

Regional Innovation Impact Assessment Framework Case Study "Politecnico di Torino"

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Politecnico di Torino



1 Introduction

Located in Turin, Politecnico di Torino (shortly PoliTo) is Italy's oldest technical university, formerly known as the "School of Application for Engineers". The University ranks 387th in the 2018 QS World University Ranking and 33rd in the 2018 QS World University Ranking for the Engineering and Technology subject. Besides, the 2018 QS World Graduate Employability Ranking placed the University at the first position, regarding the "Graduate Employment Rate" indicator (within 12 months of graduation), thus pointing out the quality of its education and its reputation among firms

Table 1. Key facts and figures

Year	2011	2017
Total Budget	186 M€	250 M€ ⁽¹⁾
# academic staff (FTE)	887	878
# students	28.631	33.000 ⁽²⁾
# Scopus publications	2.290 ⁽³⁾	2.810
% of top 10% publications	13 % ⁽³⁾	15 %

Source: ETER, SciVal, internal data

⁽¹⁾ 50% comes from the Italian Ministry, 10% from students' tuition fees and 40% from competitive research grants.

⁽²⁾ 15% are foreign students

⁽³⁾ 2013 data

The purpose of this case study is to show through a "narrative with numbers" the different university contributions to the regional innovation system. Given the difficulties involved in measuring the impact of a university's activities, considering their breadth and intangible nature, we will provide a narrative, along with numbers, that can help explain how this University has had and continues to have an impact on research and innovation at a regional level. Following the guidelines of Regional Innovation Impact Assessment (RI²A) framework, this case study firstly introduces the regional environment that allows contextualising the University's strategy and activities in response to the needs and issues of the region (section 1.1). Then, it explains the activities and their impacts concerning support to human capital development and entrepreneurship education (section 2), knowledge generation and transfer (section 3) and support to enterprise development (section 4). The report concludes with the vision for future developments (section 5).

1.1 Regional context and university strategy evolution

Although PoliTo performs most of its activities in the Turin metropolitan area, which is identifiable at a NUTS3 level, it is also active at a regional level. In 2017, the Regional Innovation Scoreboard (RIS) classified the Piedmont regional economic system as "moderate + innovator", a classification that is very close to the upcoming grade (Strong Innovation Leader). The Piedmont region has several local firms with strong research and innovation capabilities. This indicator shows that Piedmont has a relative advantage in the "private R&D expenditure" and "SMEs innovating-in-house" indicators, to other European regions. The region is characterized by the presence of both large multinational enterprises (e.g. FCA, Leonardo, Thales Alenia, Comau, Ferrero etc.) and small-medium sized enterprises (SMEs) which operate in global value chains (i.e. automotive, aeronautics, food, etc.). Over time, the region has developed high innovation capabilities in these

technological specialization areas and a strong network of relationships among local industrial actors.

Due to this regional industrial vocation, PoliTo has always had close relationships with firms (mainly of medium-large size), in the form of partnerships and research collaborations, as well as through the supply of a constant flow of skilled engineers and architects. However, this role has progressively changed since the nineties due to exogenous and endogenous factors: the crisis of FIAT (now FCA) and the local automotive value chain, the stagnation of the Italian economy, the rise of globalization and delocalization, and the diffusion of general-purpose technologies (i.e. ICT) in different industries.

In response to this, the regional government developed a new strategic plan¹, to define priorities, in terms of regional technological specialisations. The plan gave a key role to the university system in this technological specialisation process (Colombelli et al., 2018). Thus, PoliTo adopted some actions that were aimed at supporting the on-going transformation towards a more diversified economic system, integrating Information and Communication Technologies (ICT) to the "traditional" manufacturing competences, while favouring the creation of new industries e.g. biotechnology, mechatronics, biofuel, advanced materials etc (box 1).

To do so, PoliTo built formal and long-term collaborations with local firms, in the form of collaborative research, contract research, consulting, joint ventures, joint participation in EU funded programmes, etc. PoliTo also co-founded two different research centres (ISMB² in 2000 and SITI³ in 2002) in partnership with some large companies (e.g. Telecom Italia, Motorola, FIAT, ST Microelectronics, etc.) and local public institutions (e.g. the Compagnia di San Paolo Foundation). At the same time, the foundation of the University incubator (I3P) signals the strategic intention of the University to promote governance and leadership for the emerging entrepreneurial ecosystem (Colombelli et al., 2019).

