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HIGHER EDUCATION AND SMART SPECIALISATION: THE CASE OF APULIA (ITALY)

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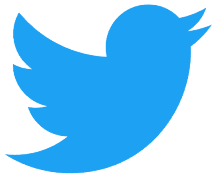
The focus on networks leads to the identification and recognition of linkages that may be beneficial for the realisation and commercialisation of new ideas. Such linkages may include those between research and education institutions and business, or those which involve both vertical and horizontal co-operation, which have the potential to **catalyse transformative change**

Veldhuizen et al. (2018), State of the Art Review of Smart Specialisation in Europe

BUT

When the wind of change blows,
the Italian puts on the double windows.



Background context HESS project: aims and activities

The project had three broad aims:

- To conceptualise and analyse the role of HEIs in Smart Specialisation.
- To help build innovation capabilities by strengthening the role of HEIs in regional partnerships.
- To promote the integration of higher education with research, innovation and regional development in S3 policy mixes, particularly in the use of European Structural and Investment (ESI) Funds.

HESS main activities include 'action research' and capacity building in some selected European regions.

HESS in Apulia

- Istituti Tecnici Superiori (ITSs), i.e. Higher Technical Institutes, a form of technology-based vocational education and training.
- Innovative Industrial Doctorates (IIDs).

Reasons to take part to this study

- New role for third mission activities in Italy
- Youth unemployment and complex transition from study to work
- Funding opportunities for vocational and doctoral training at both national and regional level

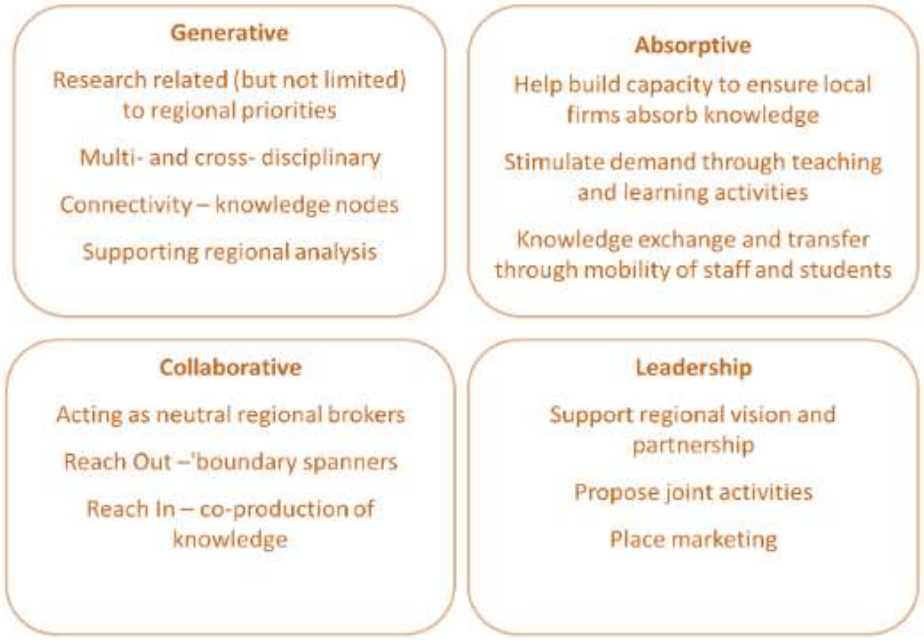
How ITS and IID are being implemented, the challenges they face and their potential role in S3 implementation

Theoretical framework

Table 1: Models of university engagement

Model	Ivory Tower	Entrepreneurial University	Civic University
Characteristics	Traditional teaching methods for the elite, curiosity research, disciplinary silos.	Strong focus on research, technological innovation, commercialisation and business development which involves mobilising the resources of the university for the benefit of the economic development of the city or region.	Engagement embedded across the whole institution, providing opportunities for students, businesses and public institutions; managed to facilitate institution-wide engagement with the city and region of which it is part; operates on a global scale but uses its location to form its identity.
Concepts		Triple helix, science parks, technology transfer, incubators	Engaged research and teaching, science with and for society, quadruple helix, smart specialisation
Authors/ References		Etzkowitz (2013)	Goddard (2009), Goddard et al (2016), European Commission (2017)
International networks/tools	Campus Engage; Talloires Network; U-Multirank; Global University Network for Innovation (GUNI); HEInnovate; University Industry Innovation Network (UIIN)		

