UNIVERSITY OF SALENTO'S TRANSACTIONAL RELATIONS: ASSESSING THE KNOWLEDGE TRANSFER OF A PUBLIC UNIVERSITY IN ITALY

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With 2 figures and 5 tables
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Summary: Salento is an interprovincial area in Apulia (South Italy) formed by the three provinces of Lecce, Brindisi and Taranto. Salento is an economically heterogeneous area that is characterised by large businesses and hi-tech companies as well as a myriad of medium, small and very small traditional manufacturing firms. In this socio-economic framework, the role of the only public university in the area is critical to local development: in the post-industrial era, knowledge transfer is crucial for the diffusion of innovation and competitiveness of regional systems. This work uses a new empirical approach to track the relations between the University and the marketplace to precisely describe the extent to which research performed at the university meets the needs of near and far commissioners. Our analysis demonstrates that the majority of the knowledge produced by a public University remains within the region/local area and that the distribution of clients follows different patterns depending on whether they are public or private entities. Furthermore, through our analysis it has been possible to assess both the intensity (quantity of research) and frequency (number of relations) of transferred knowledge.

Zusammenfassung: Salento ist ein Teilgebiet der Region Apulien (Süditalien), bestehend aus den drei Provinzen Lecce, Brindisi und Taranto. Aus ökonomischer Sicht ist das Salento ein sehr heterogenes Gebiet, das sowohl über Großindustrien und High-Tech Firmen, als auch über eine Vielzahl von mittleren, kleinen und sehr kleinen, traditionellen Handwerksbetrieben verfügt. In diesem sozio-ökonomischen Umfeld ist die Rolle der einzigen öffentlichen Universität entscheidend für die örtliche Entwicklung im postindustriellen Zeitalter. Der Wissenstransfer ist von hoher Bedeutung für die Verbreitung von Innovationen und für die Wettbewerbsfähigkeit des regionalen Systems. Die vorliegende Arbeit nutzt einen neuen empirischen Ansatz, um die Beziehungen zwischen der Universität und dem Marktgeschehen einzuschätzen, mit der Absicht, so präzise wie möglich den Grad abschätzen zu können, mit dem die universitäre Forschung die Bedürfnisse der nahen und fernen Auftraggeber trifft. Unsere Analyse zeigt, dass der Großteil des an einer öffentlichen Universität produzierten Wissens innerhalb der Region bleibt, und dass die Verteilung der Klienten verschiedenen Mustern folgt, je nachdem ob es sich bei diesen um öffentliche oder private Einrichtungen handelt. Zudem ist es durch unsere Analysen noch möglich, sowohl die Intensität (die Menge an Forschung), als auch die Häufigkeit (die Anzahl der Beziehungen) des Wissenstransfers festzustellen.

Keywords: Geography of flows, local development, knowledge transfer, regional geography, Apulia

1 Introduction: The role of universities in local and regional development

The current economic phase is characterised by the international division of labour, outsourcing of labour-intensive activities to developing countries and geography of flows or networks. Consequently, the competition among economic systems and territories in advanced economies is more than ever based on innovation and knowledge (Lundvall 1988; Giddens 1990; Lundvall and Johnson 1994; Bathelt et al. 2004; Castells 2004). Scholars have almost unanimously ascribed the development driver role along with the two traditional functions of education and research to universities (Etzkowitz 1997; Leydesdorff and Etzkowitz 1998). A significant amount of the literature agrees that universities are one of the main actors of technological, institutional and cultural innovation in territorial processes (De Rubertis et al. 2011; Goddard and Vallance 2011).

Scholars who have examined both the role of universities in regional development and the University-Industry (U-I) linkages have privileged the analysis of factors such as «the employment of university graduates in the industry, informal meetings, joint research programmes,

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consultancy works commissioned by the industry and not involving original research, licensing of university patents, purchase of prototypes developed by the industry, etc.» (Giuliani and Arza 2008, 4).

Most of these studies, however, have led to conflicting conclusions and have given rise to non-definitive evidence because of empirical and methodological problems (Lawton Smith 2007). Many scholars have encountered difficulties in acquiring sufficient data for accurately measuring the economic effects of university research and evaluating the related transfer activities (Thanki 1999; Drucker and Goldstein 2007).

In Italy as well as abroad, the majority of studies have considered patenting, licensing and creating academic start-ups as the main contributions of universities for knowledge and technology diffusion (Mowery et al. 1996; Henderson et al. 1998; Chiesa and Piccaluga 2000; Tijssen 2001; Balconi et al. 2004; Franzoni and Lissoni 2006; Fini et al. 2009; Algieri et al. 2013 and so on). These research projects often overlooked other significant factors. We agree with D'Este and Patel (2007) who argued that U-I linkages embrace a broader spectrum of activities than the mere commercialisation of intellectual property rights (Faulkner and Senker 1995; Cohen et al. 1998, 2002; Agrawal and Henderson 2002; Arundel and Geuna 2004) and that too much attention is paid to patenting and spin-off activities, which obscures the relevance of other types of U-I interactions that are equally or even more important in terms of frequency and economic impact.

