

# **Regional Innovation Impact Assessment Framework Case Study "University of Trieste"**

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# 1 Introduction

The University of Trieste with its 13.300 enrolled students in 2017, can be defined as a medium size “generalist” university <sup>(1)</sup>. It comprises almost all the scientific sectors - from hard sciences to humanities and a leading medical school.

It hosts as well a unique course in international language and translation - a distinguished international hub of official translators at European Institutions - and the first founded Italian course in International Studies and Diplomacy, where many officials of European Union and international institutions, as well as foreign affairs specialists, have been trained. Moreover, the University hosts a course in Statistics and Actuarial Sciences that dates back to foundation of the University of Trieste training, still, many of the country’s professionals in the insurance sector.

The University of Trieste has a long research tradition in hard sciences, in particular physics and chemistry and ranks among the world’s 500 leading universities in several of the major university rankings (THE, Leiden Shanghai ARWU). Based on the citations of the top Italian scientists, and on the number of citations in Scopus (via Academy), in 2017 the University of Trieste ranks respectively 2° and 3° among Italian Universities.

Following Censis ranking <sup>(2)</sup> (2017) of all Italian Universities for teaching and student’s services, Trieste reaches the sixth position among all 58 medium size <sup>(3)</sup> universities, the absolute national record in the three-year degrees in the Linguistic Group and in International Relations; a second place in the Scientific Group (Science and Technology of Navigation, Physics, Informatics, Mathematical Sciences); and third one in the Socio-Political Group in career progression <sup>(4)</sup>.

Four Departments -Math & Science (DMG), Life Sciences (DSV), Medicine, Surgery and Health Sciences (DSM), Legal, Language, Interpreting and Translation Studies (IUSLIT)- have been recognized for Excellence by MIUR <sup>(5)</sup> (Ministry of Education for Italian Universities, 2017 <sup>(6)</sup>).

Since the end of the 1990, the University has paid increasing attention to engage in Technology and knowledge transfer. In 2008 an ILO - Industrial Liaison Office – was formally established <sup>(7)</sup>, but the engagement in these activities had already started earlier.

The University is located in the city of Trieste, a medium size city of 200.000 inhabitants which is the capital of the Friuli Venezia Giulia region (Nuts 1), a small Italian region (population 1.2 million) of the North East on Italy’s border with Slovenia and Austria. Since its creation, the University has trained most of the region’s doctors, lawyers, politicians, civil servants, business leaders and researchers.

The region has an average income slightly above the EU mean, an employment rate above the Italian average and an unemployment rate well under the Italian average, but well above the European one (RIS, 2017). Its core economic activity is based on small- and middle-size enterprises in the manufacturing sector <sup>(8)</sup>. According to the Regional Innovation Scoreboard (RIS, 2017), with respect to the European average, the region

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<sup>(1)</sup> Historically the University was born as University of Economics and Business in 1924; Law Political Sciences followed in 1938; Engineering in 1942; Literature and Philosophy in 1943; Mathematics, Physics and Natural Sciences in 1946; Pharmacy, Education in 1956; Medicine and Surgery in 1965; Advanced School of Modern Languages for Interpreters and Translators in 1978; Psychology in 1997; Architecture in 1998.

<sup>(2)</sup> Medium size Universities are defined as having between 10,000 and 20,000 enrolled students.

<sup>(3)</sup> Censis is an Italian Independent Research Center with the mission of analyzing the Italian socioeconomic situation. It is a third party organization.

<sup>(4)</sup> Data available at [http://www.censis.it/17?shadow\\_publicazione=120579](http://www.censis.it/17?shadow_publicazione=120579).

<sup>(5)</sup> [http://www.miur.gov.it/c/document\\_library/find\\_file\\_entry](http://www.miur.gov.it/c/document_library/find_file_entry).

<sup>(6)</sup> See List of Departments of Excellence, available at [http://www.miur.gov.it/c/document\\_library/find\\_file\\_entry](http://www.miur.gov.it/c/document_library/find_file_entry).

<sup>(7)</sup> The University begun at the end of the last century, in 1999 the first spin off was set and the first patent was granted to the university. At the beginning these activities benefited of technology transfer service of Area Science Park.

<sup>(8)</sup> The regional industry in the post-crisis years suffered a huge downsizing. Nevertheless, the Friuli Venezia Giulia is still one of the most industrialized among the Italian regions.

shows weaknesses regarding R&D spending in the business sector and collaboration among innovative SMEs; on the other hand, the region shows strengths in the field of SMEs innovating in-house (reflecting the importance of its manufacturing sector) and in international scientific co-publications, thanks also to the university's contribution especially as regards scientific publications and public-private co-publications. The region has been in many years one of the most innovative regions in Italy (RIS 2014;2016; 2017) and despite the gravity of the crisis that affected the local economy, the regional innovation performance has increased in recent years <sup>(9)</sup> allowing Friuli Venezia Giulia to be the most innovative Italian region in 2017.

The province of Trieste which mostly coincides geographically with the city, has a specialization pattern different from the rest of the region, being characterized by a greater importance of the service sector, public administration and by the Port of Trieste, an international hub for overland and sea trade. However, the manufacturing sector includes a few international leading companies in the shipbuilding and marine motors industries, the coffee industry and lively cluster in biotechnology firms. The city is historically characterized by an important insurance sector which in the past marked the birth of Trieste University itself <sup>(10)</sup>. Starting at end of the '70, the University of Trieste was increasingly surrounded by numerous (mainly international) PROs (Public Research Organizations) that now, together with the University, are part of an integrated Science System, the so-called "Trieste Science System" that counts over 30 researchers in every thousand active population <sup>(11)</sup>. These organizations are now linked by an agreement for strategic collaboration to develop further Trieste as "City of Knowledge" <sup>(12)</sup>. This unique environment was one of the main reasons why Trieste was selected to host in 2020 the Euro Science Open Forum, the most important European event dedicated to science.

