the ventures.

The conceptualization of the "role" of TT intermediaries is still evolving. This role encompasses multiple responsibilities, functions, activities, and specializations that address the complex needs of TT processes and market failures. While it is challenging to define this role precisely, synthesizing contributions from different authors can help establish a portfolio of key roles and specializations that come close to capturing the essence of intermediary functions.

2.3 Consulting Firms as Private Intermediaries

Private intermediaries, such as consulting firms specializing in management and innovation, have been offering professional services and are emerging as unofficial, and often unrecognized, players in the NIS. Private consulting firms, in particular, have gained recognition as one of the main types of private intermediaries (Basu & Taylor, 2010; Howells, 2006). These firms provide a wide range of KIBS and bring a fresh perspective of "innovation-as-a-service" to the NIS (Pinto et al., 2015). They play a vital role in facilitating TT processes by offering their expertise and acting as intermediaries between companies, academia, and the state. Still, being private organizations with an unregulated role within NIS, these intermediaries and their roles are unresearched and underrepresented in the literature.

The literature on management and innovation consulting showed that consulting firms focus on increasing the value of their services by adjusting them to clients' interests and market needs (Basu & Taylor, 2010; Butler, 2009; Drucker, 1981). Thus, consultants can be the product of client-consultant relationships (Costa et al., 2021; Martinez et al., 2016). Some consulting firms may develop their value proposition on more transversal and managerial roles with more significant potential to respond to a broader market need, while other more specialized consulting firms and KIBS might focus on delivering more niche roles in specific fields and sectors related to knowledge-intensive services (Basilioa et al., 2019; Bianchi et al., 2016; Shearmur & Doloreux, 2019).

However, unlike traditional intermediaries, the roles and specializations of private consultants are not planned and designed by NIS's regulators, nor thoroughly described in the literature. As such, it should be taken into consideration the defining importance of client-consultant relationships in the roles played by private consultants as innovation intermediaries and how these roles can be influenced by their clients.

3 Methodology

3.1 Research Problem

The research gap addressed in this study is the under-researched role of private consultants as innovation intermediaries in technology transfer (TT) projects. More specifically, it is focused on defining and validating the roles these private intermediaries might play from the wide portfolio of intermediary roles depicted in the literature(Soares et al., 2020). Despite their increasing recognition within the Innovation System (IS), private consultants have been somewhat overlooked by most IS and TT literature. This might be due to their for-profit nature and their tendency to adjust themselves to their clients in the most profitable way (Bessant & Rush, 1995; Canato & Giangreco, 2011; Drucker, 1981). Thus, we can hypothesise that private consultant's roles as innovation intermediaries might be influenced by those who hire them.

To address this gap, the research questions for this study are formulated as follows:

- *What intermediary roles do private consulting firms play in TT projects?*
- *Are the roles played by private consultants influenced by their clients?*

3.2 The Case Study

For this study, a case study approach was adopted to gain an insider perspective on the roles played by private consultants in the NIS. A documental analysis methodology was employed as a

non-inferential approach (Morgan, 2022). The documental analysis involved an approach that used content analysis to extract data variables suitable for statistical analysis. The case study focused on a Portuguese innovation consultancy firm with over 25 years of experience and brand recognition in the national market, specializing in SME consulting and publicly funded projects of Strategic and Technology Innovation natures. The consultancy firm under study has a portfolio of 400+ clients, which includes industrial and technology businesses as well as dozens of Portuguese R&D centres and University units. It has over 40 specialized collaborators with backgrounds that range from economics and accounting to distinct engineering specializations, being its main focus in the field of Information and Communication Technologies (ICT), namely those technology advancements focused on digital transformation and Industry 4.0.

3.3 Sample and Data Collection

The sample for this study consisted of publicly financed projects where the case study consultancy firm was involved. Those were related to innovation grants and funds approved in Portugal between 2015 and 2021 (Alexandre, 2021), only selected those in which a concrete transfer of technology was evident. Data from documents and support elements used by consultants in TT project management was obtained directly from the firm archives. The data collection involved analysing project folders, descriptive records, communication records (i.e., emails, CRM), and some direct consultation with project managers whenever it was deemed necessary. A total of 219 projects were included in the final sample.