Figure 1: Capacities of universities in the context of smart specialisation



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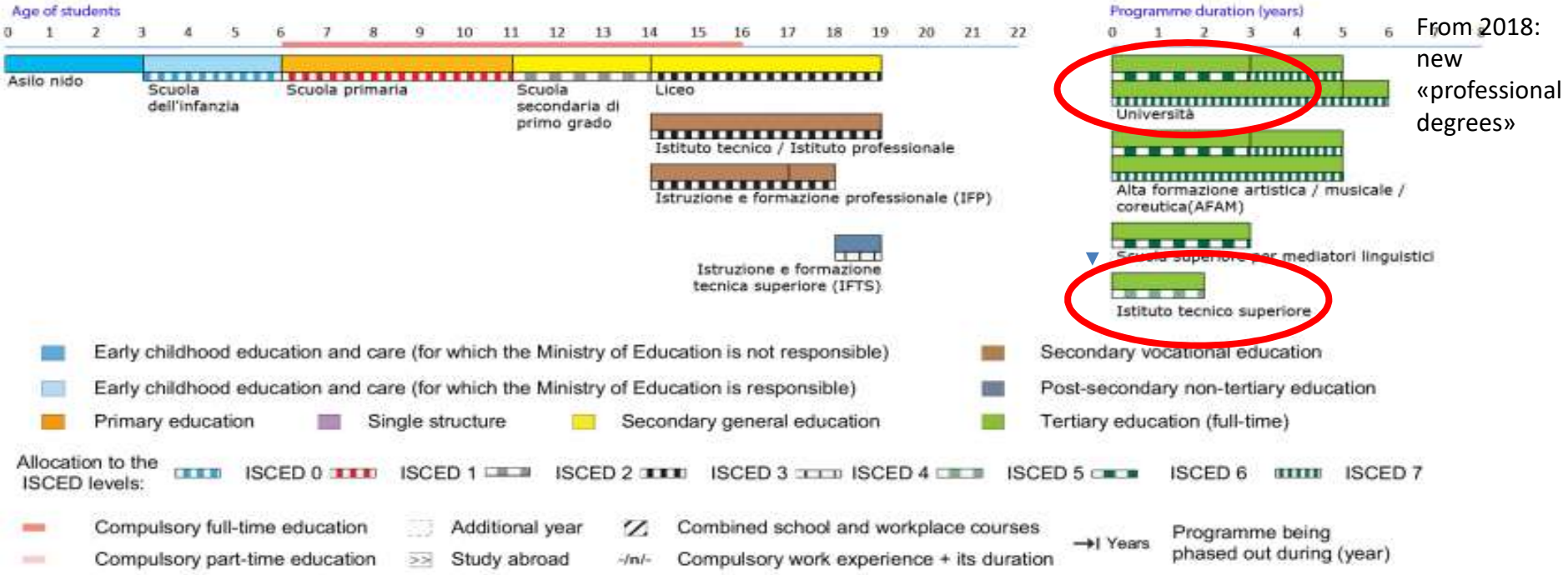
Italian Innovation System: bottlenecks

- firms, especially young and small innovative ones, have to cope with the existing R&D funding gaps
- limited availability of skilled human resources that hinders innovative performance
- weak cooperation between academia and business.

A number of policy initiatives have been taken to support Italian research and innovation system (Nascia et al. 2018):

- ✓ Italian R&I system has been fragmented with many initiatives overlapping between national and regional levels (unclear coordination)
- ✓ delays in the implementation of planned measures and uncertainty about budget availability represented major problems during the economic crisis started in 2008.

