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Organizational structures for external growth of University Technology Transfer Offices: An explorative analysis

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ABSTRACT

Despite the increasing attention to university-industry technology transfer, limited emphasis has been posed on how the university offices in charge of this task organize themselves to grow. University Technology Transfer Offices (UTTOs) can grow internally, e.g. expanding their staff, or externally, e.g. pooling resources among different UTTOs creating new organizational structures. In this paper we study the latter. Exploiting the opportunity of a specific technology transfer policy introduced in Italy, we develop six in-depth case-studies, encompassing twenty UTTOs. We identify three organizational structures that are adopted by UTTOs to achieve external growth. In discussing antecedents, advantages and disadvantages of each organizational structure, we derive implications for UTTOs' managers and policy makers.

1. Introduction

The important role played by University Technology Transfer Offices (UTTOs) has been widely acknowledged by academic research and practitioners (e.g. Comacchio et al., 2012; Lee, 1996; Siegel et al., 2003). Being responsible for a large amount of knowledge creation, universities play a key role in the innovation systems (Leten et al., 2014; Rasmussen et al., 2006) and UTTOs can be important in bringing such new knowledge to an upper level of economic exploitability (Auerswald and Branscomb, 2003; Barr et al., 2009).

The main efforts in the literature have been directed toward disentangling effective methods and models of University Technology Transfer (UTT) and toward the identification of the conditions and practices under which university-industry technology transfer is effectively accomplished (e.g. Hsu et al., 2015; Siegel et al., 2004; Anderson et al., 2007). In this framework, the effort in trying to identify the specific tasks of UTTOs and the effectiveness of UTT has led to a focus on topics as intellectual property (IP) creation, recognition and evaluation (Jensen et al., 2003; Leydesdorff and Meyer, 2013; Siegel et al., 2003); licensing and execution of IPs developed in universities (e.g. Bray and Lee, 2000; Powers and McDougall, 2005); and the creation of spinoffs and start-ups (Bercovitz and Feldmann, 2006; O'Shea et al., 2005). All these studies have been driven, in particular, by the desire to provide useful insights to practitioners and policy makers and by the desire to understand how UTTOs performances are driven and how to boost them.

Less attention has been paid to the UTTOs as organizations. Even if some scholars suggest that the limitations that UTTOs may have in their operations are largely organizational (Siegel et al., 2007), the majority of the studies have focused on the practices they adopt (e.g., Siegel et al., 2003; Debackere and Veugelers, 2005) or the incentives on UTTO's performance (e.g., Friedman and Silberman, 2003; Link and Siegel, 2005). Few contributions have considered the organizational structures of the TTOs (e.g., Bercovitz et al., 2001; Brescia et al., 2016). Furthermore, among the organizational research about UTTOs, to the best of our knowledge there are no studies focused on understanding the relationships and collaborations that can arise between different UTTOs and their external growth. Most scholars, when adopting an organizational perspective to study UTTOs, have focused on other topics, such as the exploitation by TTOs of their human capital to rise performance (Swamidass and Vulasa, 2009), the importance of having or not an internal UTTO for the diffusion of the knowledge developed inside the university (Bozeman, 2000), the usefulness of having a vertical integrated UTTO rather than to outsource technology transfer activities to more specialized external parties (Fisher and Atkinson-Grosjean, 2002), or the relationships and the organizational forms of UTTOs and the organizational relationships among UTTOs and administrative offices in academia (Bercovitz et al., 2001; Brescia et al., 2016). Even when a focus on organizational structures was used, UTTOs have been mostly considered by scholars as single entities operating in a complex environment composed by firms, governments and academies (Audretsch et al., 2002), avoiding the analysis of the relationships and

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collaborations among different UTTOs. Collaborations can be important for UTTOs because, as their parent universities develop relationships among them, so their TTOs can build connections to share practices, administrative knowledge and routines related to knowledge management. Indeed, in many countries these relationships are maintained through national associations (e.g. the “Association of University Technology Managers” – AUTM - in USA or the “Network per la Valorizzazione della ricerca” – NETVAL - in Italy); other times these connections are direct between UTTOs.

The way in which UTTOs choose to configure the relationships with other UTTOs may affect some important features such as the sharing of knowledge and practices or the possibility to reach a broader array of opportunities, allowing the growth of UTTOs involved in the collaborations.

For this reason, and given the gap in the literature, we aim at answering the following research question: how do UTTOs organize themselves to achieve external growth?

To answer to this question, we explore the organizational forms developed by 20 UTTOs to manage their relationships. We take the opportunity given by a founding program of the Italian Ministry of University and Research, started in 2006, which gave funds to UTTOs willing to organize structured relationships with other university TTOs to grow. We identify three possible external organizational structures that can be created by UTTOs and we discuss them highlighting antecedents, advantages and disadvantages of each structure.

The remainder of the paper is structured as follows. The second section presents the relevant literature about the internal organizational models of TTOs and the reasons and benefits that bring organizations to cooperate. The third section presents the research framework and the research methodology. Then the results section evidences the organizational structures for external growth adopted by UTTOs. The discussion section analyses the antecedents, the advantages and disadvantages of each organizational structure. The last section draws conclusions and implications of this study.

2. Literature review

2.1. The internal organization of UTTOs

Technology transfer's outcome is strongly influenced by an array of organizational practices that are directly linked with the different motives, incentives and organizational cultures that stakeholders involved in this activity have (Siegel et al., 2003). In this vein the organizational structure assumed by UTTOs has a direct impact on the amount of knowledge and on technologies transferred (Brescia et al., 2016).

A first relevant study published on this issue (Bercovitz et al., 2001) analyses the organizational structure of Duke, Johns Hopkins and Pennsylvania State University's Technology Transfer Offices in the USA. In this work, four distinct structures that UTTOs can assume are proposed on the basis of the organizational forms identified in Chandler (1990) and Williamson (1975, 1985) studies on modern business enterprise. Discussing advantages and drawbacks of each form, Bercovitz and colleagues link attributes of organizational forms (as information processing capacity, coordination capability and incentive alignment) to technology transfer outcomes, concluding that the best structure is a semi-centralized one, that is a structure in which the TTO is divided in semi-autonomous divisions, with different responsibilities, that are managed by a central office with high decisional power. They suggest that this could be the best structure because it involves divisional tasks promoting high coordination capability, high information processing capacity and a good incentive alignment among divisions.