3.4 Statistical Analysis

The collected data was structured and subjected to various procedures, including data entry, sample descriptive analysis, and statistical tests using IBM® SPSS® Statistics version 28.0. Descriptive analysis was conducted to measure the frequency of each of the thirteen roles proposed by Soares et al., (2020) in Table 1 for each of the 219 TT projects. Additionally, a Chi-square test of independence was performed to determine the association between the roles and the project origin or client.

The decision rule used for statistical tests had a significance level of $p \leq 0.05$. The outputs of the Chi-square tests consisted of minimal distribution tables that allowed for an understanding of the association between variables and the behaviour of the case study consultancy firm with external variables.

4 Results

4.1 Roles performed by the private consultant

The descriptive analysis of the roles performed by the case study consultancy firm in 219 TT projects can be analysed in terms of four perspectives: key roles, common roles, non-significant roles, and non-played roles.

The key roles of FF, and PMA were present in most projects. In addition, TSMF was also a significant role as it was performed in more than 50% of the sample. Other less frequent roles, but performed in more than 10% of the sample, were considered common roles, and include DI, FTF and MBD. The roles of BG, MM, IPR and AQ were performed residually (in less than 10% of the projects) and thus not considered significant. Lastly, the roles of IKT, KDS and PS were not registered in the sample.

The literature predominantly emphasizes traditional roles like Brokering, Gatekeeping, and Mediation as key intermediaries' roles. Yet, the analysis to the case study consultancy firm shown

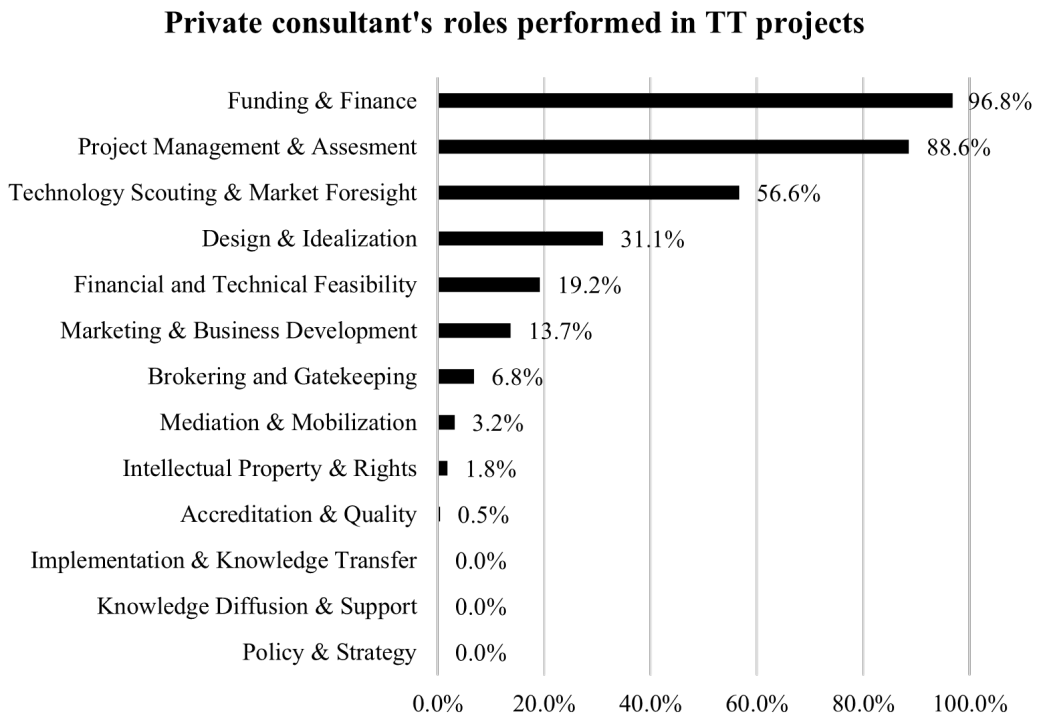

Figure 1. Roles performed by the private consultancy (case study firm) in the sample.

a sample of TT projects much less focused in these more traditional roles, in addition to only performing consistently (>10%) in six out of the thirteen roles analysed.

4.2 The existence of a correlation with the project origin entity

A set of statistical tests was performed to establish a correlation between the roles and the type of organization responsible for the project's inception and the involvement of the private consultant. Four key types of entities were registered in the sample. In 64,8% of the sample the projects originated whether by 1) a Recipient Company; 2) a University or Technology Transfer Office (TTO); or 3) a semi-public Research Centre or a Technology Interface Centre (TIC). In over a third of the sample, the TT project was designed and originated by the case study Private Consultancy firm itself.