Italian Education System at a glance



From 2018: new «professional degrees»

Source: Eurydice 2016

Italian Education System at a glance

Indicators	Italy	Europe
Early leavers from education and training (age 18-24)	13.8%	10.7%
Tertiary educational attainment (age 30-34)	26.2%*	39.1%
Employment rate of recent graduates by educational attainment (age 20-34 having left education 1-3 years before reference year) – ISCED 1-8	52.9%	78.2%
Unemployment rate for 20 to 34 year-olds	21.5%	11.8%
NEET rate for 18 to 24 year-olds	26.0%	15.2%
Employment rate for tertiary education (24-64 years old) – ISCED 5-8	79.8%	84.8%

Key indicators for Education, Training, and the Labour Market
Source *Eurostat 2016*

Italy: difficult transition from education/training and the labour market

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Early leavers from education and training (age 18-24)	13,8%	10,7%
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Source: Eurostat 2016

** National target for Italy: 26-27%; European target (Europe2020): 40%*

- limited access to **career orientation services** (OECD, 2017);
- limited **previous work experience** (especially before the introduction of the mandatory traineeship for all upper secondary students, known as "the Good School Act", 2015), or a sufficient range of skills needed on the job (cognitive and soft skills, OECD, 2017a);
- lack of **information about employment opportunities** and services (OECD, 2017);
- high **skills mismatch** (OECD, 2017a; Pastore, 2017).

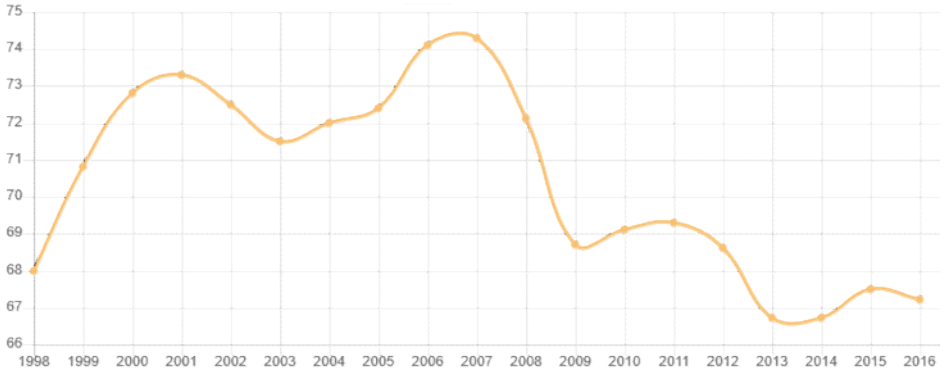
Bottlenecks in «getting skills right»

Italy's labour market suffers from shortages of cognitive and quantitative skills that need to be addressed through more innovative teaching methods able to help students develop those skills since a young age.

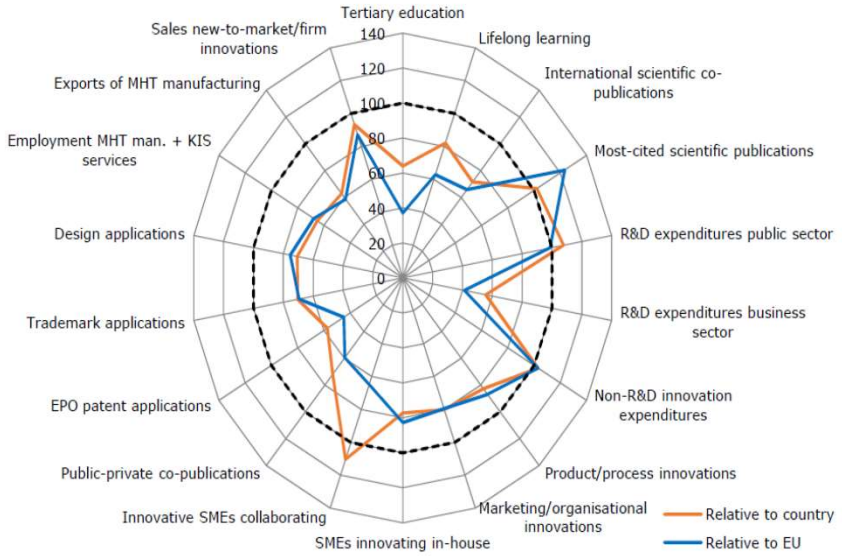
A better designed set of incentives and stronger career progression linked to performance are required to boost the attractiveness of teaching professions as well as to provide workers in this profession with adequate incentives for mobility.