The potentiality of decentralized structures (i.e. those in which the tasks are distributed among several distinct units operating autonomously) has been highlighted also by Litan et al. (2007) and by Carlsson et al. (2008), who have focused their attention on IP-management tasks. Litan et al. highlighted that centralized structures (i.e. a structure in

which decision-making and coordination responsibilities lie with a small team of top executives and that can be both functionally departmentalized or not) do not lead UTTOs to be facilitator of technology commercialization, but act as configurations that transform the UTTO in a sort of administrative intermediary that brings the technology a small step closer to the market. Furthermore, they underlined that, even if centralized structures are more effective in managing and maintaining patent expertise, semi-centralized structures have an advantage compared to them since they are more prone to answer quickly and effectively to peripheral needs, thanks to the role exerted by divisions. Another positive feature of semi-centralized structures is that they do not suffer from the problems associated with divisional structures, which are slow and ineffective in finding synergies across divisions¹.

The potential of divisional structures has been described also by Debackere and Veuglers (2005) who argued that a specialized and decentralized Technology Transfer Office within the university is instrumental to ensure a sufficient level of autonomy for the development of relations with industry. This is also useful to avoid conflicts of interests among the missions of the modern entrepreneurial universities: teach, research, commercialize (Etzkowitz and Leydesdorff, 2000).

Another key-role in organizational studies is played by the governance of TT activities. These can be directly in the hands of the university (through internal UTTOs) or in the hands of third external parties (the TT management is ascribed to specialized societies that manage the TT activities for several customers). This organizational dualism has been described by Fisher and Atkinson-Grosjean (2002), who analysed TTOs' structure in Canada. The authors individuated two models of TTO: an internal model, where the office is fully integrated into the university's structures, and the external model, where the office operates outside the university either as a non-profit or a for-profit corporation. Moreover, even if the large majority of TTOs are internal (according to Thursby et al. (2001)), only the 15% of U.S. TTOs are external and only the 4.8% are for-profit.

A further classification of organizational TTO's models, based on the analysis of some European experiences (Campbell et al., 2007), adds to a binary subdivision (internal vs external) a hybrid structure composed by an internal TTO and some external organization. The former has the main objective of supporting research and development in addition to technology and knowledge diffusion; while the latter is focused on specific scientific fields that are more flexible and that have as first objective income generation.

In the end, organizational structures of UTTOs mainly depend on two predominant choices that universities have to make: the first is to keep the TTO internal or external to the university; the second is about which organizational structure confer to the office.

2.2. The external growth of UTTOs

While internal organizational settings of UTTOs have received some attention in the literature (e.g. Siegel et al., 2003; Dill, 1995; Friedman and Silberman, 2003), external growth of UTTO appears to be an almost completely underdeveloped topic.

External growth of UTTOs happens when two or more offices decide to cooperate and to collaborate to achieve one or more purposes that they have in common. Such collaborations are not strictly linked to the achievement of a particular objective, but may be based on other reasons, such as the willingness to exchange practices, to share critical resources on specific tasks, or to exploit opportunities far from the core domain of competences of UTTOs involved in (e.g. the licensing of a technology developed in the university which is not properly belonging to its core domain).

¹ Kono and Clegg (2001) and Legerer et al. (2009) to describe the semi-centralized structure and the centralized structure use the terms hybrid divisional structures and pure divisional structures.

Exception made for some notable works (Bradley et al., 2013; Park et al., 2010), cooperation and collaboration in technology transfer have been scarcely analysed by previous literature. In their work, Bradley et al. identify collaborative technology transfer as an experimental practice. Bringing as explanatory examples three cases of collaborations that have developed legal and technical infrastructures to engage in knowledge sharing (Creative Commons, GreenXchange and the Sustainability Consortium, built by Arizona State University and the University of Arkansas), they argue that “[...] collaborative models are better suited toward the transfer of knowledge than on of physical inventions” (p.63), emphasizing that collaboration in TT should be built at the level of TTOs.

Park et al. (2010) concentrate their attention on a specific case of collaboration among public research institutes (PRIs) in South Korea. In their paper, they explore the effectiveness, the key motivations, the facilitators, the challenges and the barriers to TT consortia among PRIs. To gather information on this, they surveyed 34 members of five regional consortia concluding that: effectiveness of TT consortia is realized through proactive participation of consortia's members; well trained and skilled professionals in TTOs, as well as personal motivation of involved people, are fundamental to the success of TT consortia; effective learning systems are essential to attract and retain members.

Extending the arguments above, external growth can be an interesting strategy for UTTOs. First of all they can achieve economies of scale and cost reduction (Park et al., 2010). Moreover UTTOs organizing together to achieve external growth may obtain non-financial benefits as the sharing of administrative, managerial and practical knowledge, or the diffusion of a culture promoting and fostering technology transfer. Moreover, while a scarce debate has been built on this topic in the technology transfer literature, the reasons behind the choice to undertake external growth's paths by UTTOs can be inferred by management literature and by the literature about firms' alliances.

Firms are usually prone to alliances in response to the necessity to gain access to other organizations' capabilities, supporting focused and intensive exploitation of existing capabilities within each organization (Grant and Baden-Fuller, 1995; Nakamura et al., 1996).

Organizations usually evaluate two important and independent features before entering into alliances: relationships and performance (Das and Teng, 1996). Relationships are linked with the risk of failure of the alliance and are implicitly evaluated by organizations in terms of how much the cooperation among partners will go smoothly. Performance, on the other side, is related to the likelihood of achieving strategic goals at the basis of the alliance. While for TTOs the performance of the collaboration may arrive as a second order objective, relationships represent a primary condition when TTOs decide to pool resources together. This is because through relationships building and maintenance, it may be favored the transmission of tacit and explicit knowledge (Dhanaraj et al., 2004) that represents one of the primary objectives of many cooperation.

Other reasons at the basis of organizational alliances are represented by the possibility of participants to reach valuable economies of scale and economies of scope (Grant and Baden-Fuller, 2004). Economies of scale are represented by a cost advantage due to size, output or scale of operation (Chandler and Hikino, 2009), while economies of scope are based on the advantages due to the common and recurrent use of proprietary know-how or of an indivisible physical asset (Teece, 1980). These two economic advantages may be particularly desirable for UTTOs. Since alliances are used to lower scale problems in knowledge management (in the case of TTOs, small universities, in particular, face this problem), cooperation in managing knowledge may favor reaching high valuable economies of scale. Moreover, even economies of scope may be reached by TTOs since alliances may favor cooperation with other UTTOs in learning and in adding other specific tasks keeping the use of the same physical asset.

3. Methodology

3.1. Research design

Given the scarce amount of literature related to the external growth of UTTOs, this research has been designed to analyse external organizational structures for technology transfer created by universities through the use of case studies. Case studies are particularly adequate to this purpose since the external growth of UTTO represents a contemporary phenomenon established in a real world-context, in which the boundaries between phenomenon and context are unclearly marked (Yin, 2009). Moreover, according to the explorative aim of this research, we approach the exploration of this issue through a multiple-case study (Yin, 2009). Multiple-case studies provide good support for theory building (Yin, 2009) and allow comparisons that clarify if an emergent finding is idiosyncratic to a single case or consistently replicated by several cases (Eisenhardt, 1991). Moreover, multiple cases can be used to shed more light on a phenomenon clarifying relationships and logics among constructs (Eisenhardt and Graebner, 2007).