For example, patenting can be considered a better indicator of the invention activity output (Griliches 1990) than innovation and technology transfer. The use of statistics for patenting is subject to several limits: i) factors such as the historic period, geographical area, size of the company, technological and industrial sector and type of inventor influence the patenting capacity (Sirilli 1987; Furman et al. 2002; Acs et al. 2002; Smith 2005); ii) many important inventions are not patented and many patents refer to mediocre inventions with little commercial value (Lee 1996; Hu and Mathews 2005; Lerner 2004; Buesa et al. 2006); iii) patenting can hide strategic behaviours that inhibit possible competitors; and iv) it is almost impossible to verify whether all patents are actually commercial (Sirilli 2010).

Consequently, unexplored variables appear to be more appropriate to examine the regional economic effects of university activities and to assess the performance of innovation in a specific area (Capriati 2013). The aim of this paper is to precisely add a new element to the intense debate regarding the functions of universities in a regional context by examining the *transactional relations* (i.e. all business contacts such as commissions, contracts, agreements) between universities and those who *use* their research.

We argue that it is possible to reconstruct all university business relations with their clients and, more generally, the external market by collecting and analysing contracts signed by the university departments and natural and legal persons who commissioned consulting services and research. Our approach allows us to measure the technology transfer and knowledge exchange of universities by using a new method. Through this approach, it is possible to evaluate *how* universities meet the territorial needs of innovation and knowledge, and which portion of university research can become innovation and a source of competitive advantage for local firms. This assumption is backed by many management studies that have stressed the role played by clients in the co-production of advanced services and knowledge (Bettencourt et al. 2002; Auh et al. 2007; Möller et al. 2008; Trippl et al. 2009). This means that every research contract involves a certain degree of knowledge exchange.

Furthermore, one of the main novelties of this study is that it brings to light many important findings on a public university in Southern Italy. In fact, this study can be considered to be the first direct and real effort to show some original technology transfer dynamics and to assess where the knowledge produced by a public university ends up in a dynamic, but peripheral, area such as South Italy.

This article will be organised as follows: section 2 explains the data collection and research methodology; section 3 presents an overview of the socio-economic system chosen as a case study (Salento); section 4 focuses on the case study (this section is divided into three sub-sections where both quantitative and qualitative methods are applied); and, finally, section 5 discusses the main results of our study and presents our conclusions.

2 Data collection and methodology

We hypothesise that it is possible to reconstruct all of the university's business relations with its clients and external markets by collecting and analysing the contracts signed by the university's departments and individuals or economic firms. In our opinion, this approach provides us with an important measure to assess the regional economic effects of university research more than other models or hypotheses previously used. The aim of this paper is to precisely evaluate *how* the university meets the territorial needs of innovation and knowledge and to determine which portion of the research performed by the university can become innovation and a source of competitive advantage for local entities. By applying our approach and using quantitative and qualitative analyses, we were able to investigate all of the transactional relations between the University of Salento and its research users.

The University of Salento is a medium-sized university located in Lecce in the heart of Salento, deep south-eastern Italy. We collected the data on contracts signed by the University of Salento and its clients from 2008 to 2012 from the central administration and each department.

We then catalogued the contracts signed by the University of Salento from 2008 to 2012 as follows:

- the proper name or company name of the client;
- the client sector (private or public);
- the financial value of the contract;
- the contract objectives;
- the university department associated with the contract;
- the scientists responsible for the research project from the University of Salento;
- the present status of the contract (closed/in progress).

Furthermore, we used the following parameters to georeference the purchasers, reconstruct the transactional relations and determine the spatial dynamics of the knowledge transfer:

- the home address (individuals) or headquarters (firms) of the client;
- the Italian province or foreign country;
- the Local Labour System (a statistical unit to identify the functional urban areas in Italy);
- the distance from Lecce (the University of Salento's headquarter) of each client calculated using the Google Maps Distance Calculator.

Any research that is commissioned to carry out by the University of Salento is regulated by a specific regulation approved in 2008. This procedure provides a detailed regulation of the type of services for external commissions (contracts or agreements) performed by the various academic structures.

These activities are classified as:

- services associated with a price list, including analyses, controls, calibrations, data processing, tests and experiments (all of the above require an official certificate issued by the university); design and realisation of prototypes;
- research; services; consulting; and educational activities, including R&D activities, analyses, controls, data elaboration, consulting, formulation of scientific advice, tests and didactics (including the organisation and realisation of continuative education courses);
- transfer of the results of the research performed independently by the university.

Commissioned research is the only university activity which is subject to value added tax (V.A.T.). Consequently, this allows scholars to obtain all of the data necessary to apply the previously mentioned approach by simply selecting all of the university's or other public research centre's invoices from a given time interval.

Using simple descriptive statistics techniques and Geographic Information System software, we can determine *where* the academic knowledge ends up and to measure the *impact* of each contract.

Our approach is based on the assumption that a public university (such as the University of Salento) can exploit the results of departmental research in different ways. Knowledge, which represents the most useful result of research for public and private bodies external to the university, is not easy to determine *a priori*. We argue that the market value of each transactional relation (services *vs* contract amount) can reveal if and *how much* interest was gathered by the research performed at the university. Additionally, commissioned research is particularly important because it reveals where the research is used. In other words, with our approach, it is possible to identify *who* uses the knowledge of a specific university (the University of Salento for our case study) and *where* these users are located. This mapping is particularly useful to understand whether the majority of the knowledge produced by a university *remains* within the region/local area or extends to external regions.