Through descriptive analysis of the case study sample, six key roles emerged as the most frequently performed by the private consultancy firm in over 10% of projects: Funding & Finance (FF), Project Management & Assessment (PMA), Technology Scouting & Market Forecast (TSMF), Design & Idealization (DI), Financial and Technical Feasibility (FTF), and Marketing & Business Development (MBD). Consequently, the statistical tests were based on these six key roles, while the remaining seven were considered residual and excluded from the tests.

Table 2. Distribution tables - Intermediary Roles VS Origin entities

	Origin Entity	No	Yes	Qty
Funding & Finance	University/TTO	25%	75%	4
	Research Centre/TIC	10%	90%	10
	Recipient/Company	2.3%	97.7%	128
	Private Consultant	2.6%	97.4%	77
Project Management & Assessment	University/TTO	100%	0%	4
	Research Centre/TIC	80%	20%	10
	Recipient/Company	4.7%	95.3%	128
	Private Consultant	9.1%	90.9%	77
Technology Scouting & Market Foresight	University/TTO	25%	75%	4
	Research Centre/TIC	40%	60%	10
	Recipient/Company	46.9%	53.1%	128
	Private Consultant	39%	61%	77
Design & Idealization	University/TTO	50%	50%	4
	Research Centre/TIC	60%	40%	10
	Recipient/Company	78.9%	21.1%	128
	Private Consultant	54.5%	45.5%	77
Financial & Technical Feasibility	University/TTO	50%	50%	4
	Research Centre/TIC	60%	40%	10
	Recipient/Company	75%	25%	128
	Private Consultant	94.8%	5.2%	77
Marketing & Business Development	University/TTO	50%	50%	4
	Research Centre/TIC	80%	20%	10
	Recipient/Company	82%	18%	128
	Private Consultant	96.1%	3.9%	77

The chi-square independence tests conducted on each of the top six roles, confirmed, in five of them (FF, PMA, DI, FTF and MBD), the existence of a significant correlation ($p<0.05$) between the role performed and the type of organization promoting or originating the project. Moreover, chi-square distribution tables were generated to demonstrate the different origin entities' responses regarding the role performance rate (Table 2). This deeper insight into role disparities and patterns further fuelled discussion of the results.

5 Discussion

According to the literature, the role of innovation and TT intermediary is a multifaceted concept that goes much beyond the traditional roles of mediating and brokering. Based on the conducted case study was possible to confirm the intermediary role of a private consultancy firm as an innovation intermediary within TT projects. Considering the thirteen roles of an innovation

intermediary proposed by Soares et al. (2020), six roles were found to be performed by the case study consultancy firm in more than 13.2% of the 219 TT projects in the sample. Other roles performed in less than 10% of the sample were disregarded as non-significative.

The main role played by the case-studied consultancy firm focused on providing access to financing instruments (i.e., Funding and Finance - 96.8%). Second was the role of Project Management and Assessment (88.58%), which consisted of the managerial support related to the administrative technicalities of handling funded projects within the scope of the national EU-financed Framework Program Portugal 2020. The third key role of the consultant was to set up or complete the project consortium, either upstream with the search for suppliers and technology or downstream with the identification of target markets and companies interested in becoming recipients (i.e., Technology Scouting and Market Foresight - 56.62%). Other roles, less significant but also relevant, were Design & Idealization (31.2%), Financial and Technical Feasibility (19.2%) and Marketing & Business Development (13.7%).

The idea of private consultants adjusting their roles/services to their client's interests is present in the literature (Basu & Taylor, 2010; Martinez et al., 2016). In the case study sample, four categories of entities responsible for originating the TT project with the private consultancy were identified: 1) a Recipient Company; 2) a University or Technology Transfer Office (TTO); 3) a semi-public Research Centre or a Technology Interface Centre (TIC); or 4) the Private Consultancy firm under study itself. A series of statistical tests were conducted on the sample to identify if the roles performed by the private consultancy firm in TT projects were significantly influenced by the type of entity originating the project. The Chi-square tests of independence confirmed the existence of statistically significant associations between five (out of six) roles analysed and the category of the entity that gave rise to the project. This finding could indicate that different entities of the Innovation System could see and value different intermediary roles even within the same private consulting firm.