The University of Trieste was the only University of the Friuli Venezia Giulia Region until 1978, when a new university (University of Udine) and the doctoral School in Advanced Studies (SISSA) were established.

Since 2016, the three Universities (University of Trieste, University of Udine and SISSA) became part of the Scientific and Innovation System of Friuli Venezia Giulia, SiS FVG <sup>(13)</sup>, an institutional agreement promoted by the Regional Government and signed by all the Scientific Institutions of the region, having the specific aim of further developing the research and innovation ecosystem of Friuli Venezia Giulia as a whole.

In the years under observation the entire Italian university system has been subjected to systematic cuts in government funding and the effects of this on the University of Trieste can be seen in a reduction of the total budget from 2012 to 2015. Over the same period, the source of the university's research funds has shifted from ministry funds to regional funds and to other, mainly competitive, sources, and to European funding in particular. In this context of dramatic cuts in government funding, the University of Trieste has managed

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<sup>(9)</sup> The Regional Innovation Index (RII) increased by 3.6 points in the period 2011-17 (RIS 2017).

<sup>(10)</sup> In fact, the roots of the University of Trieste lay in the history of insurance sector. The largest Italian insurance company, (still a leader at international level, was established in Trieste in 1831. In the same century, a School for Business Studies was founded which in 1924 became the University of Economics and Business. Together, the university and leading companies in the insurance sector made a significant contribution to the rise of the actuarial science through the activity of Bruno de Finetti: a distinguished scientist who worked in the insurance company and later on at University.

<sup>(11)</sup> The Trieste Science System is a networking initiative between universities and Pro's localized in the Trieste area. It consists of the two local universities (University of Trieste and SISSA), of national PRO's (Elettra-Sincrotrone, Trieste National Institute of Oceanography and Experimental Geophysics -OGS, regional sections of the Italian National Research Council - CNR, National Institute for Astrophysics - INAF, Trieste section of National Institute of Nuclear Physics - INFN), as well as international PROs (International Centre for Genetic Engineering and Biotechnology - ICGEB, Abdus Salam International Centre for Theoretical Physics - ICTP, World Academy of Sciences -TWAS, InterAcademy Partnership -IAP) and a Science Park.

<sup>(12)</sup> The Memorandum of Understanding can be consulted here:

<https://www.units.it/convenzioni/?cod=17&tp=Convenzioni%20con%20enti%20di%20ricerca,%20consorzi%20e%20istituti%20universitari>.

<sup>(13)</sup> [https://www.sisfvg.it/sites/default/files/Accordo%20SIS\\_%20Friuli%20Venezia%20Giulia\\_traduzione%20inglese.pdf](https://www.sisfvg.it/sites/default/files/Accordo%20SIS_%20Friuli%20Venezia%20Giulia_traduzione%20inglese.pdf)

to downsize without downgrading its research activity excessively, and has maintained a variety of study programs. Finally, in 2017, the University's total budget started to recover. It is worth noting the increase in research productivity during the period considered (See table 1 for key facts and figures).

The university's contributions to its regional innovation ecosystem in recent years is outlined in the following four subsections, which are classified according to the four impact categories presented and discussed in the JRC discussion paper (2018) and its annex 1.

**Table 1.** University of Trieste: key facts and figures.

	2012	2015	2017
Budget	170.4 mln euro	150.3 mln euro	156.8 mln euro
# staff	1,468	1,397	1,303
# academic staff (headcounts)	712	681	636
# students	18,126	16,046	15,344
# publications	1,851	2,561	2,216
% top 1% publications	3.35	3.65	NA

(<sup>1</sup>) Legend: “#” stands for “the number of”.

*Source:* All data have been taken from “Relazione del Rettore”, except for the percentage of the top 1% publications that is retrieved from Incites database. We started from 2012 because of the comparability of the balance sheet data.

## 2 Regional leadership

### 2.1 Regional orientation, strategic development and knowledge infrastructure

The University is a crucial part of the regional knowledge infrastructure and innovation ecosystem. The University is at the core of Trieste Science System contributing to a rich array of laboratories and human capital localized there. The University of Trieste works closely together with research institutes, and the regional Government to define the strategic orientation of the economic system of the region.

One of the core objectives of the University is to contribute to shortening the distance between science and society, getting science as close as possible to the community to create a shared vision on the future. To this end, since 2012, the University has promoted the "Trieste Next", a science festival involving researchers from the whole Trieste Science System. The 2017 edition saw the participation of 50,000 visitors. Moreover an intense activity of knowledge diffusion is put in place by the researchers both from the humanities and hard sciences with an initiative called "Caffè delle scienze e delle lettere".

The same attitude for inclusion is observed also in research projects. An example of an inclusive innovation project is CSMON-LIFE "Monitoring biodiversity by a citizen science approach for solving environmental problems" <sup>(14)</sup>.

The research output of the University's vouches for its international standing. The share of internationally co-authored research publications in its total publication output was more than 60% in 2016 and it had an increase of 21% in 2014-2016 (Annex 1, Box D).

In the meantime, the University of Trieste plays an important role in embedding the regional innovation system in international R&D networks. In fact, the high co-publication rate with a partner located in the region (about 47.9% in 2017; Annex 1, Box D) shows that the University of Trieste is closely connected to the surrounding regional context.