Additional authors in the regional sciences used the contracts as a parameter to evaluate the degree to which two places were connected (Rossi et al. 2007; Hanssens et al. 2013). The main novelty of our approach is that we use the amount of the contracts to measure the *intensity* of the knowledge flows between two subjects and two places and their relative degree of networking.

In the current economic phase, technology influences the location of production activities. The spatial topology tends to be formed by hubs and centres (Taylor 2001; Castells 2004), which are both defined by networks. Centres are linked to places with specific cultural and social conditions. Hubs represent the geographic position of important strategic functions, which contribute to building local activities around the key functions of each network. There can be multiple, diverse networks that are not simplistically composed of the infrastructures linking hubs and centres but by the information and knowledge flows travelling through them (Taylor 2001).

By accepting this approach, which is already widely diffused in the geography literature, we admit that commissioned research is the type of knowledge flow linking two hubs and that the amount of each contract is the service value (*intensity*) of the flow itself.

3 An overview of Salento's socio-economic system

Although Apulia is located in a weaker and less developed area compared to the Northern Regions, it is one of the most dynamic regions in Southern Italy, both in terms of the number of enterprises (1 every 12 inhabitants, 6% of the overall number of Italian firms) and the business relations with foreign counterparts (with 5,869 export firms, 2.6% of the overall number of Italian firms) (REGIONE PUGLIA 2013). Apulia is ranked the sixth region in Italy (out of 20) for high-growth companies. High-growth companies are enterprises with at least 10 workers that showed an annual growth rate of workers or turnaround up to 20%, consecutively, for three years (ISTAT 2011). Finally, the GDP of the Apulia Region has more than doubled from 2003 to 2010 (REGIONE PUGLIA and UNIONCAMERE 2013).

The Salento area is a sub-region of Apulia formed by the provinces of Lecce, Brindisi and Taranto. With approximately 1.8 million inhabitants (ISTAT 2011), this area represents 44% of the overall population living in Apulia. The population is distributed as follows (Quarta 2012):

- 816,597 people live in Lecce and are distributed in 97 municipalities. This population is equal to one-fifth of Apulia. Lecce is peculiar as it is characterised by a high demographic density and a low degree of centralisation;
- the population of Taranto is 580,028 (14% of the overall population of Apulia);
- Brindisi is the smallest province in the Apulia Region, with 403,229 residents, which corresponds to 10% of the overall regional population.

Salento's economic framework is characterised by a myriad of medium, small and micro-firms; consolidated local enterprises; and multinational corporations (Tab. 1). All of these firms and industries contribute significantly to the economy of the Apulia Region. There are 114,554 enterprises located in Salento, which is 42.5% of the number of firms in Apulia. Of the firms in Apulia, 57,852 are in Lecce, 32,154 are in Taranto and 24,548 are in Brindisi (ISTAT 2012).

Salento is a diverse region. Most of the large industrial plants are located in Taranto and Brindisi, whereas both large companies and many small and medium enterprises (SMEs) as well as micro-firms are located in Lecce (Pirro and Guarini 2008).

The largest Italian iron and steel producer (the fourth-biggest in Europe), Ilva, is located in Taranto, as is ENI's oil refinery, the Arsenal of the Italian Navy, Vestas, Cementir and Alcatel Alenia Space. Additionally, the economic-production system of Taranto consists of a myriad of SMEs (which often represent the satellite activities of the main iron and steel, petrochemical and marine engineering businesses) and many important building, furniture, textile and agro-industrial firms.

Brindisi, however, is characterised by the presence of many multinational chemical and plastic corporations (Polimeri, Basell, ExxonMobil, Telcom, Sanofi Aventis, Salver, etc.), several multinational aerospace corporations (Avio, Agusta Westland, Alenia Aeronavali) and tens of other small and medium high technology enterprises, which represent satellite activities. In addition, the presence of several multinational energy corporations (Enel, Edipower, Enipower) make Brindisi the most important energy hub in Italy, with an installed power capacity that exceeds 5,000 megawatts.

The biggest plants in Lecce are Fiat-CNH (trucks, agricultural and construction equipment) and Transcom (a Swedish multinational Information and Communication Technology (ICT) corporation). However, the production system in Lecce is mainly

Tab. 1: Salento's economic framework

Province		Manufact. and mining	*Mean*	Building	*Mean*	Wholesale, retail, vehicles repairs	*Mean*	Information and Communic. services	*Mean*	Finance, insurance	*Mean*
Taranto	firms	2,847	11	3,385	3.7	14,299	2.7	472	3.5	821	3.1
	workers	31,323		12,464		38,660		1,663		2,550	
Brindisi	firms	2,206	7.1	3,223	3.1	11,343	2.6	324	2.9	493	3.2
	workers	15,590		9,976		29,278		927		1,560	
Lecce	firms	6,110	4.9	8,306	2.8	24,483	2.5	793	3.2	1,273	3.4
	workers	29,920		23,482		61,234		2,500		4,361	
Overall Salento	*firms*	*11,163*	*6.9*	*14,914*	*3.1*	*50,125*	*2.6*	*1,589*	*3.2*	*2,587*	*3.3*
	workers	*76,833*		*45,922*		*129,172*		*5,090*		*8,471*	