The consultancy firm under study played a set of six key roles that mostly define its organization's position and value proposition as a private innovation intermediary acting within TT projects. The most prominent role was of Funding & Finance (FF), being performed by the private consultant in 96.8% of the TT projects in the samples. This role shows a higher tendency to be performed in TT projects originated by private entities (either recipient companies or the private consultancy), having been found a statistically significant association between the FF role and the type of entity originating these projects ($p=0.045<0.05$). These results could indicate the FF role importance for TT projects stakeholders, with particular incidence to private entities who see in this role a gateway to a financial incentive to innovation, as private consulting firms such as the case study firm, are particularly well informed to the funding opportunities and how they can be accessed efficiently. In the Project Management & Assessment (PMA) role, a strong association with the type of origin entity was found ($p<0.001$). Thus, in TT projects originated by more traditional and public-related entities, such as Universities/TTOs and Research Centres/TICs, the PMA role was only performed residually by the private consultancy. In contrast, the same role of PMA was performed by the case study firm in more than 91% of the TT projects originated by either the recipient companies or the consultancy firm itself. These results could have different interpretations since on one hand, literature shows traditional intermediaries and related entities such as universities and R&D centres tend be professionally capacitated to manage their R&D, innovation, and TT projects. On the other hand, the high demand from the private market entities might indicate a lack of capacity, resources, or even know-how from recipient companies and at the same time a high interest of the consulting firm to manage the TT project as its intermediary.

Despite over half of the projects in the sample (56.6%) involving the consultancy firm in tasks related to the role of Technology Scouting & Market Foresight (TSMF), no statistically significant association was found between the type of entity that originated the project and the performance of this role ($p=0.605>0.05$). The distribution table shows that projects originating from academia (University/TTO) have the highest percentage of involvement from the consultancy firm in the TSMF role, while recipient companies had the lowest involvement of the consultant playing this role (in percentage). However, there is a low variability in the performance rate of the TSMF role by the private consultancy firm across types of clients/project origins. These results might suggest that the TSMF role is an intermediary role widely recognized and demanded from private consulting firms by different NIS agents within TT projects. This might happen due to the nature of the role itself that provides value in both push and pull perspectives of the innovations, and thus, catering to both ends of the market.

On a different perspective, the role of Design & Idealization (DI), despite being consistently performed in projects originating from academic entities, had more than half of its registered performance (51.5%) in TT projects originated by the private consultancy firm itself (i.e., the case study). Thus, the role showed a significant association with the entities originating the TT projects ($p=0.002<0.05$). This creative role, more directly related to the technology to be transferred, can be tentatively connected with a value proposition offered by the consultancy firm under study who seem to be proactively acting as catalyst of TT projects. Thus, it might be perceivably linked to more academic entities looking to push innovation to the market (Edquist, 2014).

Despite being a role performed in less than 20% of the TT projects sample, the role of Financial & Technical Feasibility (FTF) was found to have a very strong association ($p<0.001$) with the category of origin entity in the tests of independence, making it the second role to exhibit such an association. Moreover, in opposition to the role of PMA, this role was performed by the case study consultancy firm mostly in projects originating from academic entities such as universities and research centres. Interestingly, the FTF role was less likely to be performed in TT projects originated by the consultancy firm itself. From a later enquiry to the case study consultancy firm, a possible explanation for this specific result of the FTF role could be the consultancy firm's internal policy of only supporting ideas, technologies, and projects with high probabilities of success, and thus feasibility tests were conducted before project initiation.

The Marketing & Business Development (MBD) role, performed in just 13.7% of the sample, shows also a statistically significant association ($p=0.005<0.05$) with the type of entity originating the TT projects, being most associated with academic entities and traditional intermediaries such as universities/TTOs and research centres/TICs. The distribution tables resulting from the tests on this role showed its propensity to be performed in a Technology-Push perspective (Edquist, 2014), where academic entities and traditional intermediaries use the private consultancy firm's MBD role to push the technology/product to the market.

Despite the relevance and originality of the results, this paper isn't without limitations as the methodology chosen a path of a highly specific context, within a single case study firm being analysed and thus compromising the transferability and the generalization of its results into the literature. Much can be attributed to the secrecy of the consultancy industry that may be the leading cause of the lack of in-depth knowledge of the private innovation intermediaries within literature. Also, regardless of the considerable sample of 219 TT projects originated by several types of entities, in all projects the same consultancy firm was involved, the one under case study, which could greatly bias both the sampling as well as the findings. Still, this was a conscious choice made. The opportunity to have privilege access to such considerable pool of confidential

information from a consultancy firm highly relevant within the Portuguese innovation ecosystem resulted in a deeper understanding of the subject with more rich results to be discussed and to foment further research in this field.