In this work we adopt as unit of analysis each single new external organizational structure of Technology Transfer between universities, thus introducing the opportunity to study both the organizational structure and their constituent universities. In so doing, we design an embedded multiple-case study to analyse the phenomenon. This is to give more robustness to our results testing their validity in different conditions (e.g. different kind of universities, different past experience in Technology Transfer) providing more insights compared to those that would have arisen from the use of a single case (Yin, 2009).

To explore our research question, as explained in the following, we exploit the opportunity given by a public call promoted by the Italian Ministry of Education, Universities and Research (MIUR) aimed to foster the creation and the external growth of UTTOs in 2006.

Benefits of government instruments in supporting commercialization of research who is developed by universities has been acknowledge by past studies (e.g. Rasmussen and Rice, 2012). In particular it has been shown that such projects provide funds who help universities in developing commercialization activities and professional expertise in technology transfer (Rasmussen, 2008).

3.2. Research setting: the TT Italian context in 2005–6 and the MIUR project

In 2006, in Italy, slightly more than half the universities had established a TTO (Netval, 2007). However, in those years, it started to emerge awareness about the necessity to manage the large portfolio of knowledge existing in universities. Most of the Italian UTTOs, at that time, were young: over the 90% of UTTOs active in 2007 were built between 2000 and 2006 with more than 50% of them between 2004 and 2006 (Netval, 2007). They were characterized by a low specialization of work and limited resources: the average number of UTTOs' employees was 3,9 and the average annual budget was 195 k€ (Netval, 2007). Furthermore, at that time, most Italian UTTOs had broad scopes: they were responsible both for spin-offs support and for managing intellectual property and licensing (Muscio, 2010). In that way, they faced hard challenges due to the many contemporary activities to be learnt and to be managed, combined with a scarcity of resources.

In this context, the MIUR decided to launch a public call to foster the creation and the external growth of UTTOs. With the *Avviso n. 527 of 18 May 2005*, coherent with the *Ministerial Decree of 5 August 2004 n. 262*, the MIUR opened the call “*Industrial Liaison Office support*” (“MIUR call” in the following). The objective of the call was twofold: to enhance systematic relationships between UTTOs and local SMEs and to foster the birth of new UTTOs and adequate cooperation among different UTTOs.

Among the 87 Italian universities, 18 consortia among universities had been proposed to answer the call. Twelve of them have been

selected, by an evaluating committee created by the Ministry, and funded.² Each project was coordinated by a leader university. In total 43 universities were involved. The total amount of funds granted by the MIUR was around 5.8 million of Euro. The maximum length of the projects could be 30 months and at least 30% of the entire amount associated with each project had to be funded by participants' universities.

3.3. Cases description and selection

The case analysis has been divided in two phases. To examine in depth the dynamics of external growth of UTTOs we had to focus on a limited but significant number of cases. But to select the cases for this detailed analysis we had to examine first the characteristic of the whole population of cases, i.e. of the 12 accepted projects.

Thus, as first step in our research, we mapped all the 12 projects funded by *MIUR call* to have a comprehensive understanding of the entities involved. In doing this, we looked at general descriptive data encompassing the geographical location of each UTTO, the number of students enrolled in each university as well as the dimension of the academic teaching body. We also looked at some specificity of technology transfer offices. In particular we took into consideration the number of people that each university had involved in the project and the UTTOs' organizational structure before the start of the project. In doing this last classification we adopted the taxonomy introduced by [Brescia et al. \(2016\)](#) which distinguishes the structure of university Knowledge Transfer Office (KTO), identifying six categories of KTO according to the fact that the office is managed internally by the university (*I-SINGLE*, if all the activities are managed by a single office; *I-MULTI*, if the universities have two or more offices to manage different TT activities), by an independent company outside the university (*E-SINGLE* if the activities are conducted by a single external company; *E-MULTI* if the TT activities are managed by two or more different companies; *E-JOINT* if the TT activities are conducted by a company shared among multiple universities) or incorporates simultaneously both an internal and an external structure (*MIXED FORM*). Referring to the structure of the UTTO, it can be immediately noticed that the predominant orientation of these universities is to keep the TTO internally rather than giving in to external parties its tasks. There is a marked preference to have single structures (*I-SINGLE*, roughly 60% of the total) rather than multiple structures (*I-MULTI*, roughly 20% of the total) for those universities more active in TT, while about the 20% of our sample does not have any TTO formalized at that moment (*NO UTTO*). All these data provide a representative picture of the TT status in Italy in 2006: a system that was still developing in terms of TT.

A comprehensive list of the 12 projects funded and their characteristics is presented in [Table 1](#).

After that, we analysed the specific aspects relative to the *MIUR call*. The total investments related to *MIUR call*' projects ranged from about 500.000 Euro to 1.500.000 Euro (*Budget Total*). The number of universities belonging to each project also varied significantly from two universities (as in the case of *STRETTO* and *A24i*) to four (e.g. *UNIVERSITAS*, *ILONET*). Also the number of people involved in *MIUR call*' projects (*People Involved in the Project*) by each university was very heterogeneous and did not seem to follow a linear relation with the

human resources available in each university.

At the end of this first phase of analysis of the twelve projects, we identified the cases to be considered for our in depth analysis. We selected cases with the aim to gather the maximum generalizability possible from our analyses ([Eisenhardt, 1989](#)). To this point, given the limited number of cases that could be analysed, we gave more importance to polar situations ([Pettigrew, 1990](#)). This is due to the explorative nature of our research in which we aim to identify and analyse the different structures that UTTOs use to achieve external growth. We chose cases using a judgement sampling ([Marshall, 1996](#)) and in particular we adopted the maximum variation technique ([Patton, 2005](#)) in order to capture and describe the central features and principal outcomes cutting across the *MIUR call*. We adopted this technique since it gave us the advantage of detecting common patterns emerging from great variation helping us to capture the core experiences, central and shared aspects and impacts of the *MIUR call* ([Patton, 2005](#)). Drawing from the literature we identified three characteristics that are prominent in determining the activities of UTTOs and, based on this premise, we maximized the heterogeneity of our sample to capture the central aspects characterizing the organizational structures created. First, we identified the geographical location of the universities adhering to the different consortia. This feature is relevant since Italy is characterized by large inequalities in the industrial environment according to the different geographical area ([European Commission, 2010](#)). In this vein it is straightforward to expect that university-industry collaborations could be easier and more developed in areas where the industrial ecosystem is characterized by superior growth and dynamism. In the specific case of Italy, these conditions are more likely to manifest in the Northern regions rather than in the Southern regions. Therefore controlling for the geographical area where universities are established enabled us to avoid selecting only universities (and UTTOs) located in the more developed area. Moreover, geographical location may play a key role also in shaping the relationships between organizations ([Knoben and Oerlemans, 2006](#)), and specifically between the universities adhering to the consortium since closer universities may have a different type of engagement in the consortium compared to farther universities.