Province		Profess., scientific, technical and administr. services	*Mean*	Real estate	*Mean*	Education, Health and Social services	*Mean*	Other services and activities	*Mean*	TOTAL	*Mean*
Taranto	firms	6,009	2.5	536	1.3	1.968	3.1	1,817	2.2	32,154	3.5
	workers	15,012		712		6.189		3,908		112,481	
Brindisi	firms	3,901	2.4	317	1.6	1,287	2.8	1,454	*2.2*	24,548	3
	workers	9,227		501		3,572		3,209		73,840	
Lecce	firms	9,779	2.0	825	1.5	2,814	2.6	3,469	*2*	57,852	2.7
	workers	19,648		1,230		7,225		6,841		156,441	
Overall Salento	*firms*	*19,689*	*2.2*	*1,678*	*1.5*	*6,069*	*2.8*	*6,740*	*2.1*	*114,554*	*3*
	workers	*43,887*		*2,443*		*16,986*		*13,958*		*342,762*	

characterised by the presence of SMEs, which are mainly involved in the sectors of textile, clothing and footwear manufacturing. Many other SMEs and micro-firms are in the fields of mechanical engineering and building, agro-industrial and tourist industries.

This interprovincial area is characterised by many scientific research centres, which all have direct or indirect ties with the University of Salento.

The University of Salento is the only public university in this interprovincial economic-production setting. It is a medium-sized university located in Lecce (the city where the headquarters are established) and Brindisi. The University of Salento plays a key role in a territory that is characterised by large manufacturing and high technology companies, SMEs and a myriad of micro-firms. In this diversified frame and dynamic but peripheral geographic area, the promotion of innovation led by the local university is critical to the whole social-economic system (Boucher et al. 2003). Such a promotion may occur by building on the university's strengths (also in a business perspective) and through creating new ideas with applicable contents (Lumpkin and Dess 1996; Etzkowitz 2004; Venkataraman 2004).

4 The case-study: summary of main results

From 2008 to 2012, the University of Salento signed 1,591 contracts for commissioned research or for consulting with public or private entities. The overall income of the contracts was more than 10.5 million euros.

Of these contracts, 77.3% were signed with individuals or private enterprises, totalling more than 7.7 million euros (average income per contract: approximately 6,300 euros). The total amount of income generated by contracts signed with public bodies, however, was more than 2.8 million euros. This means that even if the latter type of contract represents only the 22.3% of the total, the average income per contract was greater than 7,800 euros (approximately 1,600 euros more than in the private sector).

The result depended on the fragmentation of hundreds of small services required by individuals or micro-firms. We counted 867 contracts with totals of less than 250 euros. That number increases to 1,186 units if we consider the contracts worth less than 1,000 euros (approximately 74.6% of the total number of contracts). The great majority of these

contracts were in Lecce (64%). This explains the high number of contracts in the province (see Tab. 2). Moreover, if we consider the three provinces of University of Salento's reference area together, the frequency reaches 56%. If frequency is defined by the numerosity of contracts, we can therefore say that the vast majority of transactional relationships are between the only public university in the region and the clients in the provinces of Brindisi, Lecce and Taranto.

4.1 Economic value of contracts and territorial distribution of clients

Using the method described above, we built a matrix containing 1,591 commissioned research contracts that were signed by the University of Salento from 2008 to 2012. We assigned a score of 100 to the overall amount of the services performed by the university. We were able to classify the contracts for each province to create a ranking of the areas made use of research carried out by the university (Tab. 2).

Table 2 shows that if we sum the overall amount of the research commissioned by local private and public entities in Salento, the result is 43. The majority of the commissioned research carried out by the University of Salento *remains* in the local system represented by the provinces of Lecce, Brindisi and Taranto.

The thematic map (Fig. 1) shows the territories where the highest service value is concentrated and reveals not only the *intensity* of the transactional relations but also the areas which have made the greatest use of the research performed by the University of Salento. The service value of Bari (the regional capital of Apulia, 10) and Rome (almost 12.5) are interesting in terms of *frequency* (number of contracts) and *intensity* (value). The result from Rome is mainly due to the presence of large industrial groups and important public organisations.

The service value of foreign demand is 8, the fifth position in the ranking. These clients are distributed in many States, including countries outside Europe (see Tab. 3).

For the foreign commissioners, we aggregated data at country level. The service value of the whole of Germany (3,7) was determined by two significant commissions by Volkswagen. If we consider only the number of contracts, Germany (5 commissions) is preceded by France (40 commissions), The Netherlands (35), Sweden (21), Spain (16), Austria (14), Slovenia and the Czech Republic (8).