6 Conclusions

The concept of "intermediation" as a "role" has evolved to encompass a broad range of roles and specializations performed by distinct intermediaries, catering to the specific requirements of innovation and technology transfer processes (Howells, 2006; Intarakumnerd & Chaoroenporn, 2013; Soares et al., 2020; Zajko, 2017). A case study analysis was performed on a private consultancy firm operating in the Portuguese NIS, using a sample of 219 TT projects where the firm was involved between 2015 and 2021. The study aimed to identify what intermediary roles private consulting firms play within TT projects and to verify whether these roles were influenced by the type of entities originating the projects.

Hence, this research contributed to a better understanding of private consultants' roles as innovation intermediaries and their involvement in technology transfer. Private consultants have been previously identified as playing a significant role as innovation intermediaries in TT, despite the limited and scattered literature on this subject (Cesário et al., 2015; Pinto, 2018). The statistical analysis of a case study allows us to identify and validate six key roles in which the private consultancy consistently acted as an innovation intermediary: 1) Funding and Finance; 2) Project Management & Assessment; 3) Technology Scouting & Market Foresight; 4) Design & Ideation; 5) Financial and Technical Feasibility; and 6) Marketing and Business Development.

Moreover, the roles performed by private consultants as innovation intermediaries may be influenced by the type of entity responsible for initiating the technology transfer project. As private, profit-driven entities, private consultants are known in the literature for their ability to create value for clients by continually adapting to profitability considerations (Butler, 2009; Costa et al., 2021). In five out of the six key roles analysed, the independence tests found evidence of an association between the roles performed by the consultancy and the type of entity responsible for initiating the TT project. Only in the role of TSMF – Technology Scouting & Market Foresight, which registered a consistent performance in the sample (56.6%), no statistical evidence was found connecting this role and the origin entity, and thus appear to be transversally valued by every entity originating the TT projects under analysis.

These results aim to be a call for awareness to the current innovation systems that tend to centre the decision-making around the public and academic helixes, underscore that there are private entities such as consulting firms finding and taking economic advantage to unfulfilled gaps by operating as alternative private innovation intermediaries. Other results implications might lead to discussions about the opportunity to involve private entities in more strategic level decision making (e.g., public funding), and the consequent discussion on how these private intermediaries can be regulated under such important role. These findings also contribute to the understanding of the evolving nature of intermediation roles and the significance of private consultants as innovation intermediaries in technology transfer, by identifying and better understanding their specific roles and positioning within the process, as well as the motivations that drive both the consultancy and its clients, from an innovation pull perspective (Jun & Ji, 2016; Laranja, 2009).

Despite the results not being generalized, the study aims to be replicated, generating new insights to expand and compare what is known about private consultancy firms and how their role in the IS may influence the functioning of the IS itself and its performance. Additional future research should also aim to further explore and analyse the dynamics between private consultants and

their clients in technology transfer processes, as well as investigate additional factors influencing the execution of specific roles by private consultants in different contexts. Qualitative in dept research (e.g., interviews) could also bring to the table the insight and experiences from different stakeholders of Portuguese IS, comparing it to more quantitative results and thus complementing them.

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7 References

Agogué, M., Berthet, E., Fredberg, T., Le Masson, P., Segrestin, B., Stoetzel, M., Wiener, M., & Yström, A. (2017). Explicating the role of innovation intermediaries in the "unknown": a contingency approach. *Journal of Strategy and Management*, *10*(1), 19–39. https://doi.org/10.1108/JSMA-01-2015-0005

Alexandre, F. (2021). Avaliação dos incentivos financeiros às empresas em Portugal: QREN 13 (2007-2013) e PT2020 (2014-2018), Working Paper, 10-130. Retrieved from: https://hdl.handle.net/1822/73555

Baglieri, D., Baldi, F., & Tucci, C. L. (2018). University technology transfer office business models: One size does not fit all. *Technovation*, *76–77*, 51–63. https://doi.org/10.1016/J.TECHNOVATION.2018.05.003