In the 2016 - 2017 cycles, 15 PhD theses (22% in total) are on joint supervision and 33 PhDs are qualified as Doctor Europaeus. Moreover, the University maintains links with some collaborative academic partners throughout the world and as such Trieste has 30 visiting researchers, and 48 visiting professors during the a.y.2016-2017 (Rector's relation 2017).

The research networks related to basic research (when measured through the number and nationality of participants to Horizon 2020 projects) span internationally. Seventy-five percent of the around 800 partners are international academic institutions and research centres, but also leading companies in industrial sectors which are highly R&D intensive. In this context the participation of regional industrial partners is limited to a few companies in transport, maritime and biotechnology sectors.

The collaboration with regional industry shows most of its relevance when we consider the revenues from contract research that come from local/regional sources. These constitute about 15% of the total revenues from competitive projects when referring to the period 2012-2017 (see par. 4).

Given its geographical location, the University of Trieste plays a strategic role in the Alpe Adria macro-region fostering research collaboration among universities, and contributing to the development of the innovation ecosystem, also thanks to competitive projects POR/FESR and Interreg.

The research networks in these projects are small in size (4/5 participants) but the groups are significantly heterogeneous from the point of view of their nationality and typology: universities, private companies, hospitals, international research centres. In this context the participation of regional firms is remarkable (50%).

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<sup>(14)</sup> CSMON-LIFE has developed a free mobile app for citizens and a computer system to validate observations. Hence citizens can download the app, choose the species they recognized in nature and take a picture. Valid data arrive directly to the Italian Ministry of the Environment, including the image and geo-spatial references.

Interreg programs are related in particular to Transport and Smart Health, but are also specifically aimed at contributing to the design and implementation of innovation policies in Adriatic region (see Box 1).

**Box 1.** Pacinno project

The Pacinno project is a platform for trans-Academic Cooperation in Innovation within the Adriatic Region.

It exploits synergies with local and EU initiatives and implements research on innovation at the micro-level (firm-level). Moreover, the project develops innovation system maps at the country level and generates concrete innovation policy proposals to the policy-makers of the region. Finally, Pacinno establishes a training platform that will provide scientists from each participating country with managerial skills.

The University of Trieste plays a constructive role in the development of innovation policy at regional and national level, connecting its main research streams to the regional as well as national industrial clusters.

The University participates in the National Committees where the industrial policy strategies are defined, in particular to those devoted to innovation creation and diffusion such as Industria 4.0, Blu Italian growth, Sustainable Processes and Resources for Innovation and National Growth, Technological Innovation in Cultural Heritage and Trasports2020.

The University of Trieste- together with the regional university system - has played a key role in defining the S3 specialization strategy of the region, with a direct engagement in Agrifood, Smart health, Marine Technology, Domotica, Culture, Creativity and Tourism.

The construction of the smart specialization strategy is an example of a virtuous integration between scientific knowledge and innovation aimed at improving the competitiveness of the territory and at contributing to the evolution of society in terms of wellbeing and environmental sustainability. This integration takes place in all sectors identified through the integration of companies operating in the region with the university and the research system (researchers, laboratories, science parks). An example is reported in Box 2.

**Box 2.** S3 at the interaction between science technology

Maritime Technologies

Maritime Technologies employs about 1,000 people engaged in R&D activities. The industry includes traditional sectors of Friuli Venezia Giulia and it has strong ties and interdependencies with other sectors of the regional economy: shipbuilding and boat construction, including its specialized chain. The sector has been able to achieve an international standing, with some companies working on the knowledge frontier. On the other end, the University of Trieste, together with the Universities of Udine and SISSA and OGS), has a world-class scientific capability in needed knowledge areas: engineering, automation and mathematics applied to the industry.

Smart Health.

Smart Health refers to three closely related sectors: Biomedical, Biotechnology and Bioinformatics. The composed sector- BioHighTech- is characterized by the highest spending in R&D in the region and includes some large companies, SME's and spinoffs with a high market potential. The contribution of the University of Trieste to its innovation performance is multifaceted, going from in vivo and in vitro diagnostics (advanced biosensors and prosthetics) to biotech drugs, customized biopharmaceuticals for rare diseases and technologies for cell therapies and gene therapies.

### 3 Support to human capital development and entrepreneurship education

Even though the University of Trieste is to be regarded as an international university, its mission strongly refers also to its regional role in contribution to human capital development of the region.

In fact, according to Almalaurea <sup>(15)</sup>, more than 80% (2017) of students find work in the North-East (NE) area (Nuts 1: ITD), 59% (2017) in the Friuli Venezia Giulia (FVG) region (Nuts 2: ITD4) (Annex Table A2).

After graduation the employment rate of its alumni is close to 57% (2017); this percentage is higher for masters (80%) and smaller (44%) <sup>(16)</sup> for bachelor degrees. Students of the University of Trieste suffer a shorter unemployment spell before finding the first job (3.8 months in 2017) compared to the national average (4,3 in the same year) (see Annex 1, Table A2).

In 2017, the average salary of the graduates of the University of Trieste is around 1,111 euro per month (1 year after graduation) and this is around 8% above the mean of the Italian graduates' salary. Moreover, about 71% (2017) of the students declared that their education was effective or very effective for their job (see Annex 1, Table A2).

Regional and national industry offers a number of grants for top performing students. In particular, one of the top insurance companies regularly offers grants to students that achieve outstanding results in actuarial science.

Moreover, in order to pursue excellence in science, the College for Science "Luciano Fonda" offers scholarships to talented students. These scholarships, devoted originally to the hard sciences, have been extended now to the Humanities and Social Sciences.

According to Almalaurea, 50% of students take a traineeship while at University in 2017, a still growing percentage; the large majority (75%) of traineeships are located in the North-East region (Nuts 1: ITD). See Table A3 of the Annex 1 for details.