Tab. 2: Provincial distribution of the economic value of commissioned research carried out by the University of Salento (2008–2012)

Province	Number of contracts	Value of contracts €	Service value
Lecce	837	2,134,597.01	20.22
Brindisi	38	1,957,239.20	18.54
Rome	74	1,314,434.82	12.45
Bari	41	1,059,638.32	10.04
foreign overall	*180*	*848,271.42*	*8.04*
Turin	27	789,865.00	7.48
Taranto	19	441,232.99	4.18
Bologna	39	421,982.60	4.00
Padua	29	246,474.18	2.33
Matera	7	185,685.00	1.76
Aosta	11	147,900.00	1.40
Milan	23	109,336.00	1.04
Naples	7	119,500.12	1.13
Trento	13	117,750.00	1.12
Novara	2	70,250.00	0.67
Genoa	20	68,650.00	0.65
Caserta	1	60,000.00	0.57
Bergamo	5	55,445.60	0.53
Como	26	48,500.00	0.46
Varese	3	40,750.00	0.39
Foggia	4	31,350.00	0.30
Bolzano	19	27,250.00	0.26
Ancona	3	24,250.00	0.23
Grosseto	2	24,250.00	0.23
Latina	1	22,000.00	0.21
Venice	14	14,813.60	0.14
Florence	15	14,750.00	0.14
Udine	7	12,587.82	0.12
Salerno	2	12,250.00	0.12
Cagliari	7	11,500.00	0.11
Pisa	10	11,000.00	0.10
Others < 10,000.00	99	104,813.10	–
Total	**1,591**	**10,556,856.78**	**100**

For the aforementioned theoretical premises, the service value determines the *intensity* of the flows of knowledge between localities. In our opinion, the economic value of a commissioned research is a measure of the *importance* of the investment (the larger the investment, the greater the regional economic effect is for potential competitiveness). We argue that a simple review of the number of works and commissioned research can be used to determine the existence of a system of relations between the university and its clients (*frequency*), but it is not sufficient to demonstrate the extent of knowledge flows between these two entities (*intensity*).

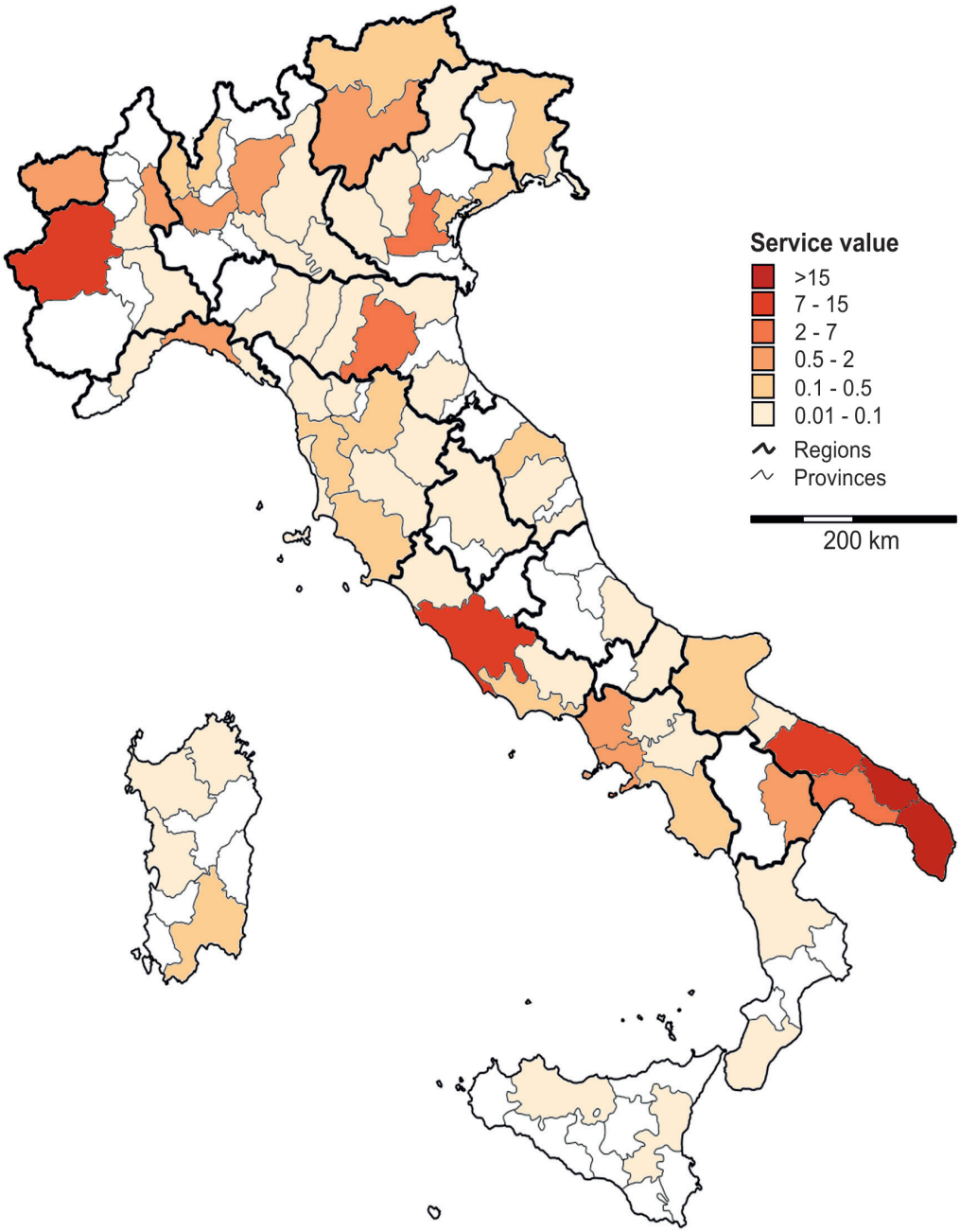

Fig. 1: Provincial distribution of service value in Italy (2008–2012)

4.2 Qualitative analysis: sectoral analysis

It is useful to introduce a differentiation between the private and public sectors.