OECD, 2017

Apulia: impact of economic crisis on a moderate innovator



Apulian GDP, 1998-2016, billion euros



Regional European Scoreboard (2017)

Table 3 - *Puglia Smart Specialisation priority areas*

Priority Area: SUSTAINABLE MANUFACTURING	
Innovation Value Chains	**Innovation Fields**
● Aerospace	● Aerostructures ● Engine design, Propulsion ● Avionics, Systems, Equipment ● Design, simulation, validation and management systems
● Transport	● Engine design, Propulsion ● Other mechanical parts and subsystems ● Systems, Equipment ● Design, simulation and management systems
● Mechatronics	● Control and actuating systems, robotics ● Design, simulation and management systems
● Other Manufacturing ○ Textiles and clothing ○ Furniture ○ Chemistry ○ ...	● Advanced manufacturing systems ● New materials ● Design, simulation and management systems ● Logistics
Priority Area: HUMAN AND ENVIRONMENTAL HEALTH	
Application Sectors	**Innovation Fields**
● Agro-food	● Food safety ● Food products shelf-life prolongation, packaging ● Functional foods
● Pharmaceutical	● Drug design
● Medical & Healthcare	● Medical diagnostics ● Advanced therapies ● Active aging and self-management of health
● Sustainable Energy	● Storage and smart distribution of energy ● Distributed production of renewable energy ● Energy efficiency
● Environment	● Sustainable management of natural resources and safeguarding of biodiversity and terrestrial and marine ecosystems ● Risks prevention, defence and securing of land and coastal areas ● Sustainable management of wastes and valorisation of scraps and by-products ● Environmental remediation
Priority Area: DIGITAL, CREATIVE AND INCLUSIVE COMMUNITIES	
Application Sectors	**Innovation Fields**
● Cultural industry	● Integrated management of cultural heritage ● Production and communication of cultural and artistic contents ● Promotion of dialogue and collaboration between creative industry and traditional manufacturing sectors
● Social innovation	● Empowerment of social networks and social inclusion

S3 in Apulia

ITS

The ITSs must have the following characteristics:

- organised as **Foundations**
- must be linked to the **six technological areas that are considered strategic for the country growth** (sustainable mobility, new life-science technologies, new technologies for “Made in Italy” products, innovative technologies for cultural heritage and tourism, information and communication technologies, energy efficiency);
- are **accessible through competition** by citizens with upper secondary education degrees or technical diploma (4 years), if they have completed an additional year of education for the access to tertiary education;
- have a **duration from 4 to 6 semesters**, for a total of 1800/2000 learning hours (of which 20% in traineeship);
- at least **the 50% of teachers must be professionals** from the labour market;
- foresee an **examination body** for the final exams that is composed by representatives of schools, universities, VET, and experts from the world of work;
- allow to achieve a High Technical Degree corresponding to **level V of the European Qualification Framework**;
- recognizes ECTS according to Law 107/2015, modified then within Law Decree 42/2016 as follows “no less than **40 ECTS** for pathways of four semesters, no less than **62 ECTS** for pathways of six semesters”.

ITS in Apulia

Technological area	SNSI area	Year	Puglia Thematic/Specialization area	Province
ITS Antonio Cuccovillo - nuove tecnologie per il made in Italy - sistema meccanica	Made in Italy (mechanics)	2010	Sustainable manufacturing/Mechatronics	Bari
ITS nuove tecnologie per il made in Italy - sistema alimentare, settore produzioni agroalimentari	Made in Italy (Agri-food)	2010	Human and environmental health/Agri-food	Bari
ITS per la mobilità sostenibile - settore aerospazio Puglia	Sustainable mobility	2010	Sustainable manufacturing/Aerospace	Brindisi
ITS Apulia Digital Maker	Technologies for ICT	2015	Digital, creative, and inclusive communities/cultural and creative industries	Foggia
ITS per l'industria della ospitalità e del turismo allargato	Technologies for Cultural Heritage	2015	Human and environmental health/Tourism	Lecce
ITS per la mobilità sostenibile gestione infomobilità e infrastrutture logistiche	Sustainable mobility	2015	Sustainable manufacturing/Smart factory	Taranto

Source: own elaboration from Banca Dati Nazionale ITS – Data Nov. 2017

Slightly below national average (70% vs 81%), employment outcomes of ITSs graduates are well above regional figures.