Second, we identified the dimension of the universities adhering to the different consortia (in terms of students and academic body) as another relevant variable. Since previous research has evidenced “x-inefficiencies” in transferring knowledge from UTTOs to firms due to scale problems that are related with the broad specialization of larger universities (e.g. [Chapple et al., 2005](#)), we took into account the dimension of universities as a key variable in selecting our sample. Larger universities with a broader specialization may be motivated in creating a consortium with a specialized university in order to exploit its specific knowledge in a specific domain. At the same time both large and small universities may be incentivised in entering a consortium to create economies of scale in transferring knowledge to firms.

Third, the previous existence of a TTO in a university and its structure has been considered in choosing the cases. Indeed, the previous existence of a TTO represents a key variable that may affect the consortium and how it will be organized. Moreover, the internal structure of the TTO may have an impact on how the consortium will organize according to the fact that the TTO is internal or external, or that it is composed by a single office or by multiple offices ([Brescia et al., 2016](#)). This may be because the coordination system needed between two UTTOs with multiple offices may be different from the coordination system needed between two UTTOs with a single office.

Our final sample for the in depth analysis was thus composed by six projects (*UNIVERSITAS*, *NUOVO ILO*, *NOVA*, *TTP*, *ILONET* and *STRETTO*) involving twenty participant universities. The heterogeneity we were looking for is well reflected by the final sample according to the parameters identified above. *TTP* and *NOVA* are for instance consortia of universities which are geographically close, *UNIVERSITAS* and *NUOVO ILO* mix some close universities in the north of Italy with some

² The 12 funded projects have been selected by an ad-hoc committee designed by the Italian Ministry of University and Research. Unfortunately, no public documents are available regarding the decision to fund a project instead of another one, as well no information are provided regarding the six projects not funded. Anyway, the major universities active in Italy in 2006 are largely included within the projects funded: 21 of the 23 Italian universities included in the Academic Ranking of World Universities of 2006 ([ARWU - <http://www.shanghairanking.com>](#)), and one internationally leading business school, are among those funded (only the University of Parma and the International School of Advanced Studies are listed in the ARWU ranking of 2006, but are missing among the universities winning the MIUR Call). This suggests that the most relevant universities have been funded by the MIUR Call.

Table 1

Overview of the 12 projects funded by the MIUR.

Source: Authors' own elaboration on multiple data sources.

	Acronym of the project	Budget		Universities involved	Organizational structure of UTTO before the project	Main features of universities		
		By MIUR	Total			Professors	Students	People involved in the project
1	UNIVERSITAS	573.307 €	914.289 €	University of Milano Polytechnic of Milano BOCCONI University	I-MULTI I-MULTI NO UTTO	2.427 1.395 212	50.289 25.519 8.588	5 3 32
2	NUOVO ILO	487.611 €	978.800 €	University of Calabria University of Padova University of Perugia University of Pavia University of Trieste	I-SINGLE I-MULTI I-SINGLE I-MULTI I-SINGLE	848 2.381 1.270 1.103 873	29.042 49.415 29.282 18.715 15.866	8 4 9 3 9
3	NOVA	345.000 €	510.000 €	University of Siena School of Saint Anne of Pisa University of Firenze	I-MULTI I-SINGLE I-SINGLE	1.056 67 2.179	16.261 n.a. 51.379	4 3 9
4	TTP	454.000 €	1.000.000 €	University of Torino University of Piemonte Orientale Polytechnic of Torino	I-SINGLE NO UTTO I-SINGLE	2.217 396 890	54.452 8.589 18.442	n.a. n.a. n.a.
5	ILONET	1.154.608 €	1.735.000 €	University of Sassari University of Milano Bicocca University of Cagliari University of Genoa	NO UTTO I-SINGLE I-SINGLE I-SINGLE	718 922 1.184 1.597	13.717 24.764 30.538 30.410	5 5 5 5
6	NILO-PUGLIA	1.060.000 €	1.540.000 €	University of Bari Polytechnic of Bari University of Foggia University of Lecce	I-MULTI I-SINGLE I-SINGLE NO UTTO	1.906 355 ^a 289 721	54.766 10.545 ^a 10.267 27.200	30 11 8 22
7	UNISCO	560.000 €	800.000 €	University of Sanno di Benevento University of Udine University of Napoli II University of Sissa-Trieste	I-SINGLE n.a. NO UTTO NO UTTO	180 ^a 718 986 ^a 59	7.718 ^a 16.233 27.925 ^a n.a.	15 20 99 14
8	UNImpresa	805.000 €	1.150.000 €	University of Bologna University of Modena & Reggio Emilia University of Ferrara University of Camerino	I-SINGLE I-SINGLE I-SINGLE I-SINGLE	3.092 775 678 155	91.884 16.995 16.188 9.121	12 7 11 10
9	PROVARE	560.000 €	800.000 €	University of Palermo University of Catania University of Napoli "Federico II" University of Roma "Tor Vergata"	I-SINGLE I-SINGLE I-SINGLE I-SINGLE	n.a. 1.591 n.a. 1.379	n.a. 62.410 n.a. 31.385	60 60 14 4
10	Industrial Liason Network	490.000 €	700.000 €	University of Salerno University of Cassino University of Molise University of Tuscìa	NO UTTO I-SINGLE I-SINGLE I-SINGLE	907 330 ^a 289 318	38.420 11.689 ^a 9.326 8.422	10 4 9 3
11	A24i	450.000 €	750.000 €	University of Roma "La Sapienza" University of L'Aquila	I-MULTI I-MULTI	4.653 631	139.358 19.269	n.a. 4
12	STRETTO	483.278 €	776.000 €	University of Reggio Calabria University of Messina	I-MULTI I-SINGLE	297 1.397	9.391 31.536	n.a. 25

Data are referred to 2006.