In 2012, the University of Trieste set up a placement service both to foster the employability of its graduates and to develop a more systematic exchange between Academia and industry. The placement office organizes every year a Career Day, which is very appreciated by both students and companies. The University of Trieste implements internships and placement programs to connect students with the world of industry and businesses and to allow a systematic knowledge exchange between companies and the university. Also thanks to these programs, 81% of students find employment in the North-East area (Annex 1, Table A2).

In cooperation with the Regional Government, a postgraduate traineeship service was established in 2013. About 8% (2017) of graduates had a traineeship in the private sector, mainly in regional (Nuts 2: ITD4) firms (75% in 2017) (Annex 1, Table A3). Around 15% take a traineeship abroad, complementing the Erasmus plus program and contributing to an augmented international employability of the students (Annex 1, Table A3).

Regional firms play an active role in curriculum design, first of all through regular consultations with the coordinators of graduate programs to discuss the effectiveness of the curricula.

The University has strengthened its relations with the local context also with respect to teaching curricula, maintaining and reinforcing its traditional fields, but also opening new courses related to local specialization: Biotechnology, Naval Engineering and Data Science. On average, 9 specialized master courses are organized yearly in collaboration with external organizations (hospitals, health Authority, research centers and local companies. They are devoted mostly to the Health sector, but also to Economics of the Coffee industry (see Table A5 in the Annex 1). Recently the University launched the first Italian the master in Robotics. The master is based on

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<sup>(15)</sup> Almalaurea is a Interuniversity Consortium established in 1994 and currently has 75 Universities as members (with the process of membership currently in the decision stage for 3 other ones) and represents about 90% of Italian graduates. It surveys the Profile and the Employment status of the graduates annually after 1, 3 and 5 years, returning to the member Universities, to the MIUR and to the National Agency of Evaluation of the University System (ANVUR) reliable documents and data bases to simplify the decision processes and the planning of the student training, orientation and services activities <http://www.almalaurea.it/en/info/chisiamo>

<sup>(16)</sup> The small ratio is due to the fact that a large number of the students taking a bachelor degree continue their studies.

a wide array of collaboration with outstanding research institutes and companies- among which there are leading regional ones- providing teaching and financial support and scholarships. The University implemented courses on Violence against women and children, and a post-graduate specialization course on the same subject. Thanks to these teaching and research activities, the University became a reference point for professionals working locally with victims of violence.

During the years under observation, many professionals from the private and public (non-academic) sectors contribute to teaching: 239 teaching contracts were signed in 2017 (Annex 1, Table A1).

The University of Trieste implements every year between 10 and 12 PhD programs in different scientific sectors <sup>(17)</sup>, in many of which PhD students are provided with the opportunity to carry out part of their research in a company or other institutions, in particular PROs of the Trieste Science System (Annex 1, Table A4). In fact, the largest part of these programs is co-financed with the contribution of research centers and a few companies. Moreover, in the last two years we have seen a direct contribution from the Regional Government (Annex 1, Table A4).

In particular, the overall percentage of the contribution from external partners is on average around 45%. The partners are located in the region <sup>(18)</sup> in a ratio that depends heavily upon the specific field of specialization with the highest value for Nanoscience and Physics (Annex 1, Table A4).

In this context the importance of the medical school for the regional society, shouldn't be overlooked. In fact, in the same period there were, on average, 340 medical interns.

It is interesting to note that in recent years, individuals holding PhDs from the University of Trieste were more likely to find employment in Friuli Venezia Giulia than those with PhDs from the other two universities in the region (Chies 2015).

Initiatives to develop entrepreneurial abilities of students have been now in place for many years (the first edition of "start cup" a business competition - still biannually going on - took place in 2004), however in the more recent periods this kind of activity has been developed further. In the period 2015-2017 many initiatives were developed under the heading of "STUD.ENT" (STUDENT ENTrepreneurship): business competitions; business game; Samsung Innovation camp; meetings with companies, International campus 02.

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<sup>(17)</sup> In the last three years the 11 PhD schools were devote to: Environmental life sciences; Molecular biomedicine; Chemistry; Physics; Civil-Environmental Engineering and architecture; Industrial and Information Engineering; Nanotechnology; Neural and cognitive sciences; Reproduction and developmental sciences; Earth science, fluid-dynamics and mathematics; Ancient Heritage Studies.

<sup>(18)</sup> Note that consider as "local" an organization that has at least one local within the area. In the majority their headquarter is located elsewhere.



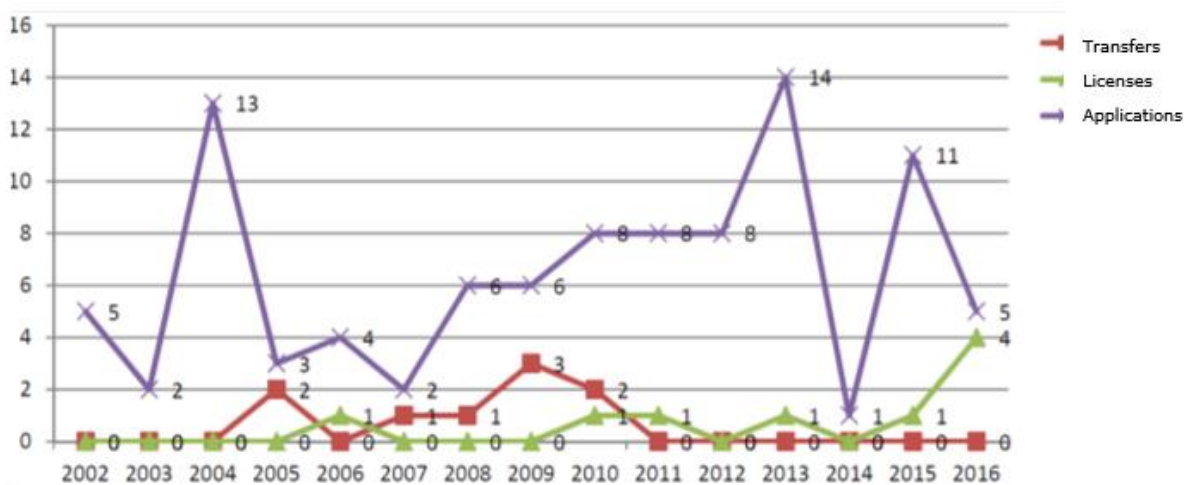
## 4 Knowledge generation and knowledge transfer