Youth unemployment rate in Puglia in ages 15-29 (which correspond to the expected cohort of the ITSs graduates), was above 40% in 2017

Puglia's ITSs and corresponding smart specialisation areas

Technological area		ITSs Puglia
Energetic efficiency	Courses No.	-
	Enrolled	-
Sustainable mobility	Courses No.	8
	Enrolled	226
New technologies of life	Courses No.	-
	Enrolled	-
New technologies for made in Italy	Courses No.	13
	Enrolled	343
Information and communication technologies	Courses No.	4
	Enrolled	122
New technologies for cultural heritage, cultural activities and tourism	Courses No.	6
	Enrolled	160
Total	Courses No.	31
	Enrolled	850

FONDAZIONE ITS – ISTITUTO TECNICO SUPERIORE - AREA "NUOVE TECNOLOGIE PER IL MADE IN ITALY - SISTEMA ALIMENTARE - SETTORE PRODUZIONI AGROALIMENTARI" LOCOROTONDO (BA)

FONDAZIONE ITS PER L'INDUSTRIA DELL'OSPITALITA' E DEL TURISMO ALLARGATO LECCE (LE)

ITS "A. CUCCOVILLO" AREA NUOVE TECNOLOGIE PER IL MADE IN ITALY - SISTEMA MECCANICO/MECCATRONICO, ENERGIA BARI (BA)

ITS APULIA DIGITAL MAKER FOGGIA (FG)

ISTITUTO TECNICO SUPERIORE PER L'INFOMOBILITA' E LE INFRASTRUTTURE LOGISTICHE "GE.IN.LOGISTIC" TARANTO (TA)

FONDAZIONE ITS AEROSPAZIO PUGLIA BRINDISI (BR)

Partners of ITS in Apulia

Private firms as Apulian ITS partners by size and Technological Area

ITS Partner	Puglia	Italy
Educational agency	19	298
Companies association	2	97
Employers association	4	41
Chamber of commerce	3	15
University Department	10	98
Local Institution	17	195
Company	73	712
High school	48	418
Credit institution	3	7
Professional association	8	34
Entity related to the scientific and technological research system	5	63
Trade Union	5	13
Foreign partner	1	6
Other	16	97
Total	214	2.094
Source: Banca Dati Nazionale ITS – November 2017		

Source *ARTI's elaboration on Banca Dati Nazionale ITS*

Innovative Industrial Doctorates

According to the first call for proposal in 2016 (Directorial Decree n. 1540 of July 26, 2016) were set up by following these criteria:

- Coherence between **scientific fields** and themes, the **National Smart Specialisation Strategy**, and the needs of **professional profiles at regional level**;
- A length of **3 years**;
- A learning pathway **embedded in existing PhD programmes** offered by accredited Universities;
- A period of **research and study** to be carried out in a **firm** (6-18 months);
- A period of **research and study abroad** (6-18 months);
- The provision of facilities and research **infrastructures**;
- The provision of learning activities to enhance **language and ICT skills**;
- The **involvement of firms in the definition of learning paths**;
- The acknowledgement of horizontal principles such **as environmental sustainability and gender equality.**

Innovative Industrial Doctorates in Apulia

HEI	2016	2017
Università degli Studi di Bari "Aldo Moro"	14	44
Politecnico di Bari	4	15
Università degli Studi di Foggia	1	7
Università del Salento	8	19
LUM "Jean Monnet" (private)	-	2
Total	27	87

Source Presentation from V. Sperati (2017) PON Italy – Innovative Doctorates in Puglia Region and our elaboration on Decree. n. 3749 figures

Data summary for Innovative Doctorates first call (Academic Year 2016/2017)

With reference to the three priority-areas of the Apulian S3, projects on "Human and environmental health" represent the 53% (16) of the total proposed, "Sustainable Manufacturing" the 30% (9), and "Digital, creative, and inclusive communities" the 17% (5). Data from 2017 are not yet available.