As a result, Turin and the Piedmont region have evolved from a traditional industrial setting with FIAT carmaker at its very center in a directive role, to a more sophisticated and technologically diversified system, which today is only partially linked to the local automotive production system (Whitford and Enrietti, 2005) and in part ascribable to PoliTo's activities in research and innovation (Colombelli et al., 2019).

Box 1. Innovation Clusters

Innovation Clusters are one of the main strategic actions undertaken by the Piedmont regional government to achieve the objective of renewing and diversifying the regional technological specialization. PoliTo participates, as a research partner, in several of such innovation clusters. According to the S3 strategy, the local government created the following clusters: Agri-food, Biotechnologies and Biomedical, Renewable energies and biofuel, ICT, Sustainable Chemistry, New Materials, Mechatronics and Advanced Production Systems. These clusters had four main objectives: funding support to sustain SME investments, knowledge and technology transfer to SMEs, networking, and applied research on key enabling technologies.

To deal with the requests coming from the local industry, particularly with the impending issues of Industry 4.0 and other emerging technologies, PoliTo, with the implementation of its Strategic Plans, has invested and created an organizational structure aimed at changing the role of the University in fostering knowledge transfer and engagement with the society and industry. PoliTo undertook two main initiatives in this organizational structuring. Firstly, the Technology Transfer office has been organized into the current Technology Transfer System (TTS), which involves three main collaborating units (fig. 1). The Technology TRansfer and Industrial Liaison Department (TRIN) manages administrative and legal issues concerning intellectual property and research collaborations. The Entrepreneurship and Innovation Centre (EIC) provides research and methodological support to technology transfer activities while informing policy. The Lab

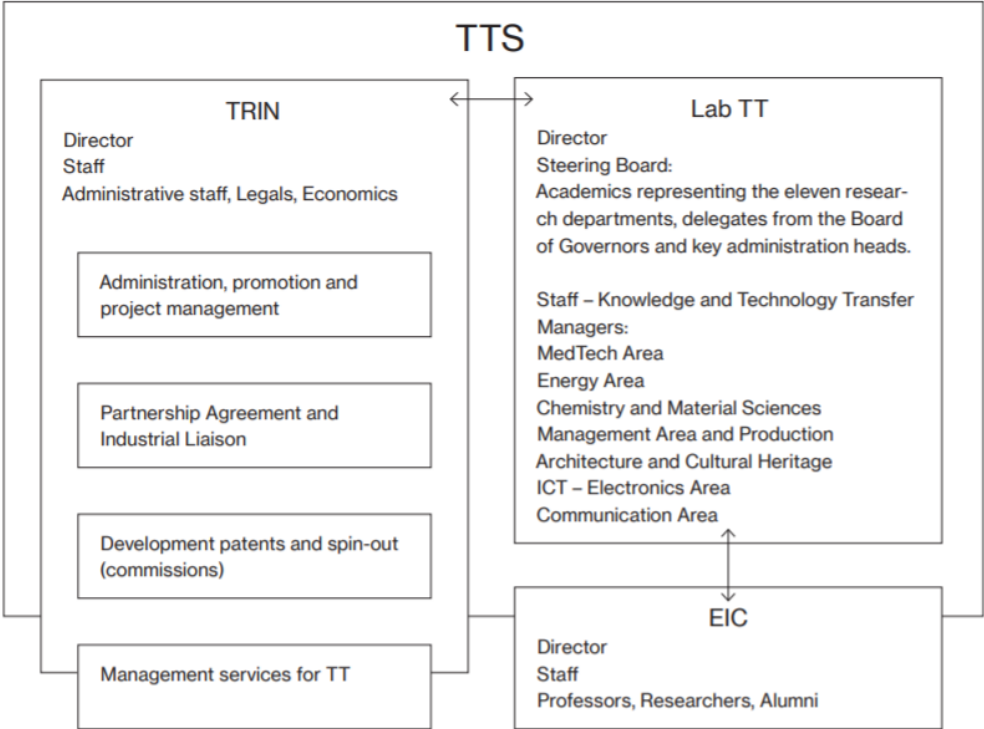
¹ DOCUP ("Documento Unico di Programmazione"), covering the 2000-2006 period.

² Istituto Superiore Mario Boella, now LINKS.

³ Istituto Superiore sui Sistemi Territoriali per l'Innovazione.

Technology Transfer (TT), an interdepartmental research centre, acts as a liaison between TRIN and the “vertical” departments.

Figure 1. Organization model for technology transfer



Source: Organization of Politecnico di Torino TTS (based on internal documents)

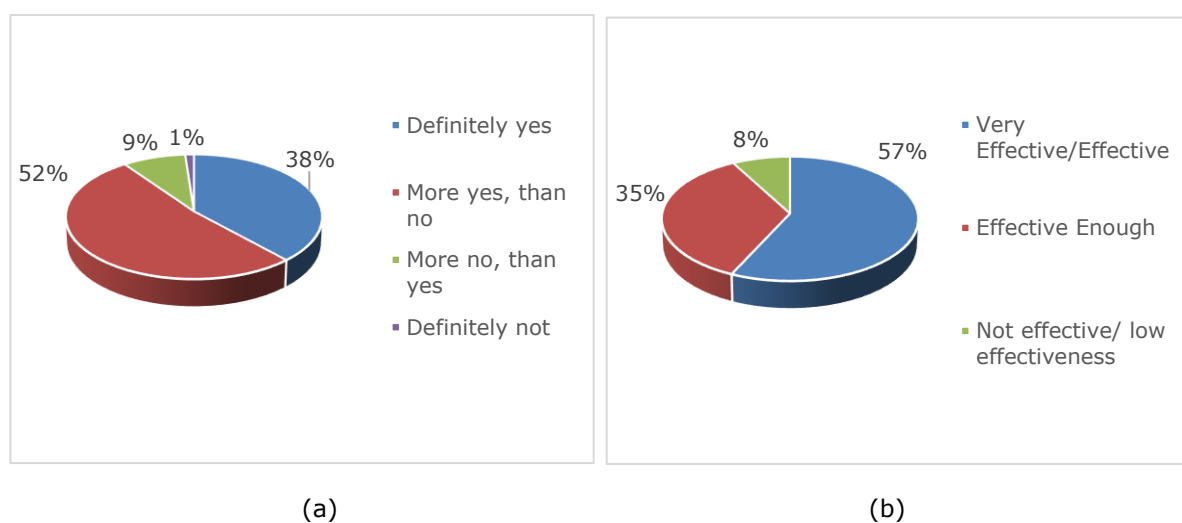
Secondly, the creation of 11 new inter-departmental research centres focusing on the key enabling technologies has the objective to tackle with the current regional needs of nurturing and diversifying the economic system towards emerging technologies (see also section 3).

2 Support to human capital development and entrepreneurship education

Currently, PoliTo provides teaching to approximately 33,500 students (including PhDs), of which around 15 % are foreign students and 45 % are Italians from outside Piedmont (students tend to choose PoliTo because its employability rate is higher compared to the most of Italian universities). Around 2/3 of the courses are given in English, and courses are provided to around 700 PhD students, whose scholarship is partly funded by local and international companies.

The quality of education has a high rating among students. A recent graduate survey, conducted by AlmaLaurea in 2017, revealed that nine students out of ten appreciate their degree course (fig. 2a). Similar results regard the rating of satisfaction with the job performed after graduation (fig. 2b).

Figure 2. Share of students satisfied with their degree course (a) and effectiveness of graduation for the job performed after graduation (b)



Source: AlmaLaurea⁴, 2018. Self-reported data

The 2017 QS World Graduate Employability Ranking, about the "Graduate Employment rate" indicator assigned the 1st position to PoliTo, and the AlmaLaurea Italian survey revealed that the employment within one year after graduation was close to 90%.

PoliTo also promotes the retention of graduate students in the Turin area. In fact, the same AlmaLaurea survey revealed that 71,1 % of graduate students would be willing to work in the Turin Area, and this choice was followed by the province of residence (62,9%), North Italy (62,2%), the Piedmont Region (62,0%) and another European country (60%). Moreover, PoliTo invests in retaining promising researchers as it decided to increase the standard national grant for PhD students by more than 25%, at its expenses, by using the resources coming from industrial research grants. PoliTo is also actively involved in connecting education with industry since more than 90% of its students participate in a traineeship in a company as a key part of their education experience.

To increase the quality of education, PoliTo has also developed international curriculum studies, thanks to the 463 partnership collaborations with international universities: every year there are more than 1.000 incoming and 1.000 outgoing Erasmus students.

However, the education carried out by PoliTo involve also employees of firms and graduate students. In particular, PoliTo collaborates with local and national associations of employers

⁴ Founded in 1994, AlmaLaurea is an association that collects annual statistics from the associated universities. All graduated students must submit an online survey before graduation.

to provide post-degree courses to develop new competencies for managers and highly skilled employees (box 2 provides an example).

Box 2. Master in Additive Manufacturing

Co-founded by the regional government, the master in Additive Manufacturing (2nd Level Specializing Master's diploma in Additive Manufacturing) is offered in close cooperation with international manufacturing companies. Sponsor organizations hire participants while undertaking 72 ECTS in classrooms. This course is an example of how to match study and work experience, and its objective is to develop at the regional level both new technical and managerial skills in a key emerging technology.

Turning to entrepreneurship education, PoliTo has started to provide entrepreneurial courses and initiatives since 2015 to an increasing number of students. The objective is twofold. Firstly, to facilitate business growth in the region and, secondly, to provide experience-based learning that can renew the established organisations' innovative spirit.

Today around 4-5% of the bachelor students attends at least one course on entrepreneurship or innovation. This figure will increase significantly in the next 3 to 5 years as this represents one of the major pillars in the recently approved strategic plan. PoliTo also offers courses at M.Sc. and PhD levels (both curricular and extra-curricular) to foster the ability to transfer research results and innovative mind-sets to companies. Whether they be specific courses, hackathons, prototyping bootcamp, weekly programs or monthly projects the key design principles are learning by doing, teamwork and mentoring. A common feature for most of the courses is the fact the students' activities start from challenges made available by companies, research centres, local institutions, universities, etc. Some examples of entrepreneurship education are provided in the boxes below.

Box 3. European Innovation Academy

For three weeks, during the summer, PoliTo hosts the European Innovation Academy, an intensive summer entrepreneurship school. Approximately 500 international students (including PoliTo's students), from over 600 Universities guided by renowned mentors (university teachers, entrepreneurs, sector professionals and venture capitalists) and with the sponsorship of multinational firms (e.g. Google) and international institutions (including universities), are challenged to transform their ideas into a high-tech start-up while working in a multidisciplinary, multicultural and international team.

Box 4. Innovation for Change

Since 2015, in partnership with CERN and the Agnelli Foundation, PoliTo offers an entrepreneurship programme for about 560 students (PhDs and MBAs) per year to identify solutions to long-term challenges presented by large companies and international institutions. Addressed to students with high technical background, the program is based on teamwork and the contribution of different skills to solve global reaching issues (health, pollution, water etc.) that would create innovation-based changes in our society.

Box 5. CLICK – Contamination Lab & Innovation Kitchen

CLIK - Contamination Lab & Innovation Kitchen is an experimental educational laboratory that recently became a major block of PoliTo's strategy to foster innovative education and entrepreneurial culture. The project started at the end of 2017 and involved in 2018 about 250 students coming from all M.Sc. courses of PoliTo, according to 7 different Challenges. CLIK is a physical place where students can experiment and put into practice what they have learnt in the classroom, in an informal and multidisciplinary environment that promotes creativity and collaboration. External firm and/or institutions provide "challenges" coming from their real business and 30 students grouped in teams, compete and develop their own solution. Teamwork helps students improve their hard and soft skills and learn how to collaborate in a complex real business environment, mixing technical and market issues.

3 Knowledge generation and knowledge transfer

PoliTo has an average of 14 % of the total top yearly publications cited in their specific scientific field. This demonstrates the high-quality research of its faculty in knowledge generation. To the same extent, the institution is committed to transforming the knowledge created from research into innovation, to have a real impact on society and economy. Indeed, PoliTo's Statute recognizes the importance of the valorisation of research results: "one of the PoliTo's objectives is to enhance the University's research results, through the promotion of activities that may also entail their capital exploitation".

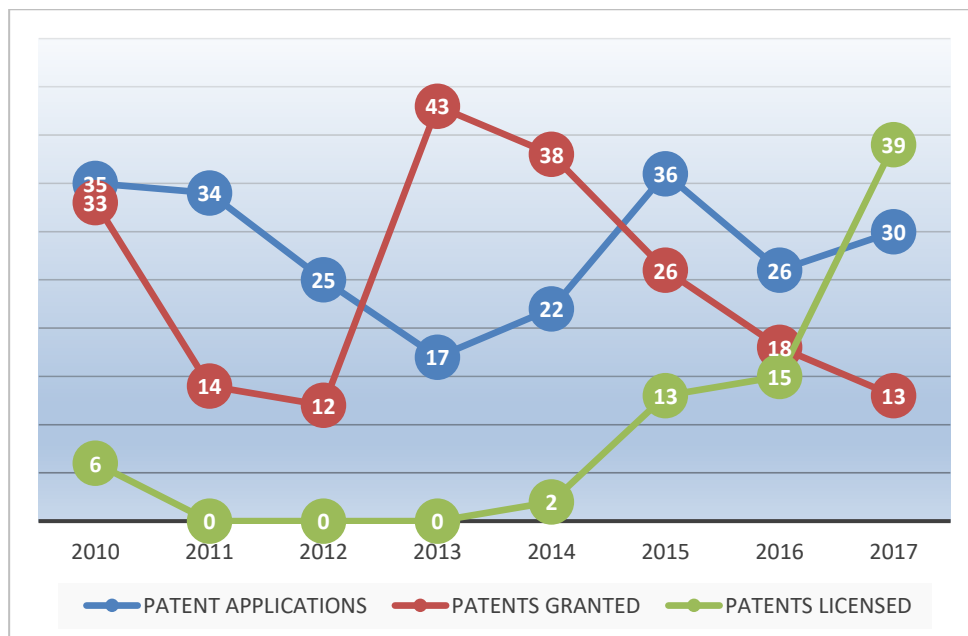
With more than 600 registered patents, PoliTo can be considered as a leading university in technology transfer. There has been a growing number of patent applications and patent licenses to companies since 2014 (fig. 3), a sign of an ever-increasing pro-activeness and growing attention to technology transfer.

The focus on collaboration with the ecosystem can be confirmed by several indicators:

- 50% of the patents are co-owned with local companies or research centres (fig. 4);
- 6,8% co-publication rate with industry partners;
- approximately 40 current long-term partnership agreements in place;
- 53,7% industry co-patent rate.

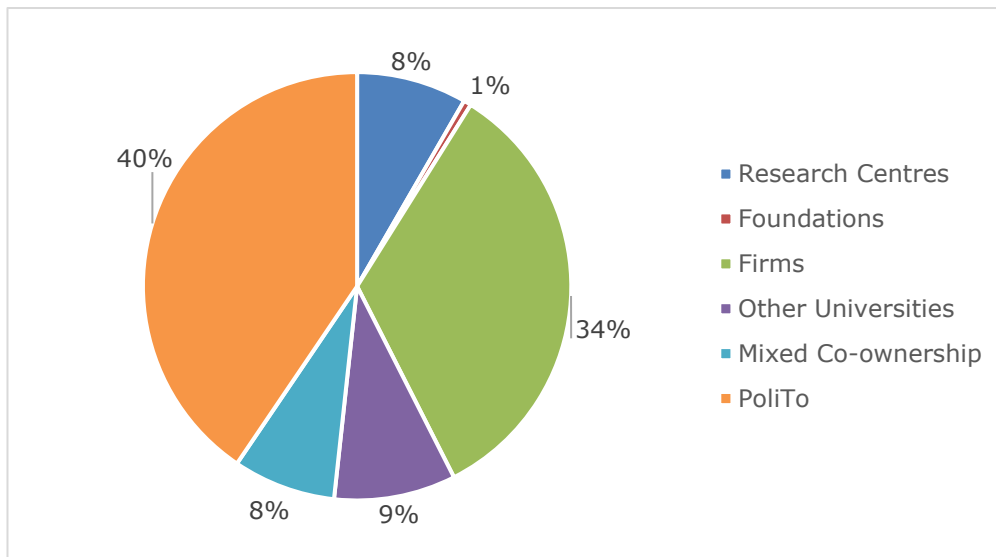
The share of patents filed in co-ownership signals both the great attention of PoliTo toward external institutions and the increasing demand from the external actors to collaborate with the University to access new knowledge.

Figure 3. Trends of patenting activities



Source: Internal data

Figure 4. Co-ownership rate (%) of patent applications



Source: Internal data

To further promote knowledge transfer PoliTo actively supports the technological development of early-stage inventions (box 6). This decision recognizes the difficulty to attract funds to convert most of the research results (when intellectual property is created) into industrial applications (when commercial concepts are verified, and proper markets are identified).

Box 6. Proof of Concept

To manage the so-called “death valley” of inventions, whereby few investors are willing to invest due to the high technical risk, PoliTo acts as a proactive investor providing small seed funds, up to 50,000 €, subject to certain conditions (e.g. team composition, availability of intellectual property etc.). The Proof of Concept program has two annual calls for a total investment of around 1 M€ per year. An analysis of financed projects (30 out of the 45 funded so far) reveals that the program has increased technology readiness level (a measure of technological maturity) by two points on average, from around 3-4 to 5-6. This project helped fill the gap between research results and industrial applications, by favouring the founding of spin-offs and new forms of collaboration with local companies.

Another initiative for in the direction of knowledge transfer pertains to Knowledge Share, a platform that collects, organizes and make available to Italian companies all the active patents of the Italian universities and research centres (box 7).

Box 7. Knowledge share

Initially developed by PoliTo, with the sponsorship of Banca Intesa and the Ministry of Economic Development, Knowledge Share is now being adopted by other Italian University under the supervision of NetVal a non-profit entity for the valorisation of research results in Italy). The rationale behind this project lies in the difficulties that Italian Universities have in adequately promoting their research results. The solution brought up by PoliTo was the creation of an Internet-based platform (<https://www.knowledge-share.eu/>), acting as a unique entry point for patents filed from most of the Italian universities and research centres. The objective is to share knowledge by matching scientific know-how with industrial applications through the direct contact of research groups with businesses and other public organizations.

As noted in section 1, PoliTo has become increasingly concerned with regional needs and issues. To respond to both the need of ICT integration in the “traditional” manufacturing industries and the diversification of the economic system into new industries, PoliTo

invested 30 M€ in 2016 to create 11 cross-departmental research centres, which became 13 in 2018. These centres perform research on key enabling technologies in close collaboration with local and international industrial companies of different size (box 8 provides an example while the annex 1 provides the list of these centres).

Box 8. Inter-departmental research centre for Additive Manufacturing

Integrating different research backgrounds (from mechanical engineering, automation, materials to management and production engineering), the inter-departmental research centre "*Integrated Additive Manufacturing*" is an example of both high-quality research and technology transfer of a key enabling technology. In addition to consultancy and research collaborations with local firms, the centre is involved in a project for the development of Additive Manufacturing in Piedmont. Such collaborative research project aims at promoting the technology development and related-innovations of Power Bed (PD) and Direct Deposition (DD), two Additive Manufacturing (AM) technologies. Financed by the Piedmont region and the EU, the project involves several partners, including universities, research centres and industrial partners.

In addition to partnership agreements and research collaborations with medium-large firms, recently the University has been providing growing support to SMEs, by an array of programmes aimed at developing new forms of collaboration with SMEs (box 9). Two specific projects have been undertaken in this direction. The former provides specific tutoring and coaching services to foster product and process innovations in SMEs (box 9). The latter, called "*Techshare day*", makes the technologies developed in the PoliTo's labs available to a large number of SMEs. On an annual basis, the number of involved companies in such programs is more than 100.

Box 9. Broad P.I.T.T.

Broad P.I.T.T. is a tutoring and coaching program, which lasts 5-7 months, conducted to sustain product and process innovations in SMEs by exploiting existing technologies with a key role played by PhD students and young researchers. Through this initiative, PoliTo (together with a team that includes designers, consultancy firms and other local actors) is bringing the capabilities needed to innovate and/or adopt new technologies to a broad set of SMEs. The planned activities include high-level training in advanced technologies, consulting and IP offering.

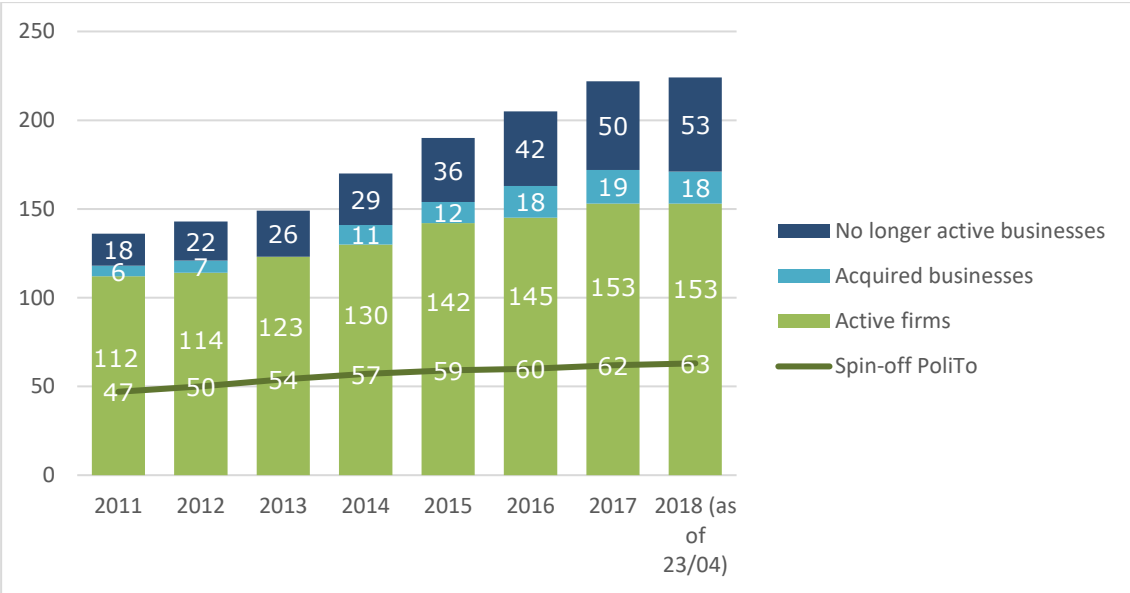
PoliTo also plays a key role in connecting the regional innovation system with international research networks. For example, it has been engaged in 12 European Research Projects funded by the ERC, of which 10 have been approved as "Principal Investigator" and 2 as "Partner Institutions". It is also participating in 2 EU FET Flagship Initiatives: Graphene and the Human Brain Project. Moreover, 45,4% of the publications in scientific journals have had at least one foreign author. These data demonstrate the strategic intention of the Institution to adopt an international orientation and to create links between regional and international actors.

4 Support to enterprise development

With more than 54 spin-offs (up to 2018), PoliTo has a relevant experience in this field. The development of spinoffs is a process requiring several stages. The Technology Transfer Office offers some services to sustain the process of spin-off creation, like intellectual property management and enforcement, business plan development and attraction of funding. In all such stages, the TTO encourages multi-disciplinary teams, the early inclusion of researchers and the involvement of professors in the founding teams of spin-offs. Doing so, the TTO prepares the conditions for successful entrepreneurial initiatives.

Enterprise development and entrepreneurship have been a key concern since the foundation of I3P⁵, the business incubator of PoliTo, in 1999. I3P is a non-profit consortium that includes the Turin Chamber of Commerce, the City of Turin and the Province of Turin as shareholders⁶. Since its inception, I3P has promoted and supported the creation and development of new enterprises coming both from PoliTo researchers (PoliTo spin-offs) and external entrepreneurs and/or established firms with new business ideas, with a special focus on high-tech industries. I3P has been successful and the number of incubated companies has increased substantially throughout the period from 2011 to 2018 (fig. 5)

Figure 5. Incubated start-ups in the PoliTo business incubator I3P



Source: I3P data

The incubated start-ups have determined a positive impact on the local economy and employment. The total turnover and employment have risen gradually from 2011 to 2018, and, in 2016, they stood at 1687 and 124 M€, respectively (table 2). The investments in start-ups have also grown in the same period, reaching a peak of 3.02 M€ and 6.16 M€ for seed and early-stage investment, respectively, in 2017 (table 2).

Table 2. Impact of incubated start-ups on the economy

	2011	2012	2013	2014	2015	2016	2017

⁵ *Incubatore Imprese Innovative del Politecnico di Torino (PoliTo Incubator for Innovative Firms)*

⁶ Very recently, although, the shares from the City of Turin and the Province have been acquired by Campania di San Paolo, one of the leading local bank foundations.

Total employment created by start-ups	672	778	1176	1408	1515	1687	2207 ⁽¹⁾
Patents owned by start-ups	78	74	78	70	86	97	103 ⁽¹⁾
Total Turnover [M€]	44	50	61	75	94	124	⁽²⁾
Seed Investment [M€]	1,7	1	2,3	3	3,2	2,9	3,02
Early-stage investment [M€]	5	-	-	2,5	8,2	5,15	6,16

Source: I3P data

⁽¹⁾ Estimated data

⁽²⁾ Data not available

The Proof of Concept programme, one of the key initiatives of PoliTo, has determined a further positive impact by accelerating the pace of spin-off creation and growth. The spin-offs created in the 2017-2018 period received around 2 M€ (before incubation), with a post-money value of around 10 M€. It is also worth noting that the CEOs of such start-ups were all post-docs who had attended the courses on entrepreneurship introduced recently at PoliTo.

PoliTo and I3P have therefore played a very important role in accelerating the diffusion of innovations generated in the PoliTo labs as well as of business ideas originating from the entrepreneurial ecosystem. The incubator works from higher technological maturity level (TRL 5-6), and, together with PoliTo, it has created an entrepreneurial climate, inside the University and the region, through specific events and meetings with industrial representatives, investors and other members of the business community.