Not infrequently, basic research projects involve leading companies active in sectors where the discoveries can find industrial application. Technology transfer therefore can take place through the participation of regional partners to University research projects of international standing (see Box 3).

Not infrequently, basic research can lead to inventions that become patents and that can be eventually a source of revenues for the University, when sold or licensed.

The first patent signed by the University of Trieste dates from 2002. Since then, the University has filed 67 patent families; 34 of them are still in University patent portfolio; 9 were licensed. In the period 2012-2016, we find 2 patent in co-ownership with companies and research centers from the region. Moreover, the University of Trieste has 3 active licenses, of which 2 are in co-ownership with companies and research centers located in Friuli Venezia Giulia. On the whole in the years considered, the patent portfolio of the University is, around 95/102 patents. Note that these data refer to the patent signed by the University as organization, without taking into account the possible patenting activity of the academics which is usually definitely larger <sup>(19)</sup>. See Table B2 of the Annex 1 for details.

**Figure 1.** Trend of university patents



Source: ILO Units.

The international patenting activity is one of the ways through which the University contributes to embed the regional actors into international research networks (see AAVV, 2012).

The technological transfer activities both in terms of patents and spin offs were in place before the formal establishment of the ILO, Industrial Liaison Office in 2008, which took up formally the mission linked to technological transfer, from patent to spin off, contract research, placement services.

Where proximity matters the most is in consultancy and contract research that have been one of the traditional channels of knowledge exchange between university and industry. In the observed years, the total budget from contract research, as reported in the Annex, shows a

<sup>(19)</sup> The involvement of regional as well as international actors in the patenting activity of the University is greater if we take into account academic patents (AAVV, 2012; Capellari, De Stefano 2014). The University patents are still only a part of the patenting activity of academics among others. In the case of Italy is well known that the national Law carries a certain degree on ambiguity on the attribution of the propriety rights (to the University or to academic inventor) giving a certain margin of choice based on the contingent situation, see Baldini et al. (2014).

pronounced cyclical evolution, due in part to characteristics of the data <sup>(20)</sup> but also to the economic crisis that hit the private sector during this period. Also in this respect the 2017 shows a significant positive change.

In 2017 the University of Trieste signed 85 new agreements for research contracts (for an average amount of about 53,000 euros), which means an increase of 37% of the number of research contracts and an increase of 45% in terms of amount with respect to 2013 (Annex 1, Table B1). The major contributions came from companies (about 30%), Pro's 40% and the public sector (30%). The percentage of research contracts with institutions and companies from Friuli Venezia Giulia region is equal to 43.5% in the 2013-2017 period.

The University has an important Engineering Department with established relations with the territory. In fact, in the whole period 2012-2017, it accounts for 58% on the total of the research contracts while Mathematics and Geoscience contributes 15%, Life Science 9%, and Business and Economics 6%.

Double positions between University and industry are less common in Italy due to rules and institutions not favoring this kind of agreement.

However, some cooperation with external organisations through research contracts and the financing of academic positions has begun to appear during the period considered. In 2017, 28 research contracts were signed and 8 academic positions were financed by a leading research center and private companies (Annex 1, Table B3).

In this context, PhD and post-Doc positions are one of the most important channels of knowledge exchange.

There are around 200 <sup>(21)</sup> post-Doc positions made available every year, all of which are financed with resources coming from competitive research projects and/or financed by external organizations, in particular companies and research centers based, in for the most part in Friuli Venezia Giulia (Annex 1, Table B3).

Moreover in 2016-2017, the University of Trieste selected 22 post-Doc positions for one-year research devoted to the different fields of smart specialization strategies within the project "HEaD Higher Education and Development", financed by regional Government.

**Box 3.** Green Boat Design building an environmentally sustainable boat

In cooperation with cluster Marefvg and regional industry, it aims at:

- modifying the manufacturing process so as to reduce both the energy consumption and emissions harmful to health and the environment;
- improving the product through the use of hybrid propulsion, diesel electric, electric-only
- prolonging the life of the boat and facilitating disposal, through the reduction of materials and the use, where possible, of recyclable materials.

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<sup>(20)</sup>The data refer to the contracts signed in the each year and the amount correspond to the total budget of the contract without correction for the contract length (annul o plurennial).