Out of 27 enrolled PhD students, 14 were at the University of Bari, the largest in the region. Total regional funding for all 4 universities was 2.047.143,96 EUR.

Research design

1. An exploratory workshop;
2. Primary data collection through semi-structured interviews and focus groups:
3. A validation workshop.

In parallel, the HESS project opened-up a continuous dialogue with MIUR, which supported the project by providing information and data on ITS and Industrial PhDs and taking part to the events.

	ITS and Industrial PhDs	
Apulia Region representatives in charge of Research, Higher Education and Regional Policy	2 Regional Policy makers	
Rectors, Vice Rectors and HEIs managers of Research/Didactic/Third Mission	1 Rector or Vice Rector or Delegate per each University (overall 4)	
	ITS	Industrial PhD
University professors	6 professors involved in the ITS Foundations (1 x ITS)	4 Directors of PhD Curriculum (1 per University)
Director/Professor Staff of ITS	1 member x ITS (overall 6)	
Students currently attending ITS	Focus Groups	
Students graduated in ITS	4	
PhD Students		4
Managers/owners of companies hosting students	4	4

40 interviews
5 focus groups/workshops
with students (> 100)

Explored topics in ITSs and Innovative Industrial PhDs

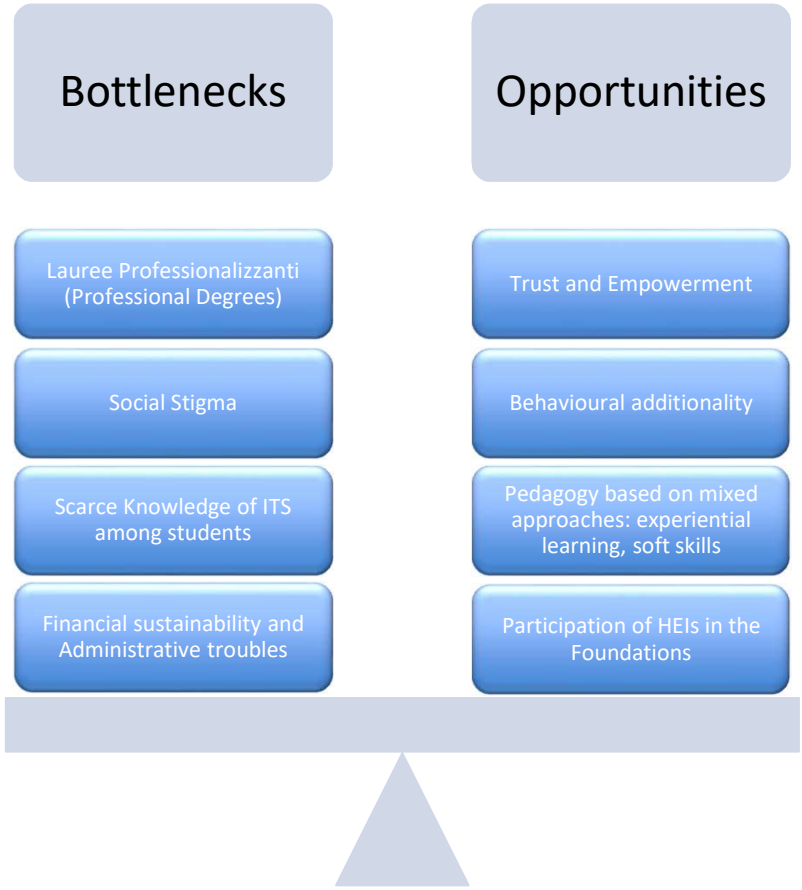
ITS	Innovative Industrial PhD
General perception about the instrument **Pros and cons of ITSs** **Pedagogical and didactical approaches** ● ITS distinctive pedagogical approaches and their linkages with the needs of the region ● Level of involvement of the private sector in the definition of ITS learning pathways **Recruiting process (of the students)** Level of ITS awareness and reputation among young people **Employability of graduates** Skills/capacities of ITS graduates that are most valued by employers in Apulia **Monitoring and updating of the learning process** ● Administrative bottlenecks ● Level of involvement of ITS Foundations in S3 ● Level of involvement of the private sector **Awareness of EU policies** ● Awareness of EU funds, programmes and tools ● Awareness of EU Cohesion Policy and Smart Specialisation. **ITS governance** ● Main administrative bottlenecks to ITSs functioning ● Level of involvement of ITS Foundations in S3 in order to contribute and to explore related opportunities	**General perception about the instrument** **Challenges and opportunities of Industrial PhD adoption in the regional system** **Pedagogical and didactic approaches** ● Differences between "traditional" and "industrial" PhD and novelty perception from different stakeholders ● Collaboration between universities, public administration and private sector in planning Industrial PhDs learning pathways ● The main features of PhDs distinctive pedagogical approaches and their linkages with the needs of the region **Selection of PhD students** ● PhDs and entrepreneurial culture in Puglia ● Administrative bottlenecks to Industrial PhDs implementation **Universities' strategies for the inter-sectorial collaboration** ● Multi-level governance – relationship between universities, regional and national administration **Intra-regional collaboration and S3** ● PhD alignment with regional priorities and S3 - Industrial vs Traditionals programmes