^a Data referred to 2007.

other farther in the south of Italy, while ILONET is composed by universities which are quite far one from the other (spread among northern and southern regions). Regarding the dimension of the universities involved in terms of students and academic body we selected consortia combining large universities and small universities (e.g. STRETTO); large, medium sized and small universities (e.g. TTP) and other combinations between medium sized universities, large universities and small universities. We acknowledge that no consortia among small universities have been funded and created. This points out the fact that in the case of the *MIUR Call* the smaller universities tried to participate in a consortium with bigger universities, probably in the attempt of being engaged in relationships allowing to reach a critical mass for technology commercialization. Finally regarding the structure of the UTTOs, since universities in the sample do not exhibit external offices, we selected those cases combining a single structure, with a multiple structure and universities without a TTO (NOVA vs. UNIVERSITAS vs. STRETTO).

3.4. Data collection and analysis

Data were obtained on one hand from interviews and archival documents which had been gathered from UTTOs, and on the other hand from MIUR publications, law decrees and press releases.

In a first phase we submitted to the TTO's managers a questionnaire composed by closed-ended questions and open questions that we used also as basis for our following semi-structured interviews (see [Appendix 1](#)). This allowed us to gather information on the prior history of UTTOs, helping the research team to identify other relevant sources of evidence ([Yin, 2009](#)). We then investigated the prior history of each UTTO and the data from each partnership among UTTOs from secondary sources as press releases. Then we conducted the series of interviews with the TT managers of the projects to let personal perceptions and insights emerge ([Yin, 2009](#)) about achieving external growth through their consortium. The questionnaire helped us as protocol guideline for the semi-structured interviews and it has been built starting from our research question and, where possible, according to the previous

literature (Yin, 2009). For instance some of the questions asked are in line with previous studies on collaborations between TTOs (Park et al., 2010; Bradley et al., 2013) and are related with key motivations of collaborations (questions 1 and 4), challenges (questions 16, 17, 18) and effectiveness (questions 11 and 15).

For each project, all the information collected were structured in a written case, and each case was developed separately by two authors. Then, a third author merged the information and checked for potential inconsistencies among the cases, creating the final written case for each consortium to corroborate evidences. When unclear evidences emerged from the analysis, a second check was made with the informants. This allowed us to increase the internal validity of our results (Yin, 2009). Secondly, we performed a ‘cross case’ analysis in order to reveal any recurrent patterns among the cases and identify the different organizational structures characterizing each project and the contextual factors influencing their organizational choices. In performing the ‘cross case’ analysis we generated a table reporting at the consortia level the main evidence emerging from the different cases and we classified the relevant evidence according to five categories (the configuration of the relationship with other UTTOs, the factors that influenced the creation of the consortia, the aim of the project and the practical objectives that consortia had before the beginning of operations, the actions taken by each consortia and the outcomes). This process allowed us to identify similarities and differences among the cases and, in particular, to analyse them in relation to the different structures adopted by the consortia (Eisenhardt, 1989). We then aggregated consortia in three different categories according to the different structure they adopted. We determined the structure adopted by each consortium from archival data and during the interviews with the informants. First, we identified two different groups, physical organizational structure and virtual organizational structure, according to the existence or absence of a new physical structure common to the UTTOs adhering to the consortium. Then, among the physical organizational structures we identified two sub-typologies of organizational structures according with the fact that the universities adhering to the consortium retained also an internal UTTO or relied only on the newly established office in common with the other universities for TT activities.

4. Results

The interviews and analyses, as previously explained, led us to identify three main organizational structures assumed by the UTTOs to achieve external growth. To distinguish the different configurations adopted we assigned to each organizational structure identified a self-explanatory name. In particular, we identified:

- a Network structure, where the organizational forms of each UTTO are maintained and the single organizations operate together in a virtual manner creating a subset of links between the existing UTTOs of the different universities;
- a Strong Hub structure, encompassing the creation of a new central UTTO which works for all the universities involved in the consortium;
- a Light Hub structure, in which a new central TTO with the functions of a hub is created, but where each university maintains internally some TT activities in a dedicated internal office.

The forms identified are similar to those found in the internationalization literature (e.g., Bartlett and Ghoshal, 1989) as coordinative forms of multinational enterprises (Decentralized Federation, Coordinated Federation, Centralized Hub)³. Indeed, different

types of organizations can resort to external organizational forms to grow and to increase performance. However, our organizational forms have specificities linked to the technology transfer process. For instance, multinational enterprises and University Technology Transfer Offices have few things in common, especially in terms of motives (profit vs non-profit) and dimensions.

The three structures identified and their characteristics are described in the following paragraph and in Table 2, according to the evidences emerged from the interviews. The final paragraph in this section presents the results achieved by these organizational structures.

4.1. Network structure

The network structure (Fig. 1) is created when several UTTOs belonging to different universities develop a structured, formal network in order to cooperate. In this case, each university maintains its own UTTO, in terms of staff, duties and responsibilities. The network has the function to allow the exchange of information, ideas, practices and, especially, of knowledge between UTTOs involved in the network (e.g. the cases of NOVA and NUOVO ILO). The exchange of knowledge is based on discussions about good practices and training of personnel. This configuration is chosen mainly for two reasons. First, it allows to share training courses and good practices. Second, the network structure allows each structure to maintain its own internal organization and its staff. This happens especially in universities that have already developed ties with the local environment (e.g. Polytechnic of Milano), that are physically-located far from each other (e.g. among universities in the NUOVO ILO consortium) or that operate in different knowledge domains (e.g. universities in the NOVA consortium). The relationships among the different UTTOs adhering to the network are mainly maintained through the development of virtual systems and Web-based platforms that allow the sharing of documents and information between participants. This happened for instance in the UNIVERSITAS and NOVA consortia which were configured as networks. Moreover, physical meetings are occasional and are mainly devoted to training events or visits from UTTOs managers to share good practices.

4.2. Strong Hub

The Strong Hub configuration is formed between universities that decide to put together their technology transfer activities to create a new unique office (Fig. 2). This office, the hub, is responsible for all the activities related to technology transfer, managing them for the universities involved.

This configuration is adopted by generalist universities whose research activities are not strictly connected with technological and scientific issues but include also humanistic, social science and other faculties. In fact, in our cases we recognise this form in the projects STRETTO and ILONET where all the universities involved are not focused only on research in technological and scientific domains. We recognise that some universities using this organizational form have never had before a TTO in their university (e.g. University of Sassari). However, the creation of such form is sustainable not only between universities that have never had TT's structures but also between institutions which have already had small technology transfer offices (e.g. University of Cagliari, University of Messina). In this latter case the new

(footnote continued)

where subsidiaries operated in an autonomous way with respect to the headquarter; the Coordinated Federation where the headquarters had a dominant position toward the parent company, especially in terms of resources; and the Centralized Hub, where core activities were retained in the headquarter. Particularly the first and the last structures they identified have similar traits with the Strong Hub and the Light Hub structures that we identified in the context of UTTOs. In the Strong Hub decision are taken autonomously with respect to the universities involved in the hub, while in the Light Hub core activities are usually retained inside the various UTTO's offices rather than in the hub (more discussion about this point is given in §5).