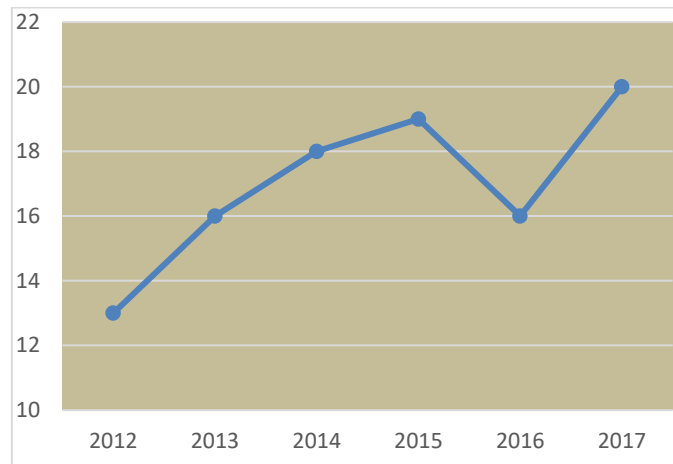
<sup>(21)</sup> This is the number of post-Doc researchers at the end of each year. The number of post-Doc in terms of FTE units will be smaller.

## 5 Support to enterprise development

The University of Trieste is one of the first universities which implemented strategies to develop entrepreneurship and spin-offs. As already mentioned in the introduction, in 2017 the University ranks 4th among Italian universities for spin-off creation.

At the end of 2017 it has 20 active spin-offs, directly employing more than 130 people, with a turnover of 10,897,868 euro in 2016 (Annex 1, Box C).

**Figure 2.** Growth of number of university spin-off companies



Source: ILO Units.

Two of them are to be mentioned for their outstanding performance: Esteco, (ICT applications to optimizes industrial process) and modeFinance (one of the few credit rating agencies authorized by ESMA). As a whole, University of Trieste's spin-off companies had a turnover increase of 20% in the period 2012-2016 (Annex 1, Box C). Many of the spin offs established in more recent years have still to develop their full potential and reach their optimal operational scale. The sectors of activity are very different, spanning from ICT (8), Engineering (3), Biomedical (2), and Chemical industry (2). In a few cases they have been created to exploit the economic potential of patents signed by the university. In other cases they come out from international research projects in knowledge areas where the patenting is not the right strategy to protect the inventions. Sometimes they arise from cooperation with regional firms closely connected to local industrial clusters (from coffee to BioHighTech).

Spin-off companies are located in Area Science Park or in the Business Innovation Centre (BIC), two of the most important infrastructures of the city of Trieste and of the SiS FVG and, recently, also in a ITT (Institute of Technology Transfer) laboratory of the University.

The University through the ILO Office launched in 2017 a contamination-LAB (C-LAB) endowed with 1000 m<sup>2</sup> co-working space where students can develop entrepreneurship skills with the support of mentoring and where a multifaceted set of initiatives are in place. The C-LAB project aims at creating a climate favourable to the birth of new start-ups and aimed at capitalizing the student's experience maintaining the link between students and Alumni over time.

## **6 Vision for future development and conclusion**

The University of Trieste intends to develop the following strategies for the near future (Rector's relation 2017):

- reinforce its role as a top research university, with aims to increase PhD degrees and strengthen collaboration with national and international research institutions, while working to recruit top level scientists and researchers;
- further develop the strategic alliance with actors of the "Trieste Science System "to reach the scale needed to compete more easily at international level encouraging the emergence of mixed research groups (University – PROs);
- strengthen systematic relations with the private sector, in particular, in those strategic areas at the crossroad between research and production (clusters, S3 specialisation areas), and increase the number of post doc financed by industry;
- supplement the courses on offer with the contribution of non-academic professionals to make students more aware of the external world and to facilitate the transition from University to employment and also increase the number of internships both at regional and international level;
- develop students' entrepreneurial skill through training courses and new educational instruments to enhance the so-called "soft skills", and exploit the full potential of C-Lab to facilitate the creation of new start-up;
- extend and intensify the cooperation with the Government at all institutional levels (national, regional and local) in order to contribute to development strategies for the region and the city of Trieste.

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## **List of abbreviations and definitions**

BIC	Business Innovation Center
C-LAB	Contamination Laboratory
DMG	Department of Math & Science
DSM	Department of Surgery and Health Sciences
DSV	Department of Life Sciences
FVG	Friuli Venezia Giulia
HEaD	Higher Education and Development
ILO	Industrial Liaison Office
IUSLIT	Department of Legal, Language, Interpreting and Translation Studies
MIUR	Ministry of Education for Italian Universities
Nuts	Nomenclature of the territorial statistical units
PROs	Public Research Organizations
RII	Regional Innovation Index
RIS	Regional Innovation Scoreboard
SIS FVG	Scientific and Innovation System of Friuli Venezia Giulia
SISSA	Doctoral School in Advanced Studies
STUD.ENT	STUDENT ENTtrepneurship

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## Annexes

### Annex 1. Tables and list of indicators

#### Box A. Education and human capital development

Table A1. Staff exchange

Year	Number of faculty members taking a temporary position in a non-academic organisations	Number of faculty members taking a temporary position in a non-academic organisations (% FVG)	Number of employees from non-academic organisations taking temporary teaching positions at university	Number of employees from non-academic organisations taking temporary teaching positions at university (% FVG)	Number of employees from non-academic organisations taking temporary research positions at university	Number of employees from non-academic organisations taking temporary research positions at university (% FVG)
2013	10	80%	333	78%	50	77%
2014	7	86%	303	82%	38	73%
2015	12	58%	281	81%	38	73%
2016	9	89%	240	73%	53	70%
2017	8	88%	239	78%	28	60%

Source: Administration office of the University of Trieste (UNITS ADM).