Basu, S., & Taylor, R. (2010). Use of Consultants in Technology Transfer Technology Transfer Professionals: Multitasking Gurus From Concept to Commerce: The Consultant's Role. *AUTM (2010) Technology Transfer Practice Manual*, Volume 4, Part 1. Retrieved from: https://www.autm.net/AUTMMain/media/ThirdEditionPDFs/V4/TTP_V4_Consultants.pdf

Becker, B., & Gassmann, O. (2006). Gaining leverage effects from knowledge modes within corporate incubators. *R and D Management*, *36*(1), 1–16. https://doi.org/10.1111/j.1467-9310.2005.00411.x

Bessant, J., & Rush, H. (1995). Building bridges for innovation: the role of consultants in technology transfer. *Research Policy*, *24*(1), 97–114. https://doi.org/10.1016/0048-7333(93)00751-E

Butler, N. (2008). *What Is Management Consultancy?*. University of Leicester, School of Management, PhD thesis. https://hdl.handle.net/2381/4782

Cesário, M., Fernandes, S., Jesus, B., & Monteiro Barata, J. (2015). Sources of Innovation: The Case of Portuguese Consultancy Sector. *Journal of Technology Management & Innovation*, *10*(3), 44–52. https://doi.org/10.4067/S0718-27242015000300005

Chesbrough, H. (2003). *Open Innovation. The new imperative for creating and profiting from technology*. Harvard Business School Publishing,.

Chesbrough, H., Vanhaverbeke, W., & West, J. (2006). *Open Innovation: Researching a New Paradigm* (H. Chesbrough, W. Vanhaverbeke, & J. West, Eds.). Oxford University Press.

Čučković, N., & Vučković, V. (2019). EU R&D Funding as a Way of Incentivizing Innovation of SMEs: A Review of Impacts. *Croatian Economic Survey*, *20*(2), 97–127. https://doi.org/10.15179/ces.20.2.4

da Costa, R. L., Pereira, L., Dias, Á., Santos, J., & Gonçalves, R. (2021). Knowledge and relationship of consultants as key in management consulting industry: The case of Portugal consulting sector. *International Journal of Services, Economics and Management*, *12*(1). https://doi.org/10.1504/IJSEM.2021.113464

Dalziel, M. (2010). Why do Innovation Intermediaries exist? *Paper Presented at the Summer Conference 2010 on "Opening Up Innovation: Strategy, Organization and Technology" at Imperial College London Business School, June 16 - 18*.

Dalziel, M., & Parjanen, S. (2012). Measuring the Impact of Innovation Intermediaries: A Case Study of Tekes. In *Practice-Based Innovation: Insights, Applications and Policy Implications* (pp. 117–132). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-21723-4_7

Edquist, C. (2014). Striving Towards a Holistic Innovation Policy in European Countries - But Linearity Still Prevails! *STI Policy Review*, *5*(2), 1–19.

Etzkowitz, H. (2002). Incubation of incubators: innovation as a triple helix of university-industry-government networks. *Science and Public Policy*, *29*(2), 115–128. https://doi.org/10.3152/147154302781781056

Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research Policy*, *35*(5), 715–728. https://doi.org/10.1016/j.respol.2006.03.005

Intarakumnerd, P., & Chaoroenporn, P. (2013). The roles of intermediaries in sectoral innovation system in developing countries: public organizations versus private organizations. *Asian Journal of Technology Innovation*, *21*(1), 108–119. https://doi.org/10.1080/19761597.2013.810949

Jun, Y., & Ji, I. (2016). Demand-pull Technology Transfer and Needs-articulation of Users: A Preliminary Study. *Procedia Computer Science*, *91*, 287–295. https://doi.org/10.1016/j.procs.2016.07.079

Klerkx, L., Álvarez, R., & Campusano, R. (2015). The emergence and functioning of innovation intermediaries in maturing innovation systems: The case of Chile. *Innovation and Development*, *5*(1), 73–91. https://doi.org/10.1080/2157930X.2014.921268

Laranja, M. (2009). The development of technology infrastructure in Portugal and the need to pull innovation using proactive intermediation policies. *Technovation*, *29*(1), 23–34. https://doi.org/10.1016/J.TECHNOVATION.2008.07.010

Li, C., Lan, T., & Liu, S.-J. (2015). Patent attorney as technology intermediary: A patent attorney-facilitated model of technology transfer in developing countries. *World Patent Information*, *43*, 62–73. https://doi.org/10.1016/j.wpi.2015.08.003