³ Bartlett and Ghoshal (1989) highlight that in the context of multinationals enterprises, firms used three different ways over time to coordinate the headquarter with the different subsidiaries. Those coordination forms were the Decentralized Federation

Table 2
Overview of the analysed cases.

External organizational structure	Project	Universities involved
Network	NUOVO ILO	Leader: University of Padua Others: University of Perugia, University of Pavia, University of Trieste
	UNIVERSITAS	Leader: University of Milano Others: Polytechnic of Milano, Bocconi University, University of Calabria
	NOVA	Leader: University of Siena Others: School of Saint Anne of Pisa, University of Firenze
Strong - Hub	STRETTO	Leader: University of Reggio Calabria Others: University of Messina
	ILONET	Leader: University of Sassari Others: University of Cagliari, University of Genoa, University of Milano Bicocca
Light - Hub	TTP	Leader: Polytechnic of Torino Others: University of Torino, University of Piemonte Orientale

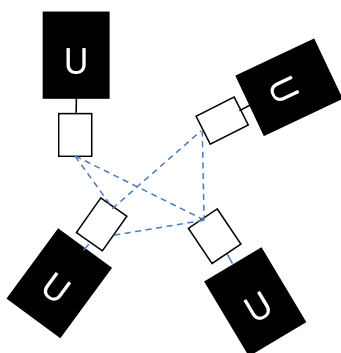


Fig. 1. The network structure configuration.

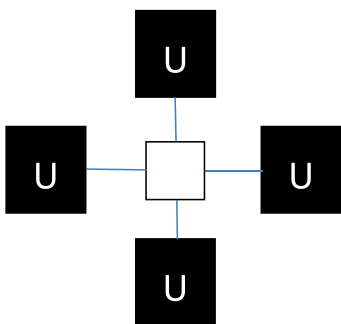


Fig. 2. The Strong Hub configuration.

UTTO is composed by new people hired in the new structure and by some skilled people coming from the old UTTOs of the universities involved. The new UTTO operates managing the intellectual property through licensing, sponsoring research agreements, disclosing inventions and technologies or managing spinoffs development for the universities involved in the hub. This is, for instance, the case of STRETTO where a new UTTO was in charge of such activities for the different universities. This structure allows an efficient management of the technology transfer process, enabling the creation and the spread among participants of knowledge and creating, besides formal collaborations, an informal collaborative structure. This organizational solution was chosen especially by universities that were geographically close (e.g. Sicily and Calabria in the case of STRETTO).

4.3. Light Hub

The Light Hub structure is a hybrid variant of the Strong Hub form and of the network structure (Fig. 3). In this configuration, UTTOs participating to the consortium maintain some functions inside an internal and already developed TTO and externalise some others, creating an ad-hoc office operating for all the universities. When this

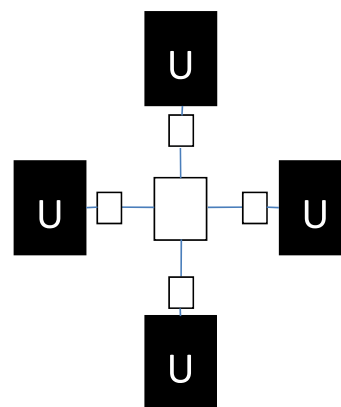


Fig. 3. The Light Hub configuration.

configuration is established, the key resources are maintained inside the UTTO and new resources are put together and shared between all participants through the new office. This kind of structure emerges when some participants of the consortium are skilled TTOs, having already developed some internal capabilities, but are not able to exploit all the possibilities of the technologies possessed (for instance through IP) because of critical mass problems that do not allow the reaching of sufficient economies of scale for the activity. This means that such UTTOs are capable to manage their knowledge portfolio but need to cooperate with other similar structures to reach a critical mass which gives visibility to the knowledge to transfer (especially in the form of IP). For instance this is the case of the TTP project: University of Torino and Polytechnic of Torino, together with the University of Piemonte Orientale decided to create a regional hub in the Piemonte region to achieve a critical mass of exploitable IP. The choice to separate some functions is due to the fact that some universities wanted to maintain the UTTO inside their structure, but, at the same time, wanted to accelerate the technological-diffusion process to grow through the establishment of a new structure dedicated just to some activities. In this case the costs of learning are cut since they are split across multiple organizations, while the economic benefit is maximized since the hub is created to manage only the more problematic operations common to the universities involved.

4.4. Results achieved by the MIUR's projects and their organizational structures

The evaluation of UTTOs is difficult both considering an economic perspective, because it is not their primary objective, and considering the number of patents granted or the number of spin-offs created, as it takes many years to achieve significant results and there are other exogenous factors influencing them including university ownership, academic quality, local high-tech demand conditions, license contract

Table 3
Antecedents, advantages and disadvantages of the three configurations identified.

Configuration	Antecedents	Advantages	Disadvantages
Network structure	<ul style="list-style-type: none"> ● Established UTTOs ● Universities operating in different knowledge domains ● Geographically far universities 	<ul style="list-style-type: none"> ● Internal structure of UTTOs maintained ● Low degree of trust required between universities 	<ul style="list-style-type: none"> ● Exchange only of codified knowledge ● Weak ties among participants
Strong Hub	<ul style="list-style-type: none"> ● Small Universities ● General Universities ● Scarce technological output in each university in the consortium ● Unskilled staff ● Spatial proximity between universities 	<ul style="list-style-type: none"> ● Economies of scale ● Economies of scope ● Sharing of explicit and tacit knowledge 	<ul style="list-style-type: none"> ● Difficulties in the coordination ● Difficult strategic alignment between universities
Light Hub	<ul style="list-style-type: none"> ● Established small UTTOs ● Universities with strategic interests in particular TT activities ● Critical mass problem on some TT activities 	<ul style="list-style-type: none"> ● Economies of scale ● Core TT capabilities can be retained inside the university 	<ul style="list-style-type: none"> ● High commitment of participants ● Duplication of costs ● Competition for resources

design and the characteristics of the University Technology Transfer Office (Di Gregorio and Shane, 2003; Thursby and Kemp, 2002; Thursby and Thursby, 2002; Thursby et al., 2001). This complicates the measurement of the results achieved by the projects and the collaborations among university UTTO analysed in this work. This has emerged also in the interviews, with many managers not confident enough to ascribe the results of their structures to the new external organizational structures. As a UTTO's manager pointed out:

“The number of patents granted is increased from 19 to 51, but I have to underline that the growth is more due to a natural growth of the UTTO than to the interaction between the universities.”
(TTO's manager of University of Trieste)