Table A2. Regional student retention, graduate tracking, student satisfaction

Year	Regional student retention		Graduate tracking of salaried employment			Students
	Graduate employment: percentage of graduates working in the region after graduation (North-East area; Nuts 1: ITD)	Graduate employment: percentage of graduates working in the region after graduation (FVG region; Nuts 2: ITD4)	Wait unemployment	Wages of university graduates (1 year after graduation)	% of students finding employment in the North-East area	Labour outcomes and student satisfaction post-graduation
2012	86%	66%	4.0	1015		71%
2013	86%	63%	4.0	1009		73%
2014	85%	60%	4.1	990		71%
2015	84%	60%	3.9	1083	84%	75%
2016	85%	63%	3.9	1105	85%	78%
2017	81%	59%	3.8	1111	81%	76%
Mean values for all Italian universities for last available year (Almalaurea)*			4.3	917	-	71%

Source: Almalaurea.

\* Notes: in the last row, there are the mean values for all Italian universities for last available year when data are available.

Table A3. Student and Post-graduate internships

Student Internships			Post-graduate Internships					
Year	Student internships in the region	Graduates doing internships %	Graduates doing internships in companies and non-academic organizations	Graduates doing internships in companies and non-academic organizations %	Graduates doing internships in companies and non-academic organizations in FVG	Graduates doing internships in companies and non-academic organizations in FVG %	N. of companies employing trainees (Total)	N. of companies employing trainees (FVG)
2012		48%	170	5%	105	62%	61	62%
2013	6%	47%	183	6%	134	73%	76	67%
2014	31%	48%	135	4%	73	54%	62	65%
2015	45%	46%	199	6%	148	74%	106	91%
2016		46%	241	8%	179	74%	140	88%
2017		50%	255	9%	192	75%	132	86%
Mean values for all Italian universities for last available year (AlmaLaurea)*		48%						

Source: for “Student internship in the region” data are retrieved from U-Multirank; “Graduates doing internship %” is retrieved from AlmaLaurea, and only in this case, we report the mean values for all Italian universities for last available year in the last row; the other data are retrieved from the Administrative office of the University of Trieste (UNITS ADM).

Table A4. PhD programmes by Department

PhD programmes by Department	Scholarships 2017-2018				Scholarships 2016-2017				Scholarships 2015-2016			
	Total	% at least partially financed by external partners	% partner located in FVG	% financed by Regional Government	Total	% at least partially financed by external partners	% partner located in FVG	% financed by Regional Government	Total	% at least partially financed by external partners	% partner located in FVG	% financed by Regional Government
Environmental life sciences	9	56%	20%		7	14%	100%		6	0%	0%	
Molecular biomedicine	11	64%	71%		9	44%	50%		8	38%	100%	
Chemistry	12	8%	100%		11	0%	0%		16	31%	0%	
Physics	15	53%	100%		11	64%	100%		11	64%	100%	
Civil-Environmental Engineering and architecture	7	29%	100%		6	33%	0%		9	67%	100%	
Industrial and Information Engineering	8	50%	100%		6	50%	33%		0	0%	0%	
Nanotechnology	14	57%	100%		10	50%	100%		13	38%	100%	
Neural and cognitive sciences	5	80%	25%		5	60%	100%		6	83%	20%	
Reproduction and developmental sciences	8	38%	33%		7	57%	75%		7	57%	100%	
Earth science, fluid-dynamics and mathematics. Interactions and methods	7	43%	67%		8	38%	100%		9	56%	100%	
Ancient Heritage Studies	6	0%	0%		7	0%	0%		7	14%	0%	
	102	44%	73%	13%	87	44%	73%	15%	92	45%	73%	0%

Source: Administration office of the University of Trieste (UNITS ADM).

Table A5. Masters programmes

Year	Masterssubjects	Level	Partner	% of regional partners
<b>2014-2015</b>	Clinical Engeneering	I; II	Res. Centre Company	0,5
	Medical Physics	II	Res. Centre	100,00%
	Economics of the coffee industry	I	Company	100,00%
	Health Sciences	I(1) II(3)	Health org. and Res. Centers	100,00%
	Total	8		100,00%
<b>2015/2016</b>	Clinical Engeneering	I; II	Res. Centre, Company	0,5
	Medical Physics	II	Res. Centre	100,00%
	Economics of the coffee industry "	I	Company	100,00%
	Health Sciences	I(2) II(4)	Health org. Res. Centre	80,00%
	Total	10		70,00%
<b>2016/2017</b>	Clinical Engeneering	I; II	Res. Centre, Company	50,00%
	Medical Physics	II	Res. Centre	100,00%
	Health Sciences	I(2) II(4)	Health org. Res. Centre	80,00%
	Total	9		55,00%

Source: Administration office of the University of Trieste (UNITS ADM).

Box B. Research, technological development, knowledge transfer and commercialisation

Table B1. Contract research

Contract research				
Years	Contract research - Total amounts (euros)	Contract research - Number of projects	Contract research - Average amounts (euros)	Contract research - Amounts (% FVG)
2013	2,250,700.95	62	36,301.63	66%
2014	763,669.32	35	21,819.12	79%
2015	1,136,367.83	48	23,674.33	52%
2016	2,292,516.66	60	38,208.61	53%
2017	4,481,518.59	85	52,723.75	20%

Source: Administration office of the University of Trieste (UNITS ADM).

Table B2. Patent (applied/granted), co-ownership with regional industry

Patent (applied/granted), co-ownership with regional industry							
Year	Patent awarded normalised	Patents awarded (absolute numbers)	Active patents in co-ownership with companies and research centres - TOTAL	Active patents in co-ownership with companies and research centres from FVG	Active licenses with companies and research centres - TOTAL	Active licenses with companies and research centres from FVG	Patent portfolio (Patents applications + Granted patents)
2012			8	2	2	2	110
2013	0.55	11	6	2	3	2	104
2014	0.57	11	5	1	3	2	82
2015	0.59	11	5	1	3	2	87
2016	0.69	12	6	2	3	2	94
2017	0.69	12	5	2	4	3	92
U-Multirank rankings*	3	3					

Source: data of the first two columns are retrieved from U-Multirank; the other indicators are retrieved from the Industrial liaison office of the University of Trieste (UNITS ILO).