The total amount for private sector contracts from 2008 to 2012 was in excess of 7.7 million euros. We refer to the myriad of contracts signed between the University of Salento and individuals or micro-firms that have an amount of less than 1,000 euros. A more accurate analysis of the data relative to the private sector revealed that the overall amount of research commissioned by individuals or non-economic entities (parishes, associations, museums, etc.) amounts to only 99,000 euros. These commissions are often required for domestic or private purposes (building tests and calibration, backdating of small

Tab. 3: Detailed distribution (from foreign countries) of the economic value of contracts (2008–2012)

Country	Number of contracts	Value of contracts [€]	Service value
Germany	5	387,184.60	3.67
The Netherlands	35	111,200.00	1.05
France	40	85,340.00	0.81
Switzerland	4	45,749.46	0.43
Norway	1	45,000.00	0.43
Slovenia	8	40,250.00	0.38
Sweden	21	40,000.00	0.38
Austria	14	19,000.00	0.18
Czech Republic	8	16,250.00	0.15
United States	4	15,547.36	0.15
U.K.	3	10,500.00	0.10
Spain	16	8,500.00	0.08
Romania	3	6,500.00	0.06
Malta	3	3,750.00	0.04
Croatia	2	3,500.00	0.03
Greece	3	3,000.00	0.03
Mexico	1	2,500.00	0.02
Argentina	3	1,750.00	0.02
China	1	1,000.00	0.01
Belgium	1	750.00	0.01
Turkey	2	500.00	< 0.01
Colombia	2	500.00	< 0.01
Total	**180**	**848,271.42**	**8.04**

archaeological finds) and represent less than 1% of the overall economic value of the contracts. The largest portion of contracts involves the University of Salento and public (26.9%) or private (77.2%) economic entities.

The latter element had a remarkable impact on the characteristics of the commissioned research carried out by the University of Salento. Individuals or public entities that do not perform any economic activity are those that require laboratory tests exclusively to make use of specialized university equipment. Although an exchange persists in this type of commission, there is no significant knowledge transfer from the university to the research users.

When it comes to individuals or entities carrying out an economic activity the situation is very different. We hypothesise that it is possible to determine the actual and direct knowledge transfer from the university to its research users by reconstructing business activities and evaluating the economic value of the commissions. This approach measures and evaluates the extent to which the local and non-local firms purchase research performed by a specific university and potentially use this research for innovation and competitive advantages.

The qualitative analysis of the data suggests that the larger contracts (those worth more than 100,000 euros) are in science-based sectors (aerospace, mechanics and mechatronics, ICT, etc.), advanced services for local firms (applied studies, scientific support, project consulting, monitoring, etc.) and the local area (study and evaluation of the seismic vulnerability of buildings, monitoring sea-polluting agents, etc.).

It seems evident that larger contract research requires more know-how and larger technological and infrastructural capacities. These contracts have a considerable effect on the quality of transactional relations between the university and its research users and on the knowledge transfer for potential competitiveness of local and external firms.

4.3 Qualitative analysis: typology of research users and services

We also examined the contracts for client typology (public or private). We took into account the specific type of service performed by the University of Salento. It was then possible to reconstruct the *quality* of the transactional relations between the University of Salento and its research users as well as to measure the technology transfer and knowledge exchange.

In the last five years, the highest commission coming from the public sector was from the Province of Brindisi (529,000 euros). Examining only the first six commissions based on their economic value (greater than or equal to 100,000 euros), four were from Brindisi and one was from Lecce. In this ranking, Bari (one commission of 215,000 euros) is the only public body outside of Salento. The public entities in Lecce, Brindisi and Taranto commissioned more than 1.8 million euros worth of research (64.4% of the total public demand).

The analysis of private clients contracts leads to some more interesting observations. A contract signed by the University of Salento with a research user from the local economic system lies only in the fifth position in the rankings. This contract was signed in Taranto (270,000 euros) and is followed by two contracts signed in Brindisi (respec-

tively, 261,600 and 230,000 euros). Finally, a contract signed in Lecce (approximately 208,000 euros) is located in eleventh position.

The most important contracts with private entities (greater than or equal to 100,000 euros) shows a less unbalanced frame compared to the public sector in both number of contracts (*frequency*) and service value (*intensity*). 9 out of 22 contracts were signed in Salento: 5 in Lecce, 3 in Brindisi and 1 in Taranto. For the contracts greater than or equal to 100,000 euros, the private research users in Lecce, Brindisi and Taranto account for more than 1.6 million euros (21.2% of the total private demand), whereas the public sector accounts for 64.4%.