The larger benefit from the collaborations emerged more in the managerial learning (especially on technical procedures even if the learning process was usually very informal). This was confirmed by the UTTOs managers, with one stating that:

“The collaboration helped increase the efficiency of the management more than the number of contract or patents.”
(TTO's manager of School of Saint Annie of Pisa)

Furthermore, the analyses revealed that ad-hoc infrastructures have been created to corroborate the information sharing among the participants in the consortium. This data sharing was mainly oriented to share data about patents, about spin-off's creation (e.g. procedures, legal documents), and for document sharing. In particular we observed this infrastructure in all the consortiums adopting the network configuration. Moreover, we observed the creation of an informative web site in the case of NOVA, a realization of an interactive portal in the case of UNIVERSITAS, and the implementation of a unified data bank in the case of NUOVO ILO. This explains how knowledge flows were moving from one UTTO to another in contexts where UTTO employees were not working side by side. Conversely, while the UTTOs involved in the network configuration did not signal changes in the organizations of their UTTOs, differences were highlighted by the managers of the other two organizational structures.

They highlighted an increase in the number of resources in the cases of NUOVO ILO, NOVA and UNIVERSITAS and even more significant changes in the case of TTP, ILONET and STRETTO.

In particular the TTTOs of these latter projects underlined that the new external organizational structures allowed their UTTOs to reshape their activity and to be more focused on technological excellence rather than being just technology administrators.

“The new people in the organization have not only strong and specific competences related to management and administration, but are very skilled in particular scientific domains. This is very strategic for us because the technological scouting and assessment is

now done by a real expert”.

(TTO's manager of University of Piemonte Orientale).

5. Discussion

We identified three organizational structures that UTTOs can develop to achieve external growth. A logical question would thus be which one emerged as the best one. Unfortunately, as already apparent in the description of the cases, it is not possible to identify one best option as all structures present their advantages and disadvantages and each structure is configured to work in different contexts. In this vein, it is useful to discuss the contexts where each structure can work better. A summary of the advantages and disadvantages and the antecedents of the organizational structures identified is reported in Table 3 and discussed in the following.

The network structure is an organizational structure suitable for universities that have established TTTOs and are trying to improve and complement their competences rather than to radically learn and adopt new procedures. Indeed this configuration does not entail a direct co-work between the actors involved but mainly the sharing of procedures and codified knowledge. For this reason this organizational structure is also the less demanding in terms of trust among universities. In fact, to be created, trust requires time to be built since it needs a sequence of interactions between actors in which risks and commitments progressively increase over time (Lorenz, 1999). The lack of trustworthiness that can exist among universities makes this configuration more adapt to universities that are geographically far one from the other and to universities that operate in different knowledge domains. However, the network structure is characterized by weak relationships between participants and this feature may lead the network to fail if the results expected do not come soon after the establishment.

This can be viewed as a potential disadvantage in the structure. In fact, since the relationship between the UTTOs is weak and it is not connected with any specific objective, the good working of the network structure is almost left to the commitment and interest of each UTTO.

Another issue of this organizational form lies in the exchange of practices which are embedded in the organizational routines of the different UTTOs (Feldman and Pentland, 2003) and in their personnel: it is very difficult to see the exchange of tacit knowledge between UTTOs organized in the network structure. In fact, tacit knowledge, since it is acquired through direct experience, represents an implicit learning deeply ingrained and embedded within individuals (Shamsie and Mannor, 2012) and can be extracted mainly through direct co-operation, which this organizational form does not envisage. This point is supported also by the fact that, as mentioned above, the largest part of information are transferred thanks to the implementation of virtual systems. In sum, even if specific physical actions are taken to implement

this structure, the network structure can be seen as closer to a virtual network rather than a physical organization.

The Strong Hub organizational structure seems to be an effective structure in overcoming some problems affecting small or generalist universities. Such universities typically have a limited IP portfolio or have to face problems in the creation and management of relationships with firms. Moreover, the Strong Hub is also viable among universities that are characterized by low skills in technology transfer. In this vein, the single physical location of the UTTO allows the creation of a sharing environment in which UTTO's employees may develop competences, routines and knowledge.

The principal reasons, at the basis of why this configuration can be convenient for UTTOs, may be found in economies of scale and economies of scope. Putting together activities, which otherwise would be very fragmented among universities, allows the achievement of a distribution of the fixed costs associated to UTTO's staff and management enabling the reaching of economies of scale. Furthermore, benefits arise also from the number of activities that can be undertaken by the new office: the diversification of activities that is associated to one single and indivisible structure is made efficient thanks to the common and recurrent use of a proprietary know-how (Teece, 1980). This allows a greater control, a greater accuracy and a high repeatability of the processes as well as a reduction of the costs associated with trial and error processes, generating economies of scale. Moreover, this configuration maximizes the effectiveness of TT activities avoiding the duplication of efforts and resources. There is also another benefit directly related to potential evolutions in the TT of a single university in the consortium. In fact the Strong Hub, as aforementioned, allows the sharing not only of the explicit knowledge but also of the tacit one. This knowledge can be in perspective exploited by the university that is willing to create a future internal TTO. However, the coordination of the participants in the Strong Hub configuration can be difficult, especially when universities have different strategic alignments. For this reason and to increase the transfer of tacit knowledge this configuration could be better exploited when the participants are geographically close. Furthermore, since TT activities are strongly influenced by the local industrial environment (Audretsch et al., 2014), the benefits deriving from the hub configuration could be better exploited when the TT operates in the same region of influence of the universities afferent to the hub. Again, this is because the codified knowledge, developed by the TTO and by the local industrial environment, is very space-sensitive (Bathelt et al., 2004) and its exchange depends on spatial proximity between the actors involved.

However, the Strong Hub configuration is not immune from problems and difficulties, especially concerning its management. Since universities may differ in terms of scientific domain covered, long term strategies and quantity of available resources (financial and human), their objectives may be significantly different, originating tensions which are reflected on UTTO's activities. For instance, some internal conflicts may arise concerning the IP management. If three different universities are coupled in the same hub, but only one of them develops biotech and medical IP (which is one of the most profitable activities in terms of licensing; Thursby and Thursby, 2002), it is likely that the effort in licensing will be more directed toward these technologies rather than toward other less remunerative IP and developed by other universities. This is because, even if UTTOs take particular care of their technology-diffusion mission, they are very often evaluated for their performance based on cash for licensing. In many cases, this leads them to overemphasize royalty income (Markman et al., 2005), paying more attention to the value of the technology rather than to its spread.