\* Notes: in the last row, there are the rankings (scale from 1 to 5) referred to data from U-Multirank (1: very good; 2: good; 3: average; 4: below average; 5: weak).



Table B3. University positions funded by eternal organisations (Companies, Research Canters; Professionals with research positions at university; post- doc researchers

Year	Professorships or other university positions funded by local/regional industry			Post-Doc researchers	
	Professorships Headcount	Number of employees from non-academic organisations taking temporary research positions at university	Number of employees from non-academic organisations taking temporary research positions at university (% FVG)	Headcount	FTE
2012	2	50	77%	200	-
2013	4	38	73%	232	177
2014	4	38	73%	255	192
2015	5	53	70%	240	181
2016	8	28	60%	226	169
2017	8	238	164	238	164

Source: Administration office of the University of Trieste (UNITS ADM).

## Box C. Entrepreneurship and support to enterprise

Table C1. Spin-offs

Spin offs				
Years	University spin-off and start-up companies (number of, employment generated, turnover)	Number of spin-offs	FTE employed	Turnover
2012		13	100	9,063,354
2013	22.54	16	107	9,098,864
2014	3.43	18	114	8,673,043
2015	3.64	19	122	9,840,514
2016	2.98	16	130	10,897,868
2017	2.98	20		
U-Multirank rankings*	3			

Source: data of the first column are retrieved from U-Multirank; the other indicators are retrieved from the Industrial liaison office of the University of Trieste (UNITS ILO).

\* Notes: in the last row, there are the rankings (scale from 1 to 5) referred to data from U-Multirank (1: very good; 2: good; 3: average; 4: below average; 5: weak).

Box D. Regional orientation, strategic development and knowledge infrastructure

Table D1. Embedding regional innovation system in international R&D networks

	Income from regional sources	Contribution to embedding the regional innovation system in international R&D networks	Collaboration with regional partners
Years	Income from regional sources: proportion of external research revenues – apart from government or local authority core/recurrent grants – that comes from local/regional sources (i.e. industry, private organisations, charities).	<u>International joint publication</u>	<u>Regional joint publication</u>
2013	3%	58%	42%
2014	24%	62%	48%
2015	24%	62%	48%
2016	29%	61%	48%
2017	29%	61%	48%
U-Multirank rankings*	2	1	1

Source: data are from U-Multirank.

\* Notes: in the last row, there are the rankings (scale from 1 to 5) referred to data from U-Multirank (1: very good; 2: good; 3: average; 4: below average; 5: weak).

## List of indicators

<b>Indicators Box A: Education and human capital development (with a regional orientation)</b>	
<u>Subjects</u>	<u>Indicators</u>
Staff exchange	Number of faculty members taking a temporary position in a non-academic organisations
	Number of faculty members taking a temporary position in a non-academic organisations (% FVG)
	Number of employees from non-academic organisations taking temporary teaching positions at university
	Number of employees from non-academic organisations taking temporary teaching positions at university (% FVG)
Students	Labour outcomes and student satisfaction post-graduation
	Student internships in the region
	Graduates doing internships %
Post graduate Internships	Graduates doing internships in companies and non-academic organizations
	Graduates doing internships in companies and non-academic organizations %
	Graduates doing internships in companies and non-academic organizations in FVG
	Graduates doing internships in companies and non-academic organizations in FVG %
	N. of companies employing trainees (Total)
	N. of companies employing trainees (FVG)
Regional student retention	Graduate employment: percentage of graduates working in the region after graduation (North-East area; Nuts 1: ITD)
	Graduate employment: percentage of graduates working in the region after graduation (FVG region; Nuts 2: ITD4)
Graduate tracking of salaried employment	Wait unemployment
	Wages of university graduates (1 year after graduation)
	% of students finding employment in the North-East area
PhD programmes	PhD programmes and scholarships financed by external partners
Masters	Masters in cooperation with external partners
<b>Indicators Box B: Research, technological development, knowledge transfer and commercialisation</b>	
<u>Subjects</u>	<u>Indicators</u>

Contract research	Contract research - Total amounts (euros)
	Contract research - Number of projects
	Contract research - Average amounts (euros)
	Contract research - Amounts (% FVG)
	Patent awarded normalised
Patent (applied/granted), licensing income from local/regional industry	Patents awarded (absolute numbers)
	Active patents in co-ownership with companies and research centers - TOTAL
	Active patents in co-ownership with companies and research centers from FVG
	Active licenses with companies and research centers - TOTAL
	Active licenses with companies and research centers from FVG
Post-Doc researchers	Number of patents (Patents applications + Granted patents)
	Headcount
	FTE
University positions funded by external partners	Professorships or other university positions funded by local/regional industry
	Number of employees from non-academic organisations taking temporary research positions at university
	Number of employees from non-academic organisations taking temporary research positions at university (% FVG)

### Indicators Box C: Entrepreneurship and support to enterprise development

<u>Subjects</u>	<u>Indicators</u>
Spin-offs	University spin-off and start-up companies (number of, employment generated, turnover)
	Number of spin-offs
	FTE employed
	Turnover
<b>Indicator Box D: Regional orientation, strategic development and knowledge infrastructure (with involvement of local, regional, national or foreign partners)</b>	
<u>Subjects</u>	<u>Indicators</u>
Income from regional sources	Income from regional sources:

Contribution to  
embedding the  
regional innovation  
system in  
international R&D

International joint publication

Collaboration with  
regional private  
partners

Regional joint research publications within local/regional industry