The analysis of the contracts signed between the University of Salento and its public and private research users shows that there are only 28 contracts greater than or equal to 100,000 euros (Tab. 4), but their total amount exceeds 5 million euros and accounts for 51.9% of the overall amount of contracts

Tab. 4: Details on the 28 most relevant contracts (greater than or equal to € 100,000)

	Province/ Foreign Country	Sector	Amount	Object of the contracts
1	Brindisi	Public	529,000.00	Monitoring and analysis of sea pollution
2	Bologna	Private	360,000.00	development of a nano-HAp loaded chitosan scaffold
3	Turin	Private	306,000.00	integrated multidisciplinary optimisation (CAE-CAM) of machining for chip removal
4	Rome	Private	300,000.00	research consultancy on ICT
5	Taranto	Private	270,000.00	research consultancy for heavy industry
6	Brindisi	Private	261,600.00	technical and economic feasibility study about the "cold chain"
7	Brindisi	Private	230,000.00	study on a multi-generator system with multifuel generator
8	Padua	Private	220,000.00	monitoring of accelerations and deformations during the impact of a POD
9	Bari	Public	215,000.00	innovative system for identifying and locating water loss in water supply networks
10	Rome	Private	210,000.00	research consultancy on ICT
11	Lecce	Private	208,333.00	development of a space-based relay architecture
12	Lecce	Public	200,000.00	study and evaluation of the seismic vulnerability of hospitals
13	Germany	Private	191,900.00	in-cylinder Temperature and Soot Measurement in car Engine
14	Germany	Private	191,900.00	electrospray Investigation for GDI injectors
15	Lecce	Private	169,000.00	development of aviation seat
16	Lecce	Private	160,000.00	temperature monitoring of welded rails
17	Rome	Private	160,000.00	expansion and integration of production technologies
18	Brindisi	Public	149,440.00	components and modules for interior and bodywork for innovative urban vehicles
19	Brindisi	Public	141,824.85	analysis of marine sediments
20	Bari	Private	130,000.00	innovation of organizational and production processes of polyethylene pipes
21	Turin	Private	120,500.00	mechanical testing and evaluation of new repair techniques for turbine
22	Rome	Private	120,000.00	research consultancy on technology communities
23	Napoli	Private	118,000.00	flaps, spoilers and MLG door design allowable test
24	Lecce	Private	110,000.00	study and implementation of wireless transmission models
25	Lecce	Private	106,743.00	development of integrated framework for customer care
26	Brindisi	Private	100,000.00	implementation of a platform prototype for speaker recognition
27	Brindisi	Public	100,000.00	consultancy on advanced structural materials for building applications
28	Trento	Private	100,000.00	software platform for aviation industry

signed from 2008 to 2012. We observed the presence of a high qualitative transactional relation and a relatively significant know-how or knowledge transfer in more than half of the contracts.

Figure 2 illustrates this reasoning. *Public users* are all localised close to the University of Salento (within 200 km of Lecce), whereas *private users* are distributed over a 1,500 kilometre radius (see Tab. 5). This suggests that the research performed by the University of Salento is attractive for both local and external businesses, but there is no interest from external public bodies. The local public entities see the university as a privileged actor in virtue of its high-profile research and consultancies. We cannot exclude that these relevant transactional relations are motivated by a strategic alliance between two types of organisations to the benefit of the same territory, as previous literature suggests (Caldwell 2002; Gibb and Hannon 2006).

5 Discussion of main results and conclusions

If our goal is to assess the relevance of a public university in terms of knowledge and innovation diffusion in its region and for local business competitiveness, then, by using this approach, we have been able to quantify that, in an index of 100, 43% of knowledge (produced and sold by the University of Salento) remains in its local area.

Consequently, we can confidently assert that the University of Salento, the only public university in its region, is a key player in the processes of local technology transfer, thereby confirming the conclusions of Boucher et al. (2003). In addition, we were also able to demonstrate that, especially for private users, in several technology areas the University of Salento is an important partner also in regions which are more geographically distant.

Although the literature on knowledge transfer mechanisms is wide and varied, to date there has not been a detailed examination which accurately quantifies and localizes the knowledge transferred. In a substantial review, Mathieu (2011) gives an account of the diversity of approaches and results reached by international literature in recent years; these studies dealt mainly with the comparison of individual characteristics of academic researchers with institutional factors (Thursby and Thursby 2001; D'Este and Patel 2007; Bekkers and Freitas 2008); the role of scientific disciplines (Faulkner and Senker 1994; Zucker et al. 1998, 2002a, 2002b; Cohen et al. 2002; Landry et al. 2005; Martinelli et al. 2008); the characteristics of firms involved in U-I partnership (Cohen and Levinthal 1990; Acs et al. 1994; Lee 2000); motivations, outcomes and barriers to interactions (Schartinger et al. 2001; Carayol 2003; Fontana et al. 2006; Perkmann and Walsh 2007, 2008, 2009); and consequences of U-I partnerships (Thursby and Thursby 2000; Geuna