Apart from these internal conflicts, as the dimension of the technological activity of one university grows, there is an increasing necessity to internalize some TT competences and activities for the university, since it assumes a strategic role in the TT's operations, as well as to develop specific capabilities based on core and strategic tasks (for instance to develop a TT team completely dedicated to follow a specific

knowledge flow developed inside the university). In this vein, the Strong Hub UTTO can constrain the growth of the TT activities of a specific university. The Light Hub structure could be a solution to overcome these limits.

The Light Hub is an organizational structure of TTOs which arises among universities that face problems in achieving a critical mass in some TT activities but that have a strategic interest in pursuing such activities. This configuration solves the problems of economies of scale (in the same way as done by the Strong Hub configuration) but does not force the universities to renounce to their capabilities in some TT areas, sharing them with the other consortium's participants. Such capabilities in fact may be kept inside the university in the internal TTO. On the contrary of the Strong Hub, in this configuration even if the duties of the new TTO are centred on activities that one or more partners do not feel extremely core, the failure likelihood of the project does not grow. This may happen, for instance, among partners which decide to create a structure that has the objective of ramping up the number of research contracts for the universities (e.g. TTP consortium). If one member does not receive any benefit from this activity the structure is reduced by one component but can still go ahead in pursuing its objectives, while the exiting university can continue in his TT activities thanks to its internal TTO (this would not be possible in the Strong Hub since after the exit from the consortium, the leaving university should establish an internal TTO to continue in pursuing TT). Indeed, this configuration requires a high commitment of the participants and leads to some inefficiencies due to the duplication of some costs. The new structure, in fact, requires new resources for dedicated personnel, for facilities and for training. These costs are added to those already spent for the internal UTTO. In addition, sometimes, such resources are duplicated, being present both in the new TTO and in each UTTO creating a sort of inefficiency. Another concern related to Light Hub structures may be the competition that could arise between the hub and universities' internal offices. For instance, the hub may lobby to obtain more resources at the expenses of the internal offices. However, the Light Hub structure appears to be the most effective configuration for universities that have an established but small internal TTO to achieve external growth and can be interesting also for bigger ones which need to extend their portfolio of TT activities. This is coherent with Litan et al.'s (2008) research: the new infrastructure established can be exploited in order to achieve more results both in terms of technological spreading and high speed in marketing technologies, making it very beneficial for the internal UTTO.

6. Conclusions

In this paper we analysed how UTTOs organize themselves to achieve external growth. Drawing on a multiple case study in the Italian context, we analysed six consortia created by twenty Italian universities under the incentive given by the Italian Ministry of University and Research. We recognised that UTTOs can organize themselves with three different organizational structures to achieve external growth: a network structure, a Strong Hub structure and a Light Hub structure. We highlighted that each organizational structure has its advantages and disadvantages. The organizational structure has to be chosen by each UTTO willing to achieve external growth, in accordance with the internal constraints and objectives of its university.

We contribute to literature drawing attention to the concept of external growth of UTTOs and identifying the three organizational structures that can be adopted. We believe that the insights we provided have implications both for practitioners and policy makers. The former can benefit from the analysis about antecedents, advantages and disadvantages of each organizational structure to identify the more suitable structure for their organizations to achieve external growth. The latter, since such external growth processes seem to be effective, may support these strategies through ad-hoc policies.

Being one of the first studies to explore organizational structures for

external growth of UTTOs, this work is not free of limitations. We conducted our study in a specific country-context which is Italy. Although technology transfer activities cannot be separated by the national and institutional context (Kapetaniou and Lee, 2016), Italy may have some specific features that characterize it differently from other countries. Moreover, Italy is not at the frontier for technology and for University Technology Transfer. This means that it could be useful to conduct further analyses in other countries, considering both more advanced ones and less advanced ones, to strengthen the evidences emerged from this research. We used a qualitative approach on a small sample of consortia to discuss the issue and to let emerge evidences since the issue was not bounded in a specific framework and the existing knowledge base was poor (Yin, 2009). Future research could explore possible additional structures that can be used to achieve external growth by UTTOs and could test the validity of the organizational structures identified above with quantitative data and larger samples. This could allow shedding more light on the effectiveness of each organizational structure and providing other useful insights to TT managers in choosing the right organizational structure to achieve external growth.

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Appendix 1. Questionnaire

Questions

1. Which had been the dynamics bringing your university to choose your partners in creating the consortia?
 - a. Social reasons
 - b. Political reasons
 - c. Strategic reasons
 - d. Vision
 - e. Others (please indicate)
2. Did your TTO influenced this dynamics?
 - a. Yes
 - b. No
- 2.1 If yes, in which way?
3. In financing the project, do other external entities (i.e., not related to the university, excluded the MIUR) participated providing money to the consortia?
 - a. If yes which percentage of the total cost of the consortiu has been paid by them?
 - i. Less than 25%
 - ii. Between 25% and 50%
 - iii. Between 50% and 75%
 - iv. More than 75%
4. What have been the factors leading your university to create links with other UTTOs?
- 4.1 Can you please rank them from the most significant to the less significant for your university?
5. When the new consortia was established, which were the shared objectives among participants?
 - a. Identification of best practices
 - b. Creation of a new TTO
 - c. Creation of a collaboration with strong ties (e.g., sharing of resources)
 - d. Creation of a collaboration with weak ties (e.g., to facilitate the sharing of best practices)
 - e. Others (please indicate)
6. How did you manage the IPRs shared between the universities involved in the consortium?
 - a. Specialized personnel of the UTTOs
 - b. External consultants
 - c. Other (please indicate)
7. What was the relationship with the new partners after the consortium was created?
8. Did your internal structure changed as consequence of the new collaboration?
 - 8.1 If yes, what did change?
 9. Which kind of competences did your TTO have before the project was launched?
 10. Which kind of competences do your TTO have now?
 11. How the interaction with the other UTTOs has changed your internal competences?

Please, consider the activities of your TTO.

 12. Which activities were developed internally before the project?
 13. Which activities are developed internally after the project?
 14. Can you argue that there has been a learning process due to the collaboration?
 - a. Yes
 - b. No
 15. Do you perceive an increase in the number of patents, licensing or research contracts due to the project?
 - 15.1 If yes, in your opinion, how much of these increased performance depend on the project and how much to endogenous factors (e.g. natural growth of the TTO, higher stimulus from the university to be engaged in industry relationships)?
 - 15.2 Could you provide us some numbers?
 16. Did you implement mechanisms favouring the sharing of information and enhancing the collaboration between UTTOs?
 - 16.1 If yes, can you describe them to us?
 17. How did you manage the financing of common activities within the consortium?
 18. Did you implement new control mechanisms for the single phases of the TT process?
 - 18.1 If yes, which one?
 - 18.2 If yes, why?
 - 18.3 If yes, with which results?

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