Main outcomes (1)

Transversal consensus emerged in ITSs and IID over several aspects:

- **Active teaching methods** (such as problem based learning, experiential learning, etc.) are considered valuable by all consulted stakeholders. They have proved efficient and highly motivating for students.
- The development of **soft skills** is seen as crucial for employability: this issue was particularly underlined by companies, either consulted by ITSs/IIDs in the frame of preliminary contacts for programme design, or directly interviewed for this study;
- The novelty of the instruments implies a **significant organisational challenge**, which was stressed by all interviewees involved in running IID and ITS and was also clearly perceived by students.

Main outcomes (2)



Relationships between ITS Foundations and Firms

- Importance of direct involvement in setting up didactic offer

«*We are driven by firms. Their commitment is essential for the success of our work!*»

- Importance of direct relationships with external firms

«Collaboration means: a series of meetings, reciprocal listening, structured reflexivity, availability to host internships. That does not mean cheap workforce, but a real co-creation»

- Indirect relationships with a B2B market: students can become future partners or skilled customers of managers and teachers coming from the entrepreneurial world.

«*We are a firm that provides tools and support to innovate. Many firms, our existing customers, were looking for skilled workforce with a focus on ICT, ready to use our solutions. We decided to jump in this sector because we need to face this challenges. If you come from High Schools, you don't have the right knowledge; conversely, if you come from the university system, you are not ready to apply your knowledge. Thus we decided to work with both of them, to train our customers of tomorrow*»

Firms' dimensions and skills demand

- Micro-firms in sectors with a medium-low level of innovation (i.e. agrifood or tourism) need a relationship with a network/district/system of other firms
  - Less strategic planning orientation > less clarity and consciousness on skills requested by the job market in perspective);
  - Less ability to identify proper needs in terms of training;
  - Less opportunities to hire stagiaires after the end of the internships

  «*There is a lack of a **real culture** on collaboration and training. I understand that this could be helpful but I don't act in order to follow my perception*»

- Medium-sized Enterprises (i.e. Mechatronics) : direct relationship > «customisation» of training!

- Soft skills and/or Hard skills?

Examples: Soft Skills

«*Problem solving, leadership, open mindedness, ability to anticipate a problem, etc…* these are elements that characterize the intern who comes here".

"Having the right time to "breath the business atmosphere" and understanding how it works, seeing company employees, understanding the value of the hierarchy, etc.»