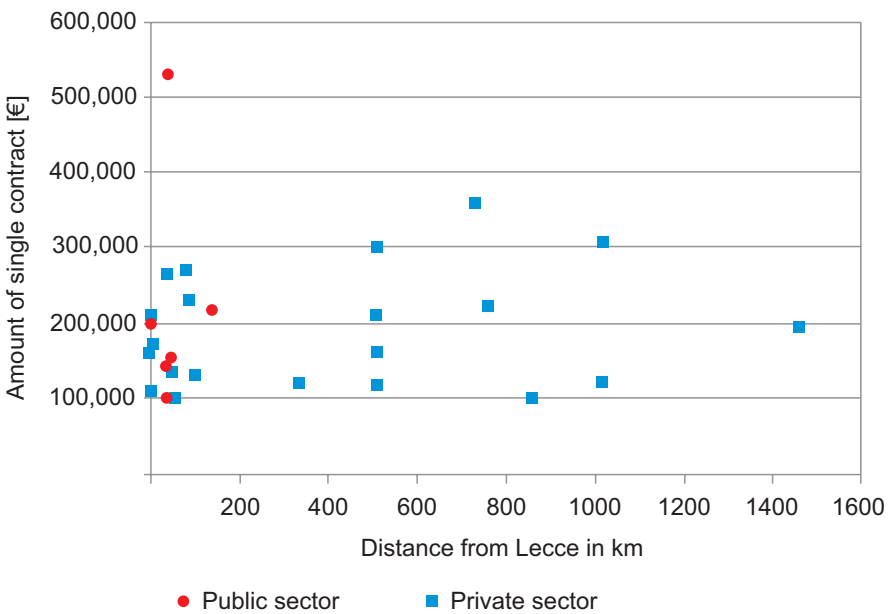

Fig. 2: The first 28 contracts' localisation for their economic value

Tab. 5: Detailed localisation of the most relevant contracts (only private users per province, 2008–2012)

Greater or equal to 100,000 euros (Private Sector)			
Province/Foreign Country	**Number of contracts**	**Amount €**	**Amount %**
Salento *(Brindisi, Lecce and Taranto)*	9	1,615,676	39
Rome	4	790,000	19.07
Turin	2	426,500	10.29
Germany	2	383,800	9.24
Bologna	1	360,000	8.69
Padua	1	220,000	5.31
Bari	1	130,000	3.14
Naples	1	118,000	2.85
Trento	1	100,000	2.41
Overall	*22*	*4,143,976*	*100*

2001; Geuna and Nesta 2003; Owen-Smith 2003; Stephan et al. 2007; Azoulay et al. 2007), etc. The findings of these studies seem more concerned with examining the "ideal model" of knowledge transfer between those who produce research and those who use it, than they are in determining how these mechanisms effectively work (how knowledge is transferred, where it is transferred, who uses it, how it is used, etc.).

Management studies suggest that in each commissioned research there is always a certain degree of knowledge exchange (Bettencourt et al. 2002; Auh et al. 2007; Möller et al. 2008; Trippl et al. 2009).

Taking this assumption as a starting point, we can reasonably assume that if a client is willing to pay a certain amount of money for a scientific consultancy, this amount constitutes the value of the research for the client; at the same time, a university that is willing to work for a certain amount in order to deliver scientific results to a client, also assesses the importance and value of the job it is carrying out.

In this free appraisal of the price of supply and demand, the importance of knowledge transfer is determined; therefore we use this value to measure the *intensity* of knowledge transferred. Following this reasoning, our research tells us that the University of Salento (in the time interval 2008–2012) transferred knowledge to public and private entities for a value of about 10.5 million euros and that more than half of the knowledge transferred was concentrated in the 28 largest contracts (that exceed 100,000 euros).

In addition to the economic value of research contracts, the analysis of the contract elements gives us the ability to pinpoint the locations of clients (where the knowledge produced ends up) and to assess the *frequency* of knowledge flows between the places of production and use through the consideration of the numerosity of contracts carried out. Indeed, without taking the value of each contract into consideration, it is possible to measure the *frequency* of the knowledge exchange through the number of transactions. This allowed us to assert that the frequency of exchanges between the University of Salento and its reference area is very high with a value of 56.2 (on an index of 100).

We pointed out above that many scholars complained about data collection and elaboration issues for knowledge production and the territorial effects of research (Lawton Smith 2007; Thanki 1999; Drucker and Goldstein 2007). At the beginning of our study we wondered why, despite the relative ease of availability, commissioned research was neglected in favour of other instruments that are considered more generic, partial and fuzzy, such as patents, academic start-ups, scientific papers, and so on (Roessner 1993; Sequeira and Martin 1997; Schartinger et al. 2001; D'este and Patel 2007; Capriati 2013).

Undoubtedly one of the strong points of our methodology is that we are able to provide a direct and real measure of the knowledge flow destination, which is not mediated by sampling, survey or indirect indexes.

Particularly if compared to previous studies, this new approach has provided a large amount of quantitative and qualitative data that have allowed us–on the demand side–to map the location of clients, i.e., the research users and analyse the user typology, i.e., the size and type of commissioners. Moreover, we were able–on the supply side–to analyse the typology of the knowledge, technology and scientific sectors and to obtain, in this way, useful indicators of policy, such as how much a public university earns from selling services.

In conclusion, this paper has presented a case study regarding *transactional relations* (i.e. all business contacts such as commissions, contracts, agreements) between the University of Salento and those who *use* their research. Furthermore, this empirical

work has been embedded in a broader theoretical and methodological framework regarding the functions of a public university in a regional context.

Coming in the wake of other major studies (Boucher et al. 2003; De Rubertis et al. 2011), we are firmly convinced that this work will help to ensure that proper importance is given to the strategic role played by public universities in the process of developing marginal areas.

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