Martinez, L. F., Ferreira, A. I., & Can, A. B. (2016). Consultant–Client Relationship and Knowledge Transfer in Small- and Medium-Sized Enterprises Change Processes. *Psychological Reports*, *118*(2), 608–625. https://doi.org/10.1177/0033294116639429

Meyer, M., Siniläinen, T., & Utecht, J. T. (2003). Towards Hybrid Triple Helix Indicators: A Study of University-related Patents and a Survey of Inventors. *Scientometrics*, *58*(2), 321–350. https://doi.org/10.1023/A:1026240727851

Morgan, H. (2022). Conducting a Qualitative Document Analysis. *Qualitative Report*, *27*(1). https://doi.org/10.46743/2160-3715/2022.5044

Motta, K., Luna, M., Santos, J., & Romero, F. (2017). Uma revisão da literatura sobre transferência de tecnologia. *HOLOS*, *8*, 255. https://doi.org/10.15628/holos.2016.4462

Muller, E., & Zenker, A. (2001). Business services as actors of knowledge transformation: the role of KIBS in regional and national innovation systems. *Research Policy*, *30*(9), 1501–1516. https://doi.org/10.1016/S0048-7333(01)00164-0

Papagiannidis, S., & Li, F. (2005). Skills Brokerage:: A New Model for Business Start-ups in the Networked Economy. *European Management Journal*, *23*(4), 471–482. https://doi.org/10.1016/J.EMJ.2005.06.002

Pinto, M., Brito, C., Dias, R., & Brito, C. (2015). Innovation in services: exploring the role of innovation intermediaries. *Revista Portuguesa de Marketing*, *38*(34), 53–64.

Pinto, M. C. (2018). *Exploring the role of consultancies as innovation intermediaries in services*. Universidade do Porto. Retrieved from: https://hdl.handle.net/10216/121407

Prud'homme, D., von Zedtwitz, M., Thraen, J. J., & Bader, M. (2018). "Forced technology transfer" policies: Workings in China and strategic implications. *Technological Forecasting and Social Change*, *134*, 150–168. https://doi.org/10.1016/J.TECHFORE.2018.05.022

Rocha, A., & Romero, F. (2012). Technology evaluation practices in universities' technology transfer offices. *2012 IEEE International Conference on Industrial Engineering and Engineering Management*, 703–707. https://doi.org/10.1109/IEEM.2012.6837830

Shearmur, R., & Doloreux, D. (2019). KIBS as both innovators and knowledge intermediaries in the innovation process: Intermediation as a contingent role. *Papers in Regional Science*, *98*(1), 191–209. https://doi.org/10.1111/pirs.12354

Silva, M., Howells, J., & Meyer, M. (2018). Innovation intermediaries and collaboration: Knowledge–based practices and internal value creation. *Research Policy*, *47*(1), 70–87. https://doi.org/10.1016/J.RESPOL.2017.09.011

Soares, J., Romero, F., & Lopes Nunes, M. (2020). Innovation and technology transfer: a framework for clustering intermediation roles. *2020 IEEE International Conference on Technology Management, Operations and Decisions (ICTMOD)*, 1–6. https://doi.org/10.1109/ICTMOD49425.2020.9380600

Sung, T. K., Gibson, D. V., & Kang, B. S. (2003). Characteristics of technology transfer in business ventures: the case of Daejeon, Korea. *Technological Forecasting and Social Change*, *70*(5), 449–466. https://doi.org/10.1016/S0040-1625(02)00360-8

Tether, B. S., & Tajar, A. (2008). Beyond industry–university links: Sourcing knowledge for innovation from consultants, private research organisations and the public science-base. *Research Policy*, *37*(6–7), 1079–1095. https://doi.org/10.1016/J.RESPOL.2008.04.003

Watkins, A., Papaioannou, T., Mugwagwa, J., & Kale, D. (2015). National innovation systems and the intermediary role of industry associations in building institutional capacities for innovation in developing countries: A critical review of the literature. *Research Policy*, *44*(8), 1407–1418. https://doi.org/10.1016/j.respol.2015.05.004

Zajko, M. (2017). Open Innovation Intermediaries – Current Roles and Benefits. In *Innovation Management, Entrepreneurship and Sustainability (IMES 2017)* (pp. 1129–1143). Vysoká škola ekonomická v Praze.

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