5 Vision for future development and conclusion

In the future, PoliTo will increase its investments aimed at addressing the most important societal and economic challenges, with special attention on the regional ecosystem. PoliTo decides to keep on evolving to make an impact on a rapidly changing society. This is the key goal of the new strategic plan for PoliTo in years 2018-2024, designed to have a significant growth in all the key performance indicators of PoliTo reported in table 3)

Key performance indicators of Innovation	value
Invention disclosures since 2010	352
Patent applications since 2010	257
Patents granted since 2010	213
Commercialised patents since 2010	80
Patent co-ownership rate since 2010	59 %
Spin-offs since 2004	54
Total Start-ups launched by the incubator	224

Table 3. Key performance indicators of PoliTo

In response to such challenges, the PoliTo's strategy is to act as a "platform" for innovation in its region, following an open innovation paradigm. In this direction, a traditional "inside-out" approach to knowledge and technology transfer and enterprise development, is complemented with an "outside-in" viewpoint, where the University becomes open to the needs and issues of industry and society. The University's ambition is to build a network through which an extended academic community can access and interact with multiple stakeholders. To reflect these changing dimensions of impact, terms such as "knowledge transfer" are being replaced by "knowledge sharing" and "co-generation of knowledge".

PoliTo will, therefore, open its courses to the contribution of industry experts and professionals, develop an entrepreneurial culture to students and early-stage researchers, and create physical spaces or platforms to perform and complement education, research and innovation. Such "platforms" will regard key enabling technologies (Industry 4.0, green energy, smart mobility, circular economy, space economy etc.), through which academic researchers and non-academic partners will share knowledge, facilities, equipment and personnel.

Last but not least a particular focus will be devoted to SMEs, which in the past years have remained to the margin of knowledge sharing with universities. In consideration of the key importance of SMEs for the Piedmont and Italian economies, the involvement of such SMEs will continue and expand soon, together with the upcoming technological platforms (see box 10 for details).

Box 10. A Competence Centre for Industry 4.0

In June 2018, PoliTo, in partnership with the *Università Degli Studi di Torino*, won a competitive national tender, financed with 10,5 M € by the Italian Minister of Economic Development, for the creation of a "Competence Centre" focused on key enabling technologies regarding Industry 4.0. The Competence Centre will provide innovative "pilot lines" for different manufacturing technologies and will be a point of reference in all areas related to Industry 4.0 (e.g. Big Data, Internet of Things, robotics, photonics, cybersecurity, new materials, energy efficiency processes etc.), including the organization of work and production. In synergy with the wider European initiative called "EIT Manufacturing" (in which PoliTo is a partner together with the *Politecnico di Milano* and several co-founding companies), the Competence Centre aims to bring the development of new products to a level of technological maturity close to the market, making the transition towards new production paradigms faster for companies. The Competence Centre will provide education, research, and knowledge transfer in these subjects, in particular to small-medium firms.

The activities related to the so-called "third Mission" need further investments to maintain the steady growth in the number of filed patents regarding new technologies, the growth in the number of spinoffs and their ability to raise early-stage funding from investors and local companies.

For this reason, more recently PoliTo started a plan to attract investors. In this respect, the agreements signed in the last three years with Venture Capital funds that specifically target university Technology Transfer represent a first remarkable channel designed to attract early-stage investments to foster technology development and transfer. Following up this initiative, new actors are entering the ecosystem and creating more international opportunities. For example, at the beginning of 2019, TechStars, the renowned accelerator from Silicon Valley, has opened a new site in Turin as the result of an agreement signed with local institutions.

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List of abbreviations and definitions

ERC	European Research Council
FCA	Fiat Chrysler Automobiles
ISMB	Istituto Superiore Mario Boella
I3P	Incubatore Imprese Innovative Politecnico di Torino
ICT	Information and Communication Technologies
NUTS	Nomenclature des unités territoriales statistiques
PoliTo	Politecnico di Torino
RIS	Regional Innovation Scoreboard
RI ² A	Regional Innovation Impact Assessment
SITI	Istituto Superiore sui Sistemi Territoriali per l'Innovazione
SMEs	Small and Medium Enterprises
S3	Smart Specialization Strategy
TTO	Technology Transfer Office
TTS	Technology Transfer System

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CWC - CleanWaterCenter@PoliTo

Ec-L - Energy Center Lab

FULL - Future Urban Legacy Lab

IAM@PoliTo - Integrated Additive Manufacturing

J-Tech@PoliTo

PEIC - Power Electronics Innovation Center

PhotoNext - Centro Interdipartimentale PoliTo sulla Fotonica applicata

PIC4SeR - PoliTo Interdepartmental Centre for Service Robotics

PoliToBIOMed Lab - Biomedical Engineering Lab

R3C - Responsible Risk Resilience Centre

SISCON - Safety of Infrastructures and Constructions

SmartData@PoliTo - Big Data and Data Science Laboratory

Acknowledgements