«Humility, social / emotional intelligence, ability to read the context. Sometimes we do not even need those who anticipate the problem. We need someone who knows how to perceive the problem right now»

«We must start from the ability to listen in different contexts. Ability to cope with stress is a fundamental skill for companies that play in a global market, nowadays»

«We must provide a« toolbox» to be competitive in companies»

Quality of didactic offer depends on:

- Curriculum fitting with current and prospective learning needs
- Professionalism and the right mix of faculty members
- Professionalism of administrative staff (coordinators, tutors, supervisors, managers in charge of communication – not overpromising!)
- Effectiveness of processes to avoid waste of time – especially during internships
- Importance of previous experiences in teaching for professional purposes, or relationships - both institutional and personal - already established within stakeholders of the vocational education and training system

Coherence and alignment

- Economic sectors / regional policies / teaching and training
- Do investments in a certain economic sector match with investment in education for the employability in such sector?
- Economies of scale of investments: certain skills can be transferred to other sectors, thus a coordination between different foundations would be desirable

Employability at regional level

- Virtuous relations with local territorial systems with stakeholders such as:
  - Employment Centres for employment
  - Career counselling Centres
  - Infopoints for entrepreneurship and other regional tools and methods

- Relations with other training offer characterized by common modules or common methods or KETs to favour regional mobility

- Relationships with other ITS

«*The dialogue with other ITS is mainly on bureaucratic issues. Even if we work in different areas, we should work on content as well*»

«It's a real need to work with other ITS on thematic issues at transregional level as well as with other regional ITS»

Financial sustainability and stakeholder engagement

- EU Funds (e.g. Interreg, IPA-Adriatic, ENPI CBD MED, etc.)
- Attitude to participate in R&D project with private and public partnerships
- Organisation of scientific dissemination events for local communities
- Higher financial participation of firms both internal and external
- Fundraising? (e.g. banks, foundations, etc.?)

Students and graduates

- High motivation of students / learning attitudes
- In some cases socioeconomic context characterised by entrepreneurial activities / family business
- Heterogeneity of previous education pathways (adults in their 50ies to be re-trained)
- Some students available to carry on the University path once finished their experience within the ITS
- Knowledge of the training programme via social media (FB). Scarce level of advertising and promotion among high school students
- Perception of a great opportunity: «more practical knowledge than University», «studying abroad and taking certifications almost for free, are great chances»

The point of view of university scholars on ITS

- “Social stigma” on professional education and training
- Doubts on new “Lauree professionalizzanti”

Nevertheless, ITSs are considered:

«Attractive pathways because they are projected on a real need. Concrete»

"Even our university colleagues who come here behave differently. We are looking, with the colleagues involved, to "give back" to the world of school»

"ITS plays a fundamental role. A student undertakes it for a more usable journey. Here you can find the son of the farmer who wanted to study enough but who must also become independent»

«Many students who attend this course already have a labor path started in the family company»

Innovative industrial Doctorates

Opportunity for a real change of organisational behaviour and procedures

- external (firms and foreign countries – study abroad)
- internal (PhD projects and candidates selection via a participatory and shared processes)

BEHAVIOURAL ADDITIONALITY

multidimensional concept linked to institutions (companies, public bodies, clusters, etc.) ability to absorb new knowledge. The focus is on the building of innovation capabilities and competence building in general, as well as on the organisations' ability to make use of new technologies and R&D-procedures

Some recommendations

To keep this process on a long path of self-sustainability period will be needed:

- a systematic integration between training policies and active labour market policies;
- a greater dissemination of business culture;
- a greater integration of the different types of funds, with which it is possible to finance not only training activities, but also investments in equipment and laboratories;
- a greater attention to orientation, in which the individual student becomes protagonist of an individualized path of listening, direction and motivation;
- a system that makes it easier to recognise training experiences within the entire tertiary training system (such as, for example, **the recognition of training experience in the ITS course for graduates who then wish to continue with a university degree**).
- a **strengthening of the alignment between the demand for professionalism expressed by companies in the leading sectors of the regional economy**, including small ones, and the provision of technical and professional skills with a high technological content;

For further information and suggestions

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